



Powelson, Katherine &lt;katherine\_powelson@fws.gov&gt;

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## Peer Review Request from USFWS

13 messages

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: CCrooker@parksconservancy.org

Mon, Mar 11, 2019 at 3:17 PM

Dear Christina Crooker,

The U.S. Fish and Wildlife Service (Service) is soliciting independent scientific reviews of a draft recovery plan amendment for the "Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*)". In this proposed amendment, we provide draft delisting criteria for San Bruno Elfin Butterfly and Mission Blue Butterfly. Draft and final recovery plan revisions are publicly available through our Environmental Conservation Online System (ECOS, <https://ecos.fws.gov>); this draft revision is also attached.

We are seeking your expert review on the following:

- Have we assembled and considered the best available scientific and commercial information relevant to this species?
- Is our analysis of this information correct?
- Are our scientific conclusions reasonable in light of this information?

This request is provided in accordance with our July 1, 1994, peer review policy (USFWS 1994, p. 34270) and our current internal guidance. This request also satisfies the peer review requirements of the Office of Management and Budget's "Final Information Quality Bulletin for Peer Review." Our updated peer review guidelines also require that all peer reviewers fill out a conflict of interest form (**see attached**). We will carefully assess any potential conflict of interest or bias using applicable standards issued by the Office of Government Ethics and the prevailing practices of the National Academy of Sciences (<http://www.nationalacademies.org/coi/index.html>). Disclosing a conflict does not invalidate the comments of the reviewer; however, it will allow for transparency to the public regarding the reviewer's possible biases or associations. You may return the completed conflict of interest form either prior to or with your peer review.

We ask that you please provide your comments no later than **April 15, 2019**. Please provide your written response to us by email or by letter. Please be aware that your completed review of the draft recovery plan revision, including your name and affiliation, will be included in the administrative record and will be available to interested parties upon request.

Please let me know if you have any questions.

Thank you for your consideration,

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

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### 2 attachments



**Draft APG amendment Mission blue and San Bruno elfin butterflies\_revised.docx**  
54K



**Conflict of Interest Disclosure Form.pdf**  
63K

**Christina Crooker** <CCrooker@parksconservancy.org>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Mon, Apr 15, 2019 at 11:07 AM

Hi Katherine – yikes, this slipped through the cracks! I am hoping to review today and submit comments. Just to be clear, you are looking for comments only on the 16 page attachment? Thanks, Christina

CHRISTINA CROOKER

Senior Restoration Manager

Park Stewardship Program

Golden Gate National Parks Conservancy  
Building 201, Fort Mason, San Francisco, CA 94123

tel: (415) 561-3517

*The Nonprofit Partner for the Golden Gate National Parks***PARKS FOR ALL FOREVER**

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**Christina Crooker** <CCrooker@parksconservancy.org>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>, Sarah Markegard <sarah\_markegard@fws.gov>

Tue, Apr 16, 2019 at 9:46 AM

Hi-

I am reviewing the mbb and sbe recovery plan and have some questions about the content. Katherine are you the person to direct questions to or is it Sarah?

In a nutshell I am wondering why the milagra criteria for downlisting sbe is 2 colonies when we currently have 4 colonies. It seems odd to me to have fewer than existing. I was wondering if you are limited to 2 colonies due to that being the number in earlier drafts? And how much flexibility you have in changing that number.

I'm in the field all day but avail on my cell at 415-517-5184.

Thanks, Christina

Sent from my iPhone

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Christina Crooker <CCrooker@parksconservancy.org>

Tue, Apr 16, 2019 at 11:25 AM

You can have until the end of the month to complete. Thanks

**Kat Powelson****Science Support Coordinator, Science Applications  
U.S. Fish & Wildlife Service, Pacific Southwest Region****(916) 278-9448 office****3020 State University Drive East****Modoc Hall, Suite 2007****Sacramento CA 95819**

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**Christina Crooker** <CCrooker@parksconservancy.org>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Thu, Apr 18, 2019 at 9:51 AM

Thank you!

Sent from my iPhone

[Quoted text hidden]

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**Markegard, Sarah** <sarah\_markegard@fws.gov>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Thu, Apr 18, 2019 at 5:18 PM

Hi Kat,

Would you like me to forward this email to Sam, our biologist who is working on these plans, or have you already responded to Kat?

Thanks!

Sarah

[Quoted text hidden]

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Sarah Markegard  
Listing and Recovery Biologist  
U.S. Fish and Wildlife Service  
[Sacramento Ecological Services Field Office](#)  
[2800 Cottage Way W-2605](#)  
[Sacramento, CA 95825-1888](#)  
916-414-6492

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: "Markegard, Sarah" <sarah\_markegard@fws.gov>

Fri, Apr 19, 2019 at 9:03 AM

Hey Sarah,

I talked to Christina about the peer review and I am sending all the peer reviews back to Amber Aguilera who has been my contact on the APGs. I believe she will handle getting them back to the appropriate biologists.

**Kat Powelson**

**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
**3020 State University Drive East**  
**Modoc Hall, Suite 2007**  
**Sacramento CA 95819**

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**Markegard, Sarah** <sarah\_markegard@fws.gov>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Fri, Apr 19, 2019 at 9:05 AM

Got it, thanks!

I also just realized I asked in my previous email if you had already responded to Kat, which makes no sense. I had my 5 pm brain on :) Hope you're doing well!

[Quoted text hidden]

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: "Markegard, Sarah" <sarah\_markegard@fws.gov>

Fri, Apr 19, 2019 at 9:10 AM

Hahah I feel you, I am on the Friday brain struggle bus! Have a good weekend!

**Kat Powelson**

**Science Support Coordinator, Science Applications  
U.S. Fish & Wildlife Service, Pacific Southwest Region**

**(916) 278-9448 office**

**3020 State University Drive East**

**Modoc Hall, Suite 2007**

**Sacramento CA 95819**

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**Christina Crooker** <CCrooker@parksconservancy.org>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Thu, May 2, 2019 at 7:40 PM

Thank you for the opportunity to review the draft recovery plan amendment for the "Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*)". I have reviewed the criteria for delisting and downlisting for each species. Except for the questions and comments below, I believe that the best available scientific and commercial information was reviewed and considered, that the analysis of the information was correct, and that the conclusions contained within the amendment are reasonable.

### **Mission blue butterflies**

For mission blue butterflies, I found the description and usage of the terms "metapopulation" and "population" to be unclear. It would be helpful if you were to state what (at this time) the Service considers to be distinct populations and which of these populations constitute a metapopulation. The distinction between the two becomes critical when considering the downlisting and delisting recovery criteria which is based on metapopulations containing certain numbers of populations.

The text defines populations in part as being separated by 500 meters. Based on this, and on a spatial analysis of the habitat patches within the GGNRA, I am interpreting this as GGNRA having 3 separate populations in the following areas: 1) Oakwood Valley, 2) Marin Headlands (including Fort Baker), and 3) Milagra Ridge. I am not counting Sweeney Ridge as it is not currently occupied habitat. My comments are based on this interpretation.

Factor E/1, states that one metapopulation each is required in Marin, San Francisco, and San Mateo Counties and that a San Mateo metapopulation must be at San Bruno Mountain. Since metapopulation is not clearly defined, and I do not have data on San Bruno habitat patches, I am not sure how many populations are within the San Bruno metapopulation. Do the populations at Milagra or SFPUC count as their own metapopulations? If so, the recovery criteria should have 3 metapopulations at a minimum for downlisting in San Mateo. If not, the criteria should clearly stipulate that 2 of the three populations required for downlisting should NOT be found on San Bruno Mountain, to account for the separate Milagra Ridge and SFPUC populations.

Factor E/1 states that metapopulations in Marin and San Mateo Counties must contain at least three populations. If my interpretation of population is correct, Marin currently has 2 populations: Oakwood Valley and the Marin headlands (including Fort Baker). I am not sure there is room for a third that meets your criteria. Please clarify.

Factor E/2 states that patches of suitable habitat must be at least 6 hectares (15 acres) to support populations designated in E/1. Please clarify whether that is 6 hectares for each population or 6 hectares for all populations combined. I

recommend 6 hectares for each population.

Factor E/2 states that for each site, woody vegetation should make up no more than 15% of the absolute vegetation cover. Can you clarify whether "each site" refers to each metapopulation, each population, or each habitat patch? I suggest that this value be an average at either the metapopulation or population level. In the Marin headlands and Milagra Ridge, woody vegetation cover varies widely. For example, even in 1998, when mission blue relative abundance was much higher, absolute native scrub cover ranged between 0 and 28 percent at the Marin Headlands.

The population at Marin Headlands is quite large vs. the population at Milagra Ridge. Yet the downlisting criteria of 30 adults, taken from the frosted elfin recovery plan is not dependent on area. It would be more meaningful if the downlisting criteria indicated number of butterflies per unit area. While 30 butterflies over Milagra Ridge seems sound, that number spread out over the entire Marin Headlands does not seem viable.

It is not clear how an average of 30 adults with a stable or increasing populations trend will be measured. I see that the amendment calls for a population viability analyses for metapopulations of mission blue butterflies. Is this the mechanism by which the number of adults will be assessed? Will this be done once, and supported by ten-year trends of whatever monitoring method each agency uses? Or will the PVA need to be done annually over ten years to meet this criteria? At the GGNRA, we use both linear transects in select areas to measure relative abundance, and an occupancy grid to measure presence /absence park-wide. Neither of these measures can be easily translated into a population estimate. Other agencies also have different methods of assessing trends. A means of measuring population/metapopulation, or a proxy for such measurement and the frequency of this measurement should be clarified.

It is also not clear what value is being averaged – metapopulation estimates over ten years? Butterfly counts for each population constituting a metapopulation?

The text states "In San Mateo county, several metapopulations consisting of distinct populations extend from Milagra Ridge through Sweeney Ridge, and south through the SFPW. It is not clear where the metapopulations are and where the distinct populations are.

Factor A2 states that monitoring must determine that all sites support populations of silver and summer lupine, including a variety of size or age classes. Can you clarify if that means that both species must be present on a metapopulation level, a population level, or that both species should be present at each patch of lupine?

The text states that herbicide use is a potential threat to both species if used in proximity to occupied habitat and cites Varela *et al.* 2008. While I agree with your statement that herbicide use could be a threat, I did not find any mention of herbicide use in Varela *et al.* I did see multiple mentions of insecticide use to control the light brown apple moth in this paper. Insecticide use should also be included considered as a threat.

