Integration and Synthesis Summary for Insects

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will "likely be adversely affected" by the proposed action. Our jeopardy analysis of the proposed action's impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine each individual species' rankings, including environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. Status of the species for each species can be found in Appendix B.

Ranges for all species in this assessment group are entirely within the conterminous United States.

Vulnerability

For the insect species that we or EPA determined are "likely to be adversely affected" by the proposed action, we considered several factors to summarize the current vulnerability of that species to additional stressors. This effort allows us to consider whether a species' current condition is moving toward recovery or further decline. In general, we expect the species' vulnerability to additional stressors to be higher if they are moving toward further decline than if they their condition is improving. We also identify which species are most (and least) susceptible to additional stressors in general based on information that could be surmised from species listing and recovery documents, or other sources as cited and considered in the *Status* section of this biological opinion.

Our assessment of vulnerability focuses on six factors: (1) the species listing status and recent 5-Year Review recommendation (if available), (2) distribution, (3) number of populations, (4) species population trends, (5) if pesticides have been noted as a threat, and (6) impacts from activities associated with environmental baseline and cumulative effects. Sources for this information were listing rules, recovery plans, 5-Year Reviews, and Species Status Assessments. We obtained the information to create the vulnerability summary from the *Status of the Species* accounts (Appendix B), overarching *Environmental Baseline* section of this Opinion, 5-year species status reviews, species recovery plans, species status assessments, and other sources containing the best available scientific information for the species.

We scored each of the six vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as medium or high. We assigned a medium vulnerability ranking if a species' scores were a mix of high and low (though exceptions were allowed for species that have a low status score or have an uplisting recommendation). We assigned a low vulnerability ranking to species with only low scores. Considerations regarding specific aspects of the species vulnerability, or beyond what was included in the vulnerability ranking were applicable for some species depending on unique aspects of their life history. This information is reflected in the rationales for conclusion below.

Exposure

We anticipate insects will primarily be exposed to methomyl through direct contact with aerosolized methomyl in the air or through residues on foliage and other surfaces. Exposure can occur on methomyl use sites as well as off-field through spray drift. Methomyl degrades quickly in natural environments (i.e., within a few days) and as such is not likely to persist in species' habitats for long periods of time.

We characterize the expected level of exposure using overlap data, past methomyl usage data, and any species-specific considerations such as life history information (e.g., habitat preferences, dispersal behavior) and existing protections or conservation actions. Species with greater than 10% overlap between their range and methomyl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with methomyl use sites, we considered past methomyl usage data within a species' range to determine how much of a species' range we expect to be treated with methomyl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the *Usage Analysis* section of this Opinion. Species that have data which indicate they will have a large portion of their range (>10%) treated with methomyl each year are assigned a high usage score. Species that will have a medium portion of their range (5-10%) treated with methomyl each year are assigned a medium usage score, and species that data indicate will have a low portion of their range (<5%) treated with methomyl each year are assigned a low usage score. Past methomyl usage data on Pacific or Caribbean islands is unavailable. However, prior reporting data indicate that annual treatment with insecticides occurs on 8-45% of agricultural crops per island on Hawai'i and 20-70% of crops per municipality in Puerto Rico. We use these data broadly as confirmation that insecticide usage occurs on these islands, with methomyl presumably among these insecticides. Where appropriate (e.g., species with more spatially refined range maps), we use these data as an additional exposure modifier to estimate the extent that a species' range is likely to be treated with insecticides, which we consider an upper bound for methomyl usage.

We determine the overall exposure ranking by qualitatively considering both the total overlap and total usage, as well as any additional exposure considerations that might modify the level of exposure likely to occur. When overlap and usage scores are the same, we assign the overall exposure ranking the same score (e.g., if both overlap and usage is high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. (As usage is a subset of overlap, the overlap score will always be greater than the usage score.) In cases where overlap is high but usage is low, we anticipate a moderate portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. For all species, where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate.

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to methomyl at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (e.g., reduced growth) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is likely to experience when the organisms they rely on, such as those that act as food or habitat resources, are exposed to methomyl and experience adverse effects.

We consider estimated concentrations of methomyl on the landscape or within the environment and effects reported in available toxicity studies to determine the level of direct and indirect adverse effects to listed species or critical habitat. Concentrations of methomyl can