Please clarify that mission blue adults using yellow bush lupine (*L. arboreus*) are only found on the purple variety of this species in the Marin headlands/Fort Baker area. I have never seen them on the more typical yellow bush lupine.

Have you considered the role of introduced argentine ants on the mission blue? A discussion of your considerations and conclusions would be helpful.

### **San Bruno Elfin Butterfly**

The amendment states that a colony of San Bruno elfins must be separated by 100 m but not more than 800 meters. Based on this and on spatial analysis of the San Bruno elfin butterfly population at Milagra Ridge, two colonies exist at

Milagra Ridge. My comments are based on this interpretation.

E/1 states that the Milagra Ridge metapopulation must contain 2 colonies for downlisting and that each metapopulation must have an average of 30 adults with a stable or increasing population trend for 10 years. If my interpretation of the colonies at Milagra Ridge is correct, I agree with this assessment.

My comments calling for clarification of mission blue population measurements also apply to San Bruno elfin. That said, I do see that an additional Site Specific Recovery Action is to establish San Bruno elfin monitoring protocols and to investigate the biology of the San Bruno elfin to guide population estimates.

Thank you for the opportunity to review. Please do not hesitate to contact me with any questions about my comments.

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**Christina Crooker** <CCrooker@parksconservancy.org>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Thu, May 2, 2019 at 7:51 PM

Hi Kat, sorry I sent that too soon! I want to double check my spatial analysis for San Bruno elfin tomorrow at the office. I'll send my comments by the end of the day tomorrow. Thanks, Christina

[Quoted text hidden]

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**Christina Crooker** <CCrooker@parksconservancy.org>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Fri, May 3, 2019 at 3:24 PM

Dear Kat Powelson,

Thank you for the opportunity to review the draft recovery plan amendment for the "Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*)". Except for the questions and comments below, I believe that the best available scientific and commercial information was reviewed and considered, that the analysis of the information was correct, and that the conclusions contained within the amendment are reasonable.

### Mission blue butterflies

- For mission blue butterflies, I found the description and usage of the terms "metapopulation" and "population" to be unclear. It would be helpful if you were to state what (at this time) the Service considers to be distinct populations and which of these populations constitute a metapopulation. The distinction between the two becomes critical when considering the downlisting and delisting recovery criteria which is based on metapopulations containing certain numbers of populations.
- The text defines populations in part as being separated by 500 meters. Based on this, I created maps of the Milagra Ridge and Marin populations with a 250m buffer around each lupine patch to see which patches constitute a population (see attached maps). I am interpreting this as GGNRA having 4 separate populations in the following areas: 1) Oakwood Valley, 2) Marincello (on the east side of Oakwood Valley) 3) Marin Headlands (including Fort Baker), and 4) Milagra Ridge. I am not counting Sweeney Ridge as it is not currently occupied habitat. My comments are based on this interpretation.

- Factor E/1, states that one metapopulation each is required in Marin, San Francisco, and San Mateo Counties and that a San Mateo metapopulation must be at San Bruno Mountain. Since metapopulation is not clearly defined, and I do not have data on San Bruno habitat patches, I am not sure how many populations are within the San Bruno metapopulation. Do the populations at Milagra or SFPUC count as their own metapopulations? If so, the recovery criteria should have 3 metapopulations at a minimum for downlisting in San Mateo. If not, the criteria should clearly stipulate that 2 of the three populations required for downlisting should NOT be found on San Bruno Mountain, to account for the separate Milagra Ridge and SFPUC populations.
- Factor E/2 states that patches of suitable habitat must be at least 6 hectares (15 acres) to support populations designated in E/1. Please clarify whether that is 6 hectares for each population or 6 hectares for all populations combined. I recommend 6 hectares for each population.
- Factor E/2 states that for each site, woody vegetation should make up no more than 15% of the absolute vegetation cover. Can you clarify whether "each site" refers to each metapopulation, each population, or each habitat patch? I suggest that this value be an average at either the metapopulation or population level. In the Marin headlands and Milagra Ridge, woody vegetation cover varies widely. For example, even in 1998, when mission blue relative abundance was much higher, absolute native scrub cover ranged between 0 and 28 percent at the Marin Headlands.
- The population at Marin Headlands is quite large vs. the population at Milagra Ridge. Yet the downlisting criteria of 30 adults, taken from the frosted elfin recovery plan is not dependent on area. It would be more meaningful if the downlisting criteria indicated number of butterflies per unit area. While 30 butterflies over Milagra Ridge seems sound, that number spread out over the entire Marin Headlands does not seem viable.
- It is not clear how an average of 30 adults with a stable or increasing populations trend will be measured. I see that the amendment calls for a population viability analyses for metapopulations of mission blue butterflies. Is this the mechanism by which the number of adults will be assessed? Will this be done once, and supported by ten-year trends of whatever monitoring method each agency uses? Or will the PVA need to be done annually over ten years to meet this criteria? At the GGNRA, we use both linear transects in select areas to measure relative abundance, and an occupancy grid to measure presence /absence park-wide. Neither of these measures can be easily translated into a population estimate. Other agencies also have different methods of assessing trends. A means of measuring population/metapopulation, or a proxy for such measurement and the frequency of this measurement should be clarified.
- It is also not clear what value is being averaged – metapopulation estimates over ten years? Butterfly counts for each population constituting a metapopulation?
- The text states "In San Mateo county, several metapopulations consisting of distinct populations extend from Milagra Ridge through Sweeney Ridge, and south through the SFPW. It is not clear where the metapopulations are and where the distinct populations are.
- Factor A2 states that monitoring must determine that all sites support populations of silver and summer lupine, including a variety of size or age classes. Can you clarify if that means that both species must be present on a metapopulation level, a population level, or that both species should be present at each patch of lupine?
- The text states that herbicide use is a potential threat to both species if used in proximity to occupied habitat and cites Varela *et al.* 2008. While I agree with your statement that herbicide use could be a threat, I did not find any mention of herbicide use in Varela *et al.* I did see multiple mentions of insecticide use to control the light brown apple moth in this paper. Insecticide use should also be included considered as a threat.

- Please clarify that mission blue adults using yellow bush lupine (*L. arboreus*) are only found on the purple variety of this species in the Marin headlands/Fort Baker area. I have never seen them on the more typical yellow bush lupine.
- Have you considered the role of introduced argentine ants on the mission blue? A discussion of your considerations and conclusions would be helpful.

### San Bruno Elfin Butterfly

- The amendment states that a colony of San Bruno elfins must be separated by 100 m but not more than 800 meters. I created maps of occupied San Bruno elfin habitat with a 50 m buffer to identify which *Sedum* patches constitute a population. Based on this, three colonies exist at Milagra Ridge. My comments are based on this interpretation.
- E/1 states that the Milagra Ridge metapopulation must contain 2 colonies for downlisting and that each metapopulation must have an average of 30 adults with a stable or increasing population trend for 10 years. According to my maps, Milagra Ridge currently hosts three colonies. The downlisting criteria should, at a minimum, preserve all three colonies that are currently found. Decreasing that number to two colonies would the species at Milagra Ridge at risk from stochastic events.
- My comments calling for clarification of mission blue population measurements also apply to San Bruno elfin. That said, I do see that an additional Site Specific Recovery Action is to establish San Bruno elfin monitoring protocols and to investigate the biology of the San Bruno elfin to guide population estimates.

Thank you for the opportunity to review. Please do not hesitate to contact me with any questions about my comments.

Cheers,

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### 3 attachments

-  **MR\_MBB\_recovery\_planning\_2\_20190430.pdf**  
1683K
-  **MR\_MBB\_recovery\_planning\_20190430.pdf**  
1768K
-  **MR\_SBE\_recovery\_planning\_20190430.pdf**  
1194K

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Sarah Markegard <sarah\_markegard@fws.gov>

Fri, May 3, 2019 at 3:31 PM

Hey Sarah  
Ill put all of this in the google drive too.  
**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007

Sacramento CA 95819

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**3 attachments**

 **MR\_MBB\_recovery\_planning\_2\_20190430.pdf**  
1683K

 **MR\_MBB\_recovery\_planning\_20190430.pdf**  
1768K

 **MR\_SBE\_recovery\_planning\_20190430.pdf**  
1194K



Lantz, Samantha <samantha\_lantz@fws.gov>

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## Fwd: FW: [EXTERNAL] Re: Peer Review Request from USFWS

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Samantha Lantz <samantha\_lantz@fws.gov>

Mon, May 6, 2019 at 11:51 AM

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

----- Forwarded message -----

From: **Christina Crooker** <CCrooker@parksconservancy.org>  
Date: Mon, May 6, 2019 at 11:45 AM  
Subject: RE: [EXTERNAL] Re: Peer Review Request from USFWS  
To: Powelson, Katherine <katherine\_powelson@fws.gov>

Hi Kat, I thought of one other thing that I would like to add regarding mission blues.

Populations that are "counted" for delisting or downlisting should not have its component habitat patches separated by features that would discourage or make it impossible for mission blues to move between them, even if they are within 500m. Things that would prohibit regular movement are forests and woodlands and tall stands of trees such as Eucalyptus, with no grassland corridor around them. Roads and road cuts and development are also barriers to regular movement, though mission blues can occasionally traverse longer distances.

[Quoted text hidden]

# MILAGRA RIDGE

SBE colonies

Park  
Stewardship  
Program

GOLDEN GATE  
NATIONAL  
PARKS  
CONSERVANCY



● SBE monitoring points

■ SBE 50m buffer around habitat patches

0 45 90 180 Meters



# MILAGRA RIDGE MBB populations

Park  
Stewardship  
Program

GOLDEN GATE  
NATIONAL  
PARKS  
CONSERVANCY



-  LUAL
-  lupines- 250m buffer
-  LUFO
-  LUVA





 LUFO buffer 250m	 LUFO - Oakwood Valley
 LUAL buffer 250m	 LUAL - Marin headlands

0 320 640 1,280 Meters





Powelson, Katherine &lt;katherine\_powelson@fws.gov&gt;

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## Peer Review Request from USFWS

10 messages

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: bennett@wra-ca.com

Mon, Mar 11, 2019 at 3:22 PM

Dear Susie Bennett,

The U.S. Fish and Wildlife Service (Service) is soliciting independent scientific reviews of a draft recovery plan amendment for the "Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*)". In this proposed amendment, we provide draft delisting criteria for San Bruno Elfin Butterfly and Mission Blue Butterfly. Draft and final recovery plan revisions are publicly available through our Environmental Conservation Online System (ECOS, <https://ecos.fws.gov>); this draft revision is also attached.

We are seeking your expert review on the following:

- Have we assembled and considered the best available scientific and commercial information relevant to this species?
- Is our analysis of this information correct?
- Are our scientific conclusions reasonable in light of this information?

This request is provided in accordance with our July 1, 1994, peer review policy (USFWS 1994, p. 34270) and our current internal guidance. This request also satisfies the peer review requirements of the Office of Management and Budget's "Final Information Quality Bulletin for Peer Review." Our updated peer review guidelines also require that all peer reviewers fill out a conflict of interest form (**see attached**). We will carefully assess any potential conflict of interest or bias using applicable standards issued by the Office of Government Ethics and the prevailing practices of the National Academy of Sciences (<http://www.nationalacademies.org/coi/index.html>). Disclosing a conflict does not invalidate the comments of the reviewer; however, it will allow for transparency to the public regarding the reviewer's possible biases or associations. You may return the completed conflict of interest form either prior to or with your peer review.

We ask that you please provide your comments no later than **April 15, 2019**. Please provide your written response to us by email or by letter. Please be aware that your completed review of the draft recovery plan revision, including your name and affiliation, will be included in the administrative record and will be available to interested parties upon request.

Please let me know if you have any questions.

Thank you for your consideration,

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

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### 2 attachments

**Conflict of Interest Disclosure Form.pdf**  
63K

**Draft APG amendment Mission blue and San Bruno elfin butterflies\_revised.docx**

54K

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**Susie Bennett** <bennett@wra-ca.com>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Mon, Apr 8, 2019 at 10:25 AM

Hi Kat,  
Thanks for reaching out. I'm happy to review the document. I'm wondering if you reached out to Christina Crooker (Golden Gate National Parks Conservancy, ccrooker@parksconservancy) or Bill Merkle (Golden Gate National Recreation Area, [william\\_merkle@nps.gov](mailto:william_merkle@nps.gov)). They both have worked with both butterflies longer than I have and will have some excellent input, I'm sure. Is it ok if I share the document with them?

**SUSIE BENNETT** | Biologist | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

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**WRA, Inc.** | [www.wra-ca.com](http://www.wra-ca.com) | 2169-G East Francisco Blvd., San Rafael, CA 94901 | Emeryville | San Diego | Fort Bragg | Denver

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Susie Bennett <bennett@wra-ca.com>

Mon, Apr 8, 2019 at 10:34 AM

Susie,  
Thank you for taking the time to review. Christina Crooker was also selected as a reviewer. Bill Merkle was not, but there are multiple opportunities to provide review, including public comment and partner review.

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

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**Susie Bennett** <bennett@wra-ca.com>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Mon, Apr 8, 2019 at 10:36 AM

OK--thank you!

**SUSIE BENNETT** | Biologist | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

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**WRA, Inc.** | [www.wra-ca.com](http://www.wra-ca.com) | 2169-G East Francisco Blvd., San Rafael, CA 94901 | Emeryville | San Diego | Fort Bragg | Denver

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**Susie Bennett** <bennett@wra-ca.com>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Mon, Apr 8, 2019 at 11:46 AM

Hi,  
I just wrapped up my review. I only had a few editorial changes, see attached. Excellent work!

**SUSIE BENNETT** | Biologist | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

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**WRA, Inc.** | [www.wra-ca.com](http://www.wra-ca.com) | 2169-G East Francisco Blvd., San Rafael, CA 94901 | Emeryville | San Diego | Fort Bragg | Denver

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**Draft APG amendment Mission blue and San Bruno elfin butterflies\_revisedSRB.docx**  
57K

**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Susie Bennett <bennett@wra-ca.com>

Mon, Apr 8, 2019 at 12:27 PM

Thank you so much, it wasn't my work but I'll pass along the complements to our ES office.

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
**3020 State University Drive East**  
**Modoc Hall, Suite 2007**  
**Sacramento CA 95819**

[Quoted text hidden]

**postmaster@doi.gov** <postmaster@doi.gov>  
To: katherine\_powelson@fws.gov

Tue, Apr 16, 2019 at 10:18 AM

### Delivery has failed to these recipients or groups:

[Susie Bennett \(bennett@wra-ca.com\)](mailto:bennett@wra-ca.com)

The server has tried to deliver this message, without success, and has stopped trying. Please try sending this message again. If the problem continues, contact your helpdesk.

### Diagnostic information for administrators:

Generating server: [eis.doi.gov](http://eis.doi.gov)

[bennett@wra-ca.com](mailto:bennett@wra-ca.com)

#550 4.4.7 QUEUE.Expired; message expired ##

Original message headers:

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2019 13:28:22 -0600

Received: by [mail-yw1-f70.google.com](mailto:mail-yw1-f70.google.com) with SMTP id w6so11387021ywd.2 for  
<[bennett@wra-ca.com](mailto:bennett@wra-ca.com)>; Mon, 08 Apr 2019 12:28:21 -0700 (PDT)

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 Mon, 08 Apr 2019 12:28:20 -0700 (PDT)

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In-Reply-To: <CAPqdrAF-jZp+uqOkJhTy9bsbNFzxnqtZdO\_GXDu5tkPhNcDDfA@mail.gmail.com>

From: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Date: Mon, 8 Apr 2019 12:27:42 -0700

Message-ID: <CAEc3XJjV4ZAu9pxieQTB\_WcSjRAHxiDcM0G+B-R3PwLz3cFA@mail.gmail.com>

Subject: Re: [EXTERNAL] Re: Peer Review Request from USFWS

To: Susie Bennett <bennett@wra-ca.com>

Content-Type: multipart/alternative; boundary="000000000000d0973a058609d607"

X-Gm-Spam: 0

X-Gm-Phishy: 0

Return-Path: [katherine\\_powelson@fws.gov](mailto:katherine_powelson@fws.gov)

Final-Recipient: [rfc822;bennett@wra-ca.com](mailto:rfc822;bennett@wra-ca.com)

Action: failed

Status: 4.4.7

Diagnostic-Code: smtp;550 4.4.7 QUEUE.Expired; message expired

X-Display-Name: Susie Bennett

----- Forwarded message -----

From: "Powelson, Katherine" <katherine\_powelson@fws.gov>

To: Susie Bennett <bennett@wra-ca.com>

Cc:

Bcc:

Date: Mon, 8 Apr 2019 12:27:42 -0700

Subject: Re: [EXTERNAL] Re: Peer Review Request from USFWS

Thank you so much, it wasn't my work but I'll pass along the complements to our ES office.

**Kat Powelson**

**Science Support Coordinator, Science Applications**

**U.S. Fish & Wildlife Service, Pacific Southwest Region**

**(916) 278-9448 office**

**[3020 State University Drive East](#)**

**Modoc Hall, Suite 2007**

**Sacramento CA 95819**

On Mon, Apr 8, 2019 at 11:48 AM Susie Bennett <bennett@wra-ca.com> wrote:

Hi,

I just wrapped up my review. I only had a few editorial changes, see attached. Excellent work!

**SUSIE BENNETT** | Biologist | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

**WRA, Inc.** | [www.wra-ca.com](http://www.wra-ca.com) | 2169-G East Francisco Blvd., San Rafael, CA 94901 | Emeryville | San Diego | Fort Bragg | Denver

On Mon, Apr 8, 2019 at 10:36 AM Susie Bennett <[bennett@wra-ca.com](mailto:bennett@wra-ca.com)> wrote:  
OK--thank you!

**SUSIE BENNETT** | Biologist | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

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On Mon, Apr 8, 2019 at 10:35 AM Powelson, Katherine <[katherine\\_powelson@fws.gov](mailto:katherine_powelson@fws.gov)> wrote:

Susie,

Thank you for taking the time to review. Christina Crooker was also selected as a reviewer. Bill Merkle was not, but there are multiple opportunities to provide review, including public comment and partner review.

**Kat Powelson**

**Science Support Coordinator, Science Applications  
U.S. Fish & Wildlife Service, Pacific Southwest Region  
(916) 278-9448 office**

3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

On Mon, Apr 8, 2019 at 10:26 AM Susie Bennett <[bennett@wra-ca.com](mailto:bennett@wra-ca.com)> wrote:

Hi Kat,

Thanks for reaching out. I'm happy to review the document. I'm wondering if you reached out to Christina Crooker (Golden Gate National Parks Conservancy, [ccrooker@parksconservancy](mailto:ccrooker@parksconservancy)) or Bill Merkle (Golden Gate National Recreation Area, [william\\_merkle@nps.gov](mailto:william_merkle@nps.gov)). They both have worked with both butterflies longer than I have and will have some excellent input, I'm sure. Is it ok if I share the document with them?

**SUSIE BENNETT** | Biologist | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

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On Mon, Mar 11, 2019 at 3:23 PM Powelson, Katherine <[katherine\\_powelson@fws.gov](mailto:katherine_powelson@fws.gov)> wrote:

Dear Susie Bennett,

The U.S. Fish and Wildlife Service (Service) is soliciting independent scientific reviews of a draft recovery plan amendment for the "Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icarioides missionensis*)". In this proposed amendment, we provide draft delisting criteria for San Bruno Elfin Butterfly and Mission Blue Butterfly. Draft and final recovery plan revisions are publicly available through our Environmental Conservation Online System (ECOS, <https://ecos.fws.gov>); this draft revision is also attached.

We are seeking your expert review on the following:

- Have we assembled and considered the best available scientific and commercial information relevant to this species?
- Is our analysis of this information correct?
- Are our scientific conclusions reasonable in light of this information?

This request is provided in accordance with our July 1, 1994, peer review policy (USFWS 1994, p. 34270) and our current internal guidance. This request also satisfies the peer review requirements of the Office of Management and Budget's "Final Information Quality Bulletin for Peer Review." Our updated peer review

guidelines also require that all peer reviewers fill out a conflict of interest form (**see attached**). We will carefully assess any potential conflict of interest or bias using applicable standards issued by the Office of Government Ethics and the prevailing practices of the National Academy of Sciences (<http://www.nationalacademies.org/coi/index.html>). Divulging a conflict does not invalidate the comments of the reviewer; however, it will allow for transparency to the public regarding the reviewer's possible biases or associations. You may return the completed conflict of interest form either prior to or with your peer review.

We ask that you please provide your comments no later than **April 15, 2019**. Please provide your written response to us by email or by letter. Please be aware that your completed review of the draft recovery plan revision, including your name and affiliation, will be included in the administrative record and will be available to interested parties upon request.

Please let me know if you have any questions.

Thank you for your consideration,

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
[3020 State University Drive East](#)  
Modoc Hall, Suite 2007  
Sacramento CA 95819

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 **Re [EXTERNAL] Re Peer Review Request from USFWS**  
32K

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Susie Bennett <bennett@wra-ca.com>

Tue, Apr 16, 2019 at 11:23 AM

Hello Susie,  
Can you send me your conflict interest form?  
Thanks,  
**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
[3020 State University Drive East](#)  
Modoc Hall, Suite 2007  
Sacramento CA 95819

[Quoted text hidden]

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**Susie Bennett** <bennett@wra-ca.com>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Tue, Apr 16, 2019 at 11:27 AM

Sorry about that!

**SUSIE BENNETT** | [Biologist](#) | d: 415.524.7528 | o: 415.454.8868 x 1580 | c: 770.630.8198 | [bennett@wra-ca.com](mailto:bennett@wra-ca.com)

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 **Conflict of Interest Disclosure Form-petrie.pdf**  
71K

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Susie Bennett <bennett@wra-ca.com>

Tue, Apr 16, 2019 at 1:07 PM

No problem, thanks!

**Kat Powelson**

**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
**3020 State University Drive East**  
**Modoc Hall, Suite 2007**  
**Sacramento CA 95819**

[Quoted text hidden]

**Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*)**

[\[Click here to view document\]](#)

**Original Approved: October 10, 1984**  
**Original Prepared by: USFWS Portland**

**DRAFT AMENDMENT 1**

We have identified best available information that indicates the need to amend recovery criteria for this species since the recovery plan was completed. In this recovery plan modification, we will reference the current criteria, document the proposed criteria amendments and information we considered in drafting proposed criteria amendments, and add species-specific recovery actions designed to aid in the recovery. The proposed criteria amendments are shown as an appendix that supplements the recovery plan, superseding only pages 43-46 (Part II: Recovery Outline and Prime Objective in the Step-down Outline) of the recovery plan.

**For**  
**U.S. Fish and Wildlife Service**  
**Region 8**  
**Sacramento, California**

**December 2018**

Approved: XX

Regional Director, Pacific Southwest Region, Region 8,  
U.S. Fish and Wildlife Service

Date: XXXXXXXXXXXXXXXXXXXX

## **METHODOLOGY USED TO COMPLETE THE RECOVERY PLAN AMENDMENT**

This draft amendment was prepared by the Sacramento Fish and Wildlife Office (SFWO) of the U.S. Fish and Wildlife Service (Service) and will be peer reviewed in accordance with the OMB Peer Review Bulletin following the publication of the Notice of Availability. We used information from our files, survey information and reports from monitoring and population augmentations at various localities of the species, and communication with species experts. Communication with species experts and information from monitoring reports were our primary sources used in this amendment. We developed the amended recovery criteria using the concepts described in the Species Status Assessment (SSA) framework (Service 2016), and framed the criteria in terms of the current threats to each species that are attributable to the Endangered Species Act's five listing factors. While a full SSA is beyond the scope of this recovery plan revision, the Service used the SSA framework to consider what species need to maintain viability by characterizing the status of the species in terms of its resiliency, representation, and redundancy (Wolf *et al.* 2015).

### Resiliency

Resiliency describes the ability of populations to withstand stochastic events (arising from random factors). We can measure resiliency based on metrics of population health (*e.g.* population growth, numbers of individuals, demographic factors, etc.). Highly resilient populations are better able to withstand disturbances such as random fluctuations in reproductive rates (demographic stochasticity), variations in rainfall (environmental stochasticity), or the effects of anthropogenic activities.

### Representation

Representation describes the ability of a species to adapt to changing environmental conditions. Representation can be measured by the breadth of genetic or environmental diversity within and among populations and gauges the probability that a species is capable of adapting to environmental changes. The more representation, or diversity, a species has, the more capable it is to adapting to changes (natural or human-caused) in its environment. In the absence of species-specific genetic and ecological diversity information, we evaluate representation based on the extent and variability of habitat characteristics across the species' geographical range.

### Redundancy

Redundancy describes the ability of a species to withstand catastrophic events. Measured by the number of populations across the range of the species, as well as each population's resiliency, distribution, and connectivity, redundancy gauges the probability that the species has a margin of safety to withstand or the ability to bounce back from catastrophic events (such as a rare destructive natural event).

## **ADEQUACY OF RECOVERY CRITERIA**

Section 4(f)(1)(B)(ii) of the Endangered Species Act (Act) requires that each recovery plan shall incorporate, to the maximum extent practicable, "objective, measurable criteria which, when met, would result in a determination...that the species be removed from the list." Legal challenges to recovery plans (see *Fund for Animals v. Babbitt*, 903 F. Supp. 96 (D.D.C. 1995))

and a Government Accountability Audit (GAO 2006) also have affirmed the need to frame recovery criteria in terms of threats assessed under the five delisting factors.

### **Recovery Criteria**

See previous version of criteria in the original recovery plan on pages 43-45. [\[Click here to view document\]](#)

### **Synthesis**

#### Overview

San Bruno elfin butterflies and mission blue butterflies are both small diurnally active and univoltine (one generation each year) butterflies. San Bruno elfin butterfly courtship, mating and reproduction are all carried out in the immediate space around the only known larval host plant, stonecrop (*Sedum spathulifolium*), within coastal grassland and low scrub of north-facing slopes within the fog belt where the larval host plant grows. Typical habitat for mission blue butterfly is coastal scrubland and grassland vegetation that contains at least one of the three larval host plants: silver lupine (*Lupinus albifrons*), manycolored lupine (*L. varicolor*), and summer lupine (*L. formosus*). Adults have also been observed using yellow bush lupine (*L. arboreus*) for reproductive activities (Crooker *in litt.* 2018). Adults feed on a variety of nectar flowers, but do not tend to wander far from areas containing the larval host plants.

#### Spatial Distribution

The San Bruno elfin butterfly is restricted to San Mateo County. Here we use metapopulations to describe the spatial distribution. A metapopulation of San Bruno elfin butterflies is defined as a population of populations, referred to here as colonies. Sites occupied by San Bruno elfin butterflies and containing both host and nectar plants must be separated from each other by at least 100 m to count as separate colonies, but must be within 800 m of each other to facilitate connectivity. Distances within and between colonies are based on the average and maximum recorded distance of movements by San Bruno elfin butterflies (Arnold 1983, Service 1984). San Bruno elfin butterfly metapopulations occur on San Bruno Mountain, the Montara Mountain region, and Milagra Ridge. The original recovery plan refers to colonies in the Montara Mountain area at Whiting Ridge and Peak Ridge. The Montara Mountain region is now known to include colonies along the Bay Ridge Trail in the San Francisco Peninsula Watershed (SFPW; Service 2010a) and in Rancho Corral de Tierra (Bennett and Russo 2016a).

Mission blue butterflies occur in metapopulations throughout Marin, San Francisco, and San Mateo Counties. A metapopulation of mission blue butterflies is defined as a population of populations. Previous publications use both the terms “population” and “colony” (e.g., Service 2010a), but we use “population” here because the mission blue butterflies are not concentrated in discrete, persistent patches like the San Bruno elfin colonies. Sites occupied by mission blue butterflies and containing both host and nectar plants must be separated from each other by at least 500 m to count as separate populations. Populations must have a maximum nearest-neighbor distance of 2.5 km, or be connected by stepping stones of suitable habitat with both host and nectar plants that are no more than 1 km apart. Separation distance between populations

was chosen because most mission blue butterflies traveled less than 500 m during a mark-recapture study, while maximum nearest-neighbor distance is based on a documented dispersal event of 2.5 km by a female (Thomas Reid Associates 1982). Stepping stone habitat distance is based on similar requirements for the closely related Fender's blue butterfly (*Icaricia icarioides fenderi*) (Service 2010b).

At the time of its listing in 1976, only two locations with populations of mission blue butterflies were known: Twin Peaks in San Francisco County and San Bruno Mountain in San Mateo County. The original recovery plan also included a population in the Marin Headlands at Fort Baker in Marin County. Since then, additional populations have been located in San Mateo and Marin Counties (Service 2010a). In the Marin Headlands, additional populations have been located west and north of Fort Baker (Coast Ridge Ecology 2017) as far north as Oakwood Valley (Arnold and Lindzey 2003). In San Mateo County, several metapopulations consisting of distinct populations extend from Milagra Ridge through Sweeney Ridge and south through the SFPW (Service 2010a, Coast Ridge Ecology 2018). Mission blue butterflies were last seen at Sweeney Ridge in 1987 and are believed to be extirpated from that location (Bennett and Russo 2016b). Additional observations of butterflies matching the mission blue butterfly phenotype have also been reported in both Marin and San Mateo Counties, including to the north and west of Oakwood Valley in Marin County (Bennett pers. comm. 2018, Wang 2018) and at Montara Mountain and Scarpet Peak in San Mateo County (Arnold *in litt.* 2013).

Because there are no geographic barriers to movement defining the northern and southern limits of its range, hybridization zones may occur between the closely related mission blue butterfly and the pardalis blue butterfly (*I. i. pardalis*). The mission blue and pardalis blue butterfly subspecies are differentiated by phenotypic characteristics (Arnold and Lindzey 2003, Shapiro and Manolis 2007), although it is unclear if the differences in characters between the two subspecies are a result of genetic, environmental, or other factors. Oakwood Valley in Marin County has been proposed as a northern hybrid zone (Service 2010a). Phenotypes resembling each subspecies, as well as intermediate phenotypes, have been documented in this location, with most observations more closely matching the mission blue butterfly phenotype (Arnold and Lindzey 2003). Similarly, phenotypic observations suggest that butterflies matching the mission blue butterfly phenotype occur in the SFPW (Arnold *in litt.* 2018). Historically, pardalis blue butterfly specimens have been collected from the SFPW (Steiner 1990), but mission blue butterflies have been monitored in this region intermittently since 1977 and annually since 2001 (except for 2002; Arnold *in litt.* 2018, Service 2010a, Coast Ridge Ecology 2018). For now, we consider Oakwood Valley to be the northern hybrid zone and the SFPW to be the southern hybrid zone and the spatial distribution to include populations as described above (Service 2010a), with the caveat that photographs of butterflies with intermediate phenotypes or more closely resembling the pardalis blue butterfly originate from Marin, San Francisco, and San Mateo Counties (Arnold and Lindzey 2003).

#### Threats

Threats to the San Bruno elfin and mission blue butterflies can be categorized according to the five listing factors defined in section 4 of the Endangered Species Act. At the time of listing, threats to both species were centered on destruction, modification, or curtailment of habitat

through private development (Factor A). Because the majority of the butterfly metapopulations are on publicly protected lands, suburban development and habitat fragmentation are no longer considered an imminent threat to the species, although populations on private land are still at risk of habitat loss from development (Service 2010a). Ownership of lands occupied by San Bruno elfin and mission blue butterflies is summarized in the 5-year review (Service 2010a), with the exception of Rancho Corral de Tierra which is managed by the Golden Gate National Recreation Area (GGNRA) through the National Park Service (NPS).

The 2010 5-year review provided an updated assessment of threats for both the San Bruno elfin and mission blue butterflies (Service 2010a), all of which are still current. For mission blue butterflies, habitat degradation via encroachment of coastal chaparral, coastal scrub succession, and non-native grasses and associated thatch build-up is now considered the most serious threat (Factor E; Service 2010a). At San Bruno Mountain, historically home to the largest metapopulation of mission blue butterflies, grassland acreage has decreased from 1419 acres to an estimated 1180 acres because of encroachment or succession since the Habitat Conservation Plan (HCP) was approved in 1983 (Weiss *et al.* 2015). The San Bruno Mountain Habitat Management Plan estimated that grassland habitat was being converted to coastal scrub at a rate of 5 acres/year (TRA Environmental Sciences 2007). Public infrastructure projects (Factor A) are the most serious current threat to the San Bruno elfin butterfly, and also threaten the mission blue butterfly (Service 2010a). Additional threats to both species identified in the previous status review (Service 2010a) but that are new since the original recovery plan was published include: poaching (Factor B); parasitism of larvae (Factor C), potentially exacerbated by the presence of the Argentine ant which has the potential to disrupt the facultative myrmecophile (an animal that lives with ants) relationship between the butterflies and native ants; small population size (Factor E); and climate change (Factor E). Updated threats to the San Bruno elfin include non-native plants and grazing (Factor E), both listed in the original recovery plan for the mission blue butterfly but updated in the 2010 5-year review to include the San Bruno elfin butterfly as well.

Another major threat recognized in the status review for the mission blue butterfly is a fungal pathogen (*Colletotrichum lupini*) that primarily infects the host plant silver lupine (Factor A). The fungal pathogen has resulted in massive die-offs of silver lupine, especially in El Nino years. Following population declines correlated with the fungal pathogen, population augmentation of mission blue butterflies to Twin Peaks began in 2009 and to Milagra Ridge in 2017, with translocations moving butterflies from San Bruno Mountain to the populations being augmented (Wayne *et al.* 2009, GGNRA 2018).

Several threats have been recognized since publication of the last 5-year review. Herbicide use (Factor E) poses a potential threat to both species if used in proximity to occupied habitat (*e.g.* Varela *et al.* 2008, Service 2009). Vole herbivory (Factor A) threatens the host plants of the mission blue butterfly, with herbivory in some years causing severe declines in available lupine (Arechiga pers. comm. 2018, O'Brien pers. comm. 2018, Wayne pers. comm. 2018). Population monitoring may pose a threat to San Bruno elfin butterflies because of the potential for monitors to inadvertently damage habitat and/or host plants (Factor B)(Bennett and Russo 2016a, Arechiga pers. comm. 2018).

**Commented [SB1]:** The population at Rancho Corral de Tierra extends north of GGNRA's property boundary onto privately held land. I just shared spatial data with Rachel Freund from CDFW/CNDDB.

**Commented [SB2]:** My understanding is that the pathogen primarily affects LUAL, but some effects can be seen in the other host plant species as well. Christina Crooker is more familiar with that research.

## AMENDED RECOVERY CRITERIA

Recovery criteria serve as objective, measurable guidelines to assist in determining when an endangered species has recovered to the point that it may be downlisted to threatened, or that the protections afforded by the Act are no longer necessary and the San Bruno elfin butterfly or mission blue butterfly may be delisted. Delisting is the removal of a species from the Federal Lists of Endangered and Threatened Wildlife and Plants (Lists). Downlisting is the reclassification of a species from an endangered species to a threatened species. The term “endangered species” means any species (species, sub-species, or distinct population segment) which is in danger of extinction throughout all or a significant portion of its range. The term “threatened species” means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Revisions to the Lists, including delisting or downlisting a species, must reflect determinations made in accordance with sections 4(a)(1) and 4(b) of the Act. Section 4(a)(1) requires that the Secretary determine whether a species is an endangered species or threatened species (or not) because of threats to the species. Section 4(b) of the Act requires that the determination be made “solely on the basis of the best scientific and commercial data available.” Thus, while recovery plans provide important guidance to the Service, States, and other partners on methods of minimizing threats to listed species and measurable objectives against which to measure progress towards recovery, they are guidance and not regulatory documents.

Recovery criteria should help indicate when we would anticipate that an analysis of the species’ status under section 4(a)(1) would result in a determination that the species is no longer an endangered species or threatened species. A decision to revise the status of or remove a species from the Federal Lists of Endangered and Threatened Wildlife and Plants, however, is ultimately based on an analysis of the best scientific and commercial data then available, regardless of whether that information differs from the recovery plan, which triggers rulemaking. When changing the status of a species, we first propose the action in the *Federal Register* to seek public comment and peer review, followed by a final decision announced in the *Federal Register*.

Although the original recovery plan contains primary and secondary objectives and states when reclassification can be considered, it does not contain objective, measurable recovery criteria. Because the original objectives do not clearly define the terms “secure”, “colonies”, and “self-sustaining”, we are not carrying over any of the objectives verbatim in this revision.

We provide both downlisting and delisting criteria for the San Bruno elfin butterfly and mission blue butterfly, which will supersede those included in the 1984 San Bruno Elfin & Mission Blue Butterfly Recovery Plan, as follows:

## **San Bruno elfin butterfly**

### **Downlisting Recovery Criteria**

#### **FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range**

Present or threatened destruction, modification, or curtailment of the habitat or range of the San Bruno elfin butterflies due to private development projects no longer poses as serious of a threat to these species as they did at the time of listing (Service 2010a). Public infrastructure development, however, is a serious threat that may destroy, modify, or curtail the habitat or range of the species. Exotic invasive plants and habitat loss due to succession are considered with Factor E in order to be consistent with organization of the five-factor analysis in the 5-year review.

In order to downlist the San Bruno elfin butterfly to threatened status, threats to species' habitat must be reduced. This reduction will have been accomplished if the following have occurred:

- A/1** Sites supporting metapopulations of the San Bruno elfin butterfly across the historic range of the species (see E/1 below), including San Bruno Mountain, Milagra Ridge, and the Montara Mountain region, must be managed to ensure the maintenance of habitat that includes a diversity of nectar plants and the larval host plant *Sedum spathulifolium* and to control threats. Long-term maintenance of the sites must be financially sustainable. Use of herbicides, mowing, burning, or livestock grazing in management should be implemented with appropriate methods and timing to avoid impacts to the butterfly and its nectar and host plants.

#### **FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes**

Although poaching and damage to habitat during population monitoring are now considered to be threats to the San Bruno elfin butterfly populations, they are unlikely to be a significant factor in population decline and no new recovery criteria have been developed for this factor. However, please see "Site Specific Recovery Actions" for recommendations regarding San Bruno elfin butterfly population monitoring.

#### **FACTOR C: Disease or Predation**

Although insect parasitism and rodent predation of larvae are considered threats, they are unlikely to be significant factors in population decline and no new recovery criteria have been developed for this factor.

#### **FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

The inadequacy of existing regulatory mechanisms is not a current threat. Therefore, no new recovery criteria have been developed for this factor.

## FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

The following other natural or manmade factors that may affect the continued existence of the species: small population size, exotic invasive plants, recreation impacts, climate change, habitat loss due to succession, and pesticide use. Robust and redundant occurrences are needed across the species range to ensure that the species persists in light of these threats. This will have been accomplished when the following have occurred:

**Commented [SB3]:** Consider adding a qualifier here, since herbicide is specifically listed as an allowable action in Factor A. I suggest "unintended pesticide drift" or "unnecessary"

**E/1** Sites support metapopulations across the historic range of the species, including San Bruno Mountain, Milagra Ridge, and the Montara Mountain region. San Bruno Mountain must include a minimum of 7 colonies, the Montara Mountain region must include a minimum of 5 colonies (including Peak Mountain and Whiting Ridge), and Milagra Ridge must include a minimum of 2 colonies.<sup>1</sup> Each of these metapopulations must contain an average of at least 30 adults with a stable or increasing population trend for a minimum of 10 years.<sup>2</sup>

**E/2** Habitat patches in sites supporting colonies in E/1 have a stable or increasing areal extent over the same 10-year period of population growth.<sup>3</sup>

### Delisting Recovery Criteria

The San Bruno elfin butterfly will be considered for delisting<sup>4</sup> when, in addition to the downlisting criteria:

### FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

No additional recovery criteria have been established for this factor.

### FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

No additional recovery criteria have been established for this factor.

<sup>1</sup> The original recovery plan stated as a primary objective that "Secure, self-sustaining colonies of this species are established and/or re-established on Milagra Ridge, Montara Mountain, Peak Mountain, and Whiting Ridge, and colonies on San Bruno Mountain are secure. Numbers of colonies necessary for reclassification of the San Bruno elfin butterfly to threatened are 7 on San Bruno Mountain, 5 on Montara Mountain (including Peak Mountain and Whiting Ridge), and 2 on Milagra Ridge." Note that SFPW monitoring includes subpopulations along Whiting Ridge and Fifield Ridge, which were originally lumped with Montara Mountain. Multiple colonies within metapopulations are recommended to ensure redundancy.

<sup>2</sup> This is the number of adults considered necessary for resiliency in a congener (member of the same genus), the frosted elfin butterfly (*Callophrys irus*) (Service 2018). A stable or increasing population trend over a 10-year period is recommended for another member of the Lycaenidae family, the Fender's blue butterfly (Service 2010b), and also among other butterfly families (e.g. Behren's silverspot butterfly *Speyeria zerene behrensii* (Service 2015)).

<sup>3</sup> This criterion helps to protect against scrub encroachment.

<sup>4</sup> The original recovery plan stated that: "Delisting of these species will be contingent upon protection, maintenance, and/or expansion of current colonies and establishment of additional colonies."

**FACTOR C: Disease or Predation**

No additional recovery criteria have been established for this factor.

**FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

No additional recovery criteria have been established for this factor.

**FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence**

- E/1 The metapopulations at San Bruno Mountain, Milagra Ridge, and the Montara Mountain regions must include on average a minimum of 18, 4, and 7 occupied colonies, respectively, with overall stable or increasing population trends over a 20-year period.
- E/2 Habitat patches in sites supporting colonies in E/1 have a stable or increasing areal extent over the same 20-year period of population growth.<sup>5</sup>

**Mission blue butterfly**

**Downlisting Recovery Criteria**

**FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range**

Although the reduction and fragmentation to habitat is no longer the primary threat to mission blue butterflies, public infrastructure development and private development are current threats to the species. Additionally, a fungal pathogen that primarily affects the host plant silver lupine, and vole herbivory of the host plants, are threats to species habitat. Modification of habitat through coastal scrub succession and non-native grass invasion are considered in Factor E. In order to downlist the mission blue butterfly to threatened status, threats to species' habitat must be reduced. This reduction will have been accomplished if the following have occurred:

- A/1 Sites supporting metapopulations of the mission blue butterfly (see E/1 below) must be managed to ensure the maintenance of habitat that includes host plants and a diversity of nectar plants. Sites shall have in place a management plan approved by the U.S. Fish and Wildlife Service that supports grasslands and controls other threat to the species and its habitat. Long-term maintenance of the sites must be financially sustainable. Management tools including herbicides, mowing, burning, or livestock grazing should be implemented with appropriate methods and timing to avoid impacts to the butterfly and its nectar and host plants.
- A/2 Monitoring must determine that all sites support populations of silver and summer lupine (*Lupinus albifrons* and *L. formosus*), including a variety of size and/or age classes.<sup>6</sup>

<sup>5</sup> This criterion helps to protect against scrub encroachment.

<sup>6</sup> Species experts recommended multiple species of lupine as necessary for recovery.

Monitoring over a 15-year period<sup>7</sup>, which includes at least two years that have above average local rainfall<sup>8</sup>, must demonstrate natural recruitment of both lupine species and an average of 250 lupine plants/hectare.<sup>9</sup> Mission blue butterflies must be documented using both species of lupine.<sup>10</sup>

A/3 Suitable habitat has a minimum of 250 nectar plants/hectare.<sup>11</sup>

### **FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes**

Although poaching is now considered a threat to the mission blue butterfly populations, it is unlikely to be a significant factor in population decline and no new recovery criteria have been developed for this factor. However, we recommend captive breeding to ensure source stock for population augmentation, as discussed below in “Site Specific Recovery Actions.”

### **FACTOR C: Disease or Predation**

Although insect parasitism and rodent predation of larvae are considered threats, they are unlikely to be significant factors in population decline and no new recovery criteria have been developed for this factor.

### **FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

The inadequacy of existing regulatory mechanisms is not a current threat. Therefore, no new recovery criteria have been developed for this factor.

### **FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence**

The following other natural or manmade factors that may affect the continued existence of the species: small population size, exotic invasive plants, recreation impacts, climate change, habitat loss due to succession, and pesticide use. Habitat loss due to succession is widely considered the most serious threat to the species. Robust populations are needed across the species range to ensure that the species persists in light of these threats. This will have been accomplished when the following have occurred:

<sup>7</sup> A 15-year period showing a stable population is recommended for threatened congeners (member of the same genus) Kincaid’s lupine (*Lupinus sulphureus* ssp. *kincaidii*)(Service 2010b) and Tidestrom’s lupine (*L. tidestromii*)(Service 1998).

<sup>8</sup>The criterion specifies at least two years with above average rainfall because the fungal pathogen that threatens silver lupine is most prevalent following wet, El Niño years.

<sup>9</sup> Recommended lupine cover in the habitat restoration guidelines in the San Bruno Mountain Habitat Management Plan is 2.5% over 0.125 acre or 100 plants in high quality patches, with approximately one high quality patch per acre (TRA Environmental Sciences 2007). This translates to 250 plants/hectare. Maintaining a healthy population of host plants will help to protect against threats posed by non-native grasses.

<sup>10</sup> Using multiple host plants will add to population representation.

<sup>11</sup> This is the approximate recommended number of nectar plants in the San Bruno Mountain Habitat Management Plan, which specifies that there should be 100 nectar plants/acre (TRA Environmental Sciences 2007). Nectar flower abundance is also a criterion for the closely related Fender’s blue butterfly (Service 2010b).

**Commented [SB4]:** I like this idea; and I like keeping it broad as written. I believe that the butterflies at a site might favor one species over the other and utilize the less preferred species only during times of plant stress of the preferred species. I don’t think I’d expect MBBs to be using both species consistently all the time every year, but having the option to use either is important.

**Commented [SB5]:** unmanaged

- E/1** Metapopulations are maintained or re-established in suitable habitat within the historical range of the species, including at least one metapopulation each in Marin, San Francisco, and San Mateo Counties.<sup>12</sup> At least one metapopulation must be maintained on San Bruno Mountain (San Mateo County) and must contain populations across Guadalupe Hills, Southeast Ridge, Radio Ridge, and Reservoir Hill.<sup>13</sup> Metapopulations in Marin and San Mateo Counties must contain at least three populations.<sup>14</sup>
- E/2** Patches of suitable habitat must be at least 6 hectares (15 acres)<sup>15</sup> to support populations designated in E/1. Suitable habitat patches must have stable or increasing grassland acreage over at least a 25-year period, with management focused on maintaining larger habitat patches. For each site, woody vegetation should make up no more than 15% of the absolute vegetative cover.<sup>16</sup> San Bruno Mountain must have a minimum of 1200 acres of grassland as designated in the Habitat Management Plan (TRA Environmental Sciences 2007).
- E/3** Population viability analysis determines that mission blue butterflies have a 90% probability of persistence over a 25-year period across all three counties of the historic range as referred to in E/1.<sup>17</sup> Probability of persistence may be based on varying numbers of metapopulations or populations within each county.

### **Delisting Recovery Criteria**

All downlisting criteria remain applicable for delisting, and are to be extended to include the populations mentioned in delisting criterion A/1. The mission blue butterfly will be considered for delisting<sup>18</sup> when, in addition to the downlisting criteria:

### **FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range**

No additional recovery criteria have been established for this factor.

<sup>12</sup> The original recovery plan stated that “Reclassification of the mission blue butterfly to threatened status can be considered when secure, self-sustaining colonies of this species are established and/or reestablished on Twin Peaks and Fort Baker (one colony at each site) and when colonies on San Bruno Mountain (as noted in the HCP) are secure. Multiple metapopulations across the species range ensures redundancy.

<sup>13</sup> These San Bruno locations are mentioned as colony locations necessary for reclassification in the primary objective of the original recovery plan (Service 2010a). San Bruno Mountain is specified within San Mateo County because it is central in the historic range of the species.

<sup>14</sup> Having multiple populations ensures redundancy. Multiple populations are not required in San Francisco County because of the small areal amount of suitable habitat.

<sup>15</sup> This is the minimum patch size for an isolated population to persist in the absence of immigration from other patches in the Fender blue butterfly Recovery Plan, based on a conservative approach to studies showing a minimum patch size of 2-6 hectares (Service 2010b).

<sup>16</sup> Limiting woody vegetation to 15% absolute vegetative cover is part of the habitat quality guidelines for the closely related Fender’s blue butterfly (Service 2010b).

<sup>17</sup> Population viability analysis can be used to determine minimum or average population sizes to ensure persistence. This criteria is modelled after methodology used to develop minimum population sizes necessary for recovery of the closely related Fender’s blue butterfly (*Icaricia icarioides fenderi*) (Service 2010b). This probability of persistence was chosen to ensure resiliency.

<sup>18</sup> The original recovery plan states that “Delisting of these species will be contingent upon protection, maintenance, and/or expansion of current colonies and establishment of additional colonies.”

**FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes**

No additional recovery criteria have been established for this factor.

**FACTOR C: Disease or Predation**

No additional recovery criteria have been established for this factor.

**FACTOR D: Inadequacy of Existing Regulatory Mechanisms**

No additional recovery criteria have been established for this factor.

**FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence**

- E/1** Metapopulations are maintained or re-established in suitable habitat within the historical range of the species, including at least one additional metapopulation in Marin County<sup>19</sup> and three additional metapopulations in San Mateo County.<sup>20</sup>
- E/2** Population viability analysis determines that mission blue butterflies have a 95% probability of persistence in Marin, San Francisco, and San Mateo Counties over a 100-year period. Probability of persistence may be based on varying numbers of metapopulations or populations.<sup>21</sup>

All classification decisions consider the following five factors: (1) is there a present or threatened destruction, modification, or curtailment of the species' habitat or range; (2) is the species subject to overutilization for commercial, recreational scientific or educational purposes; (3) is disease or predation a factor; (4) are there inadequate existing regulatory mechanisms in place outside the ESA (taking into account the efforts by states and other organizations to protect the species or habitat); and (5) are other natural or manmade factors affecting its continued existence. When delisting or downlisting a species, we first propose the action in the *Federal Register* and seek public comment and peer review. Our final decision is announced in the *Federal Register*.

**Rationale for Recovery Criteria**

We have amended the recovery criteria for the San Bruno elfin butterfly and mission blue butterfly to include objective, measurable downlisting and delisting criteria that incorporate the biodiversity principles of resiliency, redundancy, and representation (Service 2016) and threats addressed under the five factors. The amended criteria were developed based on the Service's

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<sup>19</sup> The current range of mission blue butterflies is considered to include populations in the Marin Headlands in addition to Fort Baker, as well as a population in Oakwood Valley (Service 2010a). Observations in other locations (e.g. Tennessee Valley) suggest that other areas in the county may support mission blue butterflies.

<sup>20</sup> Mission blue butterflies have been documented in San Mateo County at Milagra Ridge, Sweeney Ridge, and the SFPW, which could all support metapopulations.

<sup>21</sup> Population viability analysis can be used to determine minimum or average population sizes to ensure persistence. This criteria is modelled after methodology used to develop minimum population sizes necessary for recovery of the closely related Fender's blue butterfly (*Icaricia icarioides fenderi*)(Service 2010b). This probability of persistence was chosen to ensure resiliency.

current understanding of the species needs and requirements. This understanding includes information gathered since the original recovery plan was published, such as more recent information about population status and trends, along with an updated understanding of the threats acting on the species, as summarized in the synthesis above. The criteria presented are based on the reduction of threats to the species, and they include a temporal aspect to ensure that the species are resilient to expected variation within a reasonable time frame.

### **ADDITIONAL SITE SPECIFIC RECOVERY ACTIONS**

Actions identified in the step-down outline in the original recovery plan are still applicable towards meeting these amended recovery criteria. In certain cases, actions may be expanded to include more recently discovered San Bruno elfin butterfly colonies and mission blue butterfly populations.

The actions identified below are those that, based on the best available science, are necessary to bring about the recovery of the listed species in this amendment and ensure their long-term conservation. However, these actions are subject to modification as might be indicated by new findings, changes in species status, and the completion of other recovery actions.

#### Key to Terms and Acronyms Used in the Recovery Action Narrative and Implementation Schedule:

Priority numbers are defined per Service policy (Service 1983) as:

- Priority 1:** An action that must be taken to prevent extinction or to prevent a species from declining irreversibly.
- Priority 2:** An action that must be taken to prevent a significant decline of the species population/habitat quality or some other significant negative impact short of extinction.
- Priority 3:** All other actions necessary to provide for full recovery of the species.

The priority assigned to each action is specified within parentheses at the end of the description.

The numeric recovery priority system follows that of all Service recovery plans. Because situations change over time, priority numbers must be considered in the context of past and potential future actions at all sites. Therefore, the priority numbers assigned are intended to guide, not to constrain, the allocation of limited conservation resources.

- 1. Establish captive breeding of mission blue butterflies at a captive breeding facility.** This action will assist in the recovery of mission blue butterflies by further protecting existing populations and allowing for population augmentation in an effort to maintain and re-establish self-sustaining populations to persist in the long-term. (Priority 1)
- 2. Conduct a population genetics study of the mission blue butterfly across the proposed**

**range.** This study will aid in genetic management at the captive breeding facility, and can more clearly define the boundaries of the species range. (Priority 3)

- 3. Conduct population viability analyses for metapopulations of the mission blue butterflies.** This action will assist in the recovery for the species by determining the target populations, minimum populations, or occupancy at each population or metapopulation site needed to achieve recovery criteria. (Priority 3)
- 4. Coordinate among habitat managers and regulatory agencies to establish recommended San Bruno elfin butterfly monitoring protocols.** Concern about damage to host plants and habitat should be considered when determining monitoring activities and frequency. (Priority 3)
- 5. Investigate biology of San Bruno elfin butterflies to guide population estimates.** Studies on oviposition rates and larval survival will help determine how to estimate adult populations from larvae monitoring. (Priority 3)

#### LITERATURE CITED

- Arnold, R. A. 1983. Ecological studies of six endangered butterflies (Lepidoptera, Lycaenidae): island biogeography, patch dynamics, and design of habitat preserves. University of California Publications in Entomology 99:1-161.
- Arnold, R. A. and S. Lindzey. 2003. Taxonomic identity of the *Plebejus icariodes* population at Oakwood Valley, Marin County, California. National Park Service Report, Golden Gate National Recreation Area.
- Bennett and Russo 2016a. 2016 San Bruno elfin butterfly survey: Montara Mountain—Rancho Corral de Tierra. Unpublished report prepared by the Golden Gate National Recreation Area.
- Bennett and Russo 2016b. 2016 Mission blue butterfly survey: Sweeney Ridge—Golden Gate National Recreation Area. Unpublished report prepared by the Golden Gate National Recreation Area.
- Coast Ridge Ecology. 2017. 2017 survey results for mission blue butterfly at Golden Gate National Recreation Area, Marin Headlands, CA. Unpublished report prepared for Golden Gate National Parks Conservancy, San Francisco, CA.
- GGNRA 2018. 2018 Mission Blue Butterfly Translocation Project Summary. Unpublished report prepared for the U.S. Fish and Wildlife Service.
- Fund for Animals v. Babbitt, 903 F. Supp. 96 (D.D.C. 1995). U.S. District Court for the District of Columbia. September 29, 1995.

- (Service) U.S. Fish and Wildlife Service. 1983. Endangered and threatened species listing and recovery priority guidelines. Federal Register 48: 43098-43105.
- (Service) U.S. Fish and Wildlife Service. 1984. Recovery plan for the San Bruno elfin and mission blue butterflies. U.S. Fish and Wildlife Service, Portland, Oregon. 81 pp.
- (Service) U.S. Fish and Wildlife Service. 1998. Seven coastal plants and the Myrtle's silverspot butterfly recovery plan. U.S. Fish and Wildlife Service, Portland, Oregon. 141 pp.
- (Service ) U.S. Fish and Wildlife Service. 2003. Final recovery plan for the Karner blue butterfly (*Lycæides melissa samuelis*). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 273 pp.
- (Service) U.S. Fish and Wildlife Service. 2009. Intra-service biological opinion on the amendment to the San Bruno Mountain Habitat Conservation Plan. Service file 81420-2008-F-0946. Dated May 20, 2009.
- (Service) U.S. Fish and Wildlife Service. 2010a. San Bruno elfin butterfly (*Callophrys mossii bayensis*) and mission blue butterfly (*Icaricia icarioides missionensis*) 5-year review: Summary and evaluation. Sacramento Field Office, Sacramento, CA.
- (Service) U.S. Fish and Wildlife Service. 2010b. Recovery plan for the prairie species of Western Oregon and Southwestern Washington. U.S. Fish and Wildlife Service, Portland, Oregon. xi + 241 pp.
- (Service) U.S. Fish and Wildlife Service. 2015. Recovery plan for Behren's silverspot butterfly (*Speyeria zerene behrensii*). U.S. Fish and Wildlife Service, Pacific Southwest Regional Office, Region 8, Sacramento, California. xi + 95 pp.
- (Service) U.S. Fish and Wildlife Service. 2016. USFWS Species Status Assessment Framework: an integrated analytical framework for conservation. Version 3.4 dated August 2016.
- (Service) U.S. Fish and Wildlife Service. 2018. Species status assessment report for the frosted elfin (*Callophrys irus*). U.S. Fish and Wildlife Service, Cortland, NY. Version 1.2. April 2018.
- Steiner, J., 1990. Bay area butterflies: The distribution and natural history of the San Francisco region Rhopalocera. Master's thesis. California State University at Hayward.
- TRA Environmental Sciences. 2007. San Bruno Mountain Habitat Management Plan. Prepared for the County of San Mateo.
- U.S. Government Accountability Office. (2006, April). Endangered species: Time and costs required to recover species are largely unknown (Publication No. GAO-20548).

Varela, L.G., M.W Johnson, L. Strand, C.A. Wilen, and C. Pickel. 2008. Light brown apple moth's arrival in California worries commodity groups. *California Agriculture* 62: 57-61.

Wang, T. 2018. 2018 Mission blue butterfly (*Icaricia icarioides missionensis*) monitoring report. Unpublished report prepared for Mariner's Pointe Owner's Association. Pacific, California.

Weiss, S.B., Naumovich L. and C. Niederer. 2015. Assessment of the past 30 years of habitat management and covered species monitoring associated with the San Bruno Mountain habitat conservation plan. Prepared for the San Mateo County Parks Department.

Wolf, S., B. Hartl, C. Carroll, M. C. Neel, and D. Greenwald. 2015. Beyond PVA: Why recovery under the endangered species act is more than population viability. *BioScience* 65: 200-207.

### **Personal Communication**

Arechiga, R. 2018. Natural Resource Manager, San Mateo County Parks and Rec. Phone calls with Samantha Lantz, Sacramento Fish and Wildlife Office. July 23 and August 22, 2018.

Arnold, R. 2018. Entomologist, Entomological Consulting Services, Ltd. Phone call with Samantha Lantz, Sacramento Fish and Wildlife Office. July 13, 2018

Bennett, S. 2018. Biologist, WRA, Inc. Phone call with Samantha Lantz, Sacramento Fish and Wildlife Office. August 16, 2018.

O'Brien, L. 2018. Amateur lepidopterist. Phone call with Samantha Lantz, Sacramento Fish and Wildlife Office. July 13, 2018.

Wayne, L. 2018. Natural Areas Manager, San Francisco Recreation & Parks. Phone call with Samantha Lantz, Sacramento Fish and Wildlife Office.

### *In litteris* communication

Arnold, R. 2013. Entomologist, Entomological Consulting Services, Ltd. Email to Ben Solvesky, Sacramento Fish and Wildlife Office. July 7, 2013.

Arnold, R. 2018. Entomologist, Entomological Consulting Services, Ltd. Email to Samantha Lantz, Sacramento Fish and Wildlife Office. September 5, ~~2013~~2018.

Crooker, C. 2018. Restoration Manager, Golden Gate National Parks Conservancy. Email to Samantha Lantz, Sacramento Fish and Wildlife Office. August 16, 2018.

Commented [SB6]: Presumed typo



Powelson, Katherine &lt;katherine\_powelson@fws.gov&gt;

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## Peer Review Request from USFWS

6 messages

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Stu Weiss <stu@creeksidescience.com>

Mon, Mar 11, 2019 at 3:15 PM

Dear Stuart Weiss,

The U.S. Fish and Wildlife Service (Service) is soliciting independent scientific reviews of a draft recovery plan amendment for the "Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*)". In this proposed amendment, we provide draft delisting criteria for San Bruno Elfin Butterfly and Mission Blue Butterfly. Draft and final recovery plan revisions are publicly available through our Environmental Conservation Online System (ECOS, <https://ecos.fws.gov>); this draft revision is also attached.

We are seeking your expert review on the following:

- Have we assembled and considered the best available scientific and commercial information relevant to this species?
- Is our analysis of this information correct?
- Are our scientific conclusions reasonable in light of this information?

This request is provided in accordance with our July 1, 1994, peer review policy (USFWS 1994, p. 34270) and our current internal guidance. This request also satisfies the peer review requirements of the Office of Management and Budget's "Final Information Quality Bulletin for Peer Review." Our updated peer review guidelines also require that all peer reviewers fill out a conflict of interest form (**see attached**). We will carefully assess any potential conflict of interest or bias using applicable standards issued by the Office of Government Ethics and the prevailing practices of the National Academy of Sciences (<http://www.nationalacademies.org/coi/index.html>). Disclosing a conflict does not invalidate the comments of the reviewer; however, it will allow for transparency to the public regarding the reviewer's possible biases or associations. You may return the completed conflict of interest form either prior to or with your peer review.

We ask that you please provide your comments no later than **April 15, 2019**. Please provide your written response to us by email or by letter. Please be aware that your completed review of the draft recovery plan revision, including your name and affiliation, will be included in the administrative record and will be available to interested parties upon request.

Please let me know if you have any questions.

Thank you for your consideration,

**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

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### 2 attachments

**Conflict of Interest Disclosure Form.pdf**  
63K

**Draft APG amendment Mission blue and San Bruno elfin butterflies\_revised.docx**

54K

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**Stu Weiss** <stu@creeksidescience.com>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Fri, Mar 15, 2019 at 6:48 AM

Katherine - I accept the offer of doing the peer review for the Elfin and Mission blue.

Stu Weiss  
[Quoted text hidden]

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Stu Weiss <stu@creeksidescience.com>

Fri, Mar 15, 2019 at 9:02 AM

Great, thanks!  
**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

[Quoted text hidden]

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Stu Weiss <stu@creeksidescience.com>

Tue, Apr 16, 2019 at 11:25 AM

Hello Stu,  
Are you still able to review?  
Thanks  
**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**  
3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819

[Quoted text hidden]

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**Stu Weiss** <stu@creeksidescience.com>  
To: "Powelson, Katherine" <katherine\_powelson@fws.gov>

Tue, Apr 16, 2019 at 11:48 AM

Katherine - this review caught me in the middle of moving out of our place of 25 years (an ordeal, to say the least), and things have fallen by the wayside. Finally catching my breath, and I could finish up the review by next Monday. Thanks for your understanding here.

Stu  
[Quoted text hidden]

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**Powelson, Katherine** <katherine\_powelson@fws.gov>  
To: Stu Weiss <stu@creeksidescience.com>

Tue, Apr 16, 2019 at 1:09 PM

Great thank you. Your insight is greatly appreciated.  
**Kat Powelson**  
**Science Support Coordinator, Science Applications**  
**U.S. Fish & Wildlife Service, Pacific Southwest Region**  
**(916) 278-9448 office**

4/23/2019

DEPARTMENT OF THE INTERIOR Mail - Peer Review Request from USFWS

**3020 State University Drive East  
Modoc Hall, Suite 2007  
Sacramento CA 95819**

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Comments on “**Recovery Plan Revision for San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icarioides missionensis*)**” DRAFT  
**AMENDMENT 1**

Stuart B. Weiss, Ph.D.  
Creekside Center for Earth Observation  
Menlo Park, CA

May 2019

**Overall Assessment**

The recovery plan revisions were clearly needed since the original plan is 35 years old, and much has been learned since then. The revisions do their best to incorporate new knowledge and information from other closely related species (i.e. Fenders blue), but several of the recommended revisions for Mission blue (habitat area, local lupine abundance, and metapopulation structure) *should be viewed as provisional* until data (especially lupine distribution and abundance) that are currently being collected are compiled and analyzed. Keeping the process open and adaptive is critical for realistic and achievable quantitative recovery goals.

**A terminology issue:** In the 5-Year Review and in some places in the Amendment, the distinction between ssp. *missionensis* and ssp. *pardalis* within these documents is often referenced at the level of individuals, i.e. some individuals within a population are *pardalis* and some are *missionensis*. This is an incorrect use of subspecific designations. Subspecific designation occurs at the *population* level, not the individual level. It is correct to say that an individual shows *pardalis* or *missionensis* phenotypic characters, but one cannot make the statement that the *individual* is one or the other subspecies. The subspecific designation is a matter of relative frequencies of the phenotypic characters within and between populations. These phenotypic characters occur in geographical clines, and the cutoff for one subspecies versus another. This population framework does not invalidate the determination that Oakwood Valley populations belong to ssp. *missionensis* nor other discussions on page 4 of the Amendment such as how far south along the Peninsula ssp. *missionensis* extends. But clarity of population thinking on the nature of subspecies is important for *Icaricia icarioides* and other taxa like *Speyeria callippe*. To refer to “hybrids” and “hybrid zones” also confuses the matter since it implies that *pardalis* and *missionensis* are more distinct entities than they actually are, and “hybrid” can be a loaded term under the ESA. Use of the terms “blend” or “transition” zones is more appropriate.

This subspecies terminology issue is far less important for the San Bruno elfin, because of distinct geographic breaks south of Montara Mountain, and at the Golden Gate. *Callophrys mossii* on Mt. Tamalpais are designated as ssp. *marinensis*. The presence of apparently suitable (hostplants and nectar sources) but unoccupied habitat in the Marin Headlands such as the rocky north-facing slopes above Tennessee Valley provides an opportunity for extending the range of San Bruno elfin.

**A quantitative population issue:** When dealing with populations, it is also critical that they be considered on a logarithmic scale, so that “average” population size is actually the geometric average of population estimates.

### **San Bruno elfin**

**Downlisting Criteria** San Bruno Elfin E/1 – It is important to document the known number of colonies in each of the metapopulations, since only 7 on San Bruno Mountain a fraction (~33%) of the known colonies (21 historic sites), and 5 on Montara Mountain is some fraction of extant colonies now that the area has been more thoroughly surveyed. Occupancy is relatively easy to determine by either adult surveys (weather dependent and prone to false zeros, though) or larval surveys (more straightforward). Also, determining that there are at least 30 adults in a colony is a methodological challenge, since adult observations are usually <5 individuals per visit (Weiss et al. 2015). A method using quantitative larval counts could be effective, if a conservative parasitism/mortality rate can be decided upon – Arnold (1983) estimates that the parasitism rate of 55-82% so larval estimates of 67 – 167 are necessary, not counting non-parasitoid pupal mortality. The high end of this range was achieved at some sites in some of the monitoring rounds in 2018 on SBM. The current methods on SBM are only quasi-quantitative, searching all *Sedum* within a 25 m radius at several points during the larval season. Tightening this method, by sampling square meters in transects to generate an actual density, would be necessary to reliably estimate populations as >30 adult butterflies. Testing of course would be a necessary step. But, some *Sedum* patches, especially on Montara Mountain, are quite inaccessible.

E/2 - Some monitoring of *Sedum* extent and brush encroachment potential is necessary to fulfill this criterion. It does not seem to have been a major issue over the past 30-years, but we do not really understand brush dynamics. Baseline data are critical.

**Delisting Criteria** San Bruno Elfin E/1 – again, the actual number of known colonies and *Sedum* patches in each of the designated areas needs to be explicitly documented. 4 colonies on Milagra Ridge seems an overestimate, unless parts of Sweeney Ridge are included.

The status of SBE in the SBM quarry also needs to be considered, as *Sedum* has colonized some of the cut slopes. The quarry is potentially the largest habitat available, and at some point will be closed.

### **Mission blue**

The largest issue at this time is the absence of current lupine maps and counts in major parts of the range, especially San Bruno Mountain, Marin Headlands, and Sweeney Ridge. This gap is being remedied in some areas as of 2019, and *it is extremely important to present the area and numerical goals for lupines as preliminary, pending better data.* The following comments are some of the questions to be answered once lupine maps and metapopulation analyses are farther along.

**Downlisting Criteria** Mission blue A/2 All sites may not be suitable for *L. formosus* and *L. variicolor* may be the most suitable alternative host to *L. albifrons* as insurance against the fungal dieback.

Lupines have been mapped well on Milagra Ridge, Twin Peaks, and Oakwood Valley. SFPUC lands have also been mapped. The criteria for aggregating these into populations and metapopulations need clarification.

The lack of current lupine counts and maps on SBM, Marin Headlands, and Sweeney Ridge is a major knowledge gap. This gap is a limitation on setting criteria for lupine densities, especially in diffuse lupine populations. The 250 lupine plants/ha criterion may be difficult to achieve depending on how the acreage is delineated. For example, the grassland habitat on the ridge dividing Owl/Buckeye canyon is excellent MBB habitat, and extends over ~5 ha, and fits the description of a population in terms of area and isolation. The criterion would require that 1250 lupines be present in this discrete grassland patch. We simply do not know if that is the case currently, nor do we know the mix of lupine species, nor the patch structure within the grassland. The same holds for much of SBM.

On Milagra, do all of the patches together constitute a population or a metapopulation, and how do Skyline College, other private lands, and Sweeney Ridge fit in?

Sweeney Ridge, especially the northern grasslands overlooking Skyline College, once supported MBB but no longer does despite many acres of grassland occupied by *L. albifrons* and *L. variicolor* (and possibly *L. formosus*). Reintroduction here is a high priority, and clarification of whether this is an independent metapopulation from Milagra and intervening Skyline College

In some small lupine patches, the density is far above the 250 plants/ha criterion but the total number of lupines is far below the 1,250 proposed for the minimum 6 ha extent. MBB populations have apparently persisted in such small areas even if they are isolated.

As mentioned above, many of these issues will be clarified once the metapopulation analysis is underway based on current maps of lupine distribution and abundance. The metapopulation viability criteria are a good addition, and create a cutting edge framework for data collection and analysis.

The nectar criterion is easily met given the variety of nectar sources used by MBB.

### **Further Actions**

The captive rearing would be a great advance and allow for larger scale population augmentation and reintroduction, as well as deeper understanding of Mission blue biology.

One other action of high priority (1) is to develop lupine propagation methods from direct seeding so that local lupine stands can be diversified and densities increased. Propagation by planting plugs has been difficult and the most suitable areas for lupines (cut slopes and rocky areas) are unsuitable for plantings. Such work is underway by Creekside Science and GGNRA, and should be mentioned.

For San Bruno elfin, assessment of the unoccupied *Sedum* habitat in the Marin Headlands and consideration as introduction sites is a desirable action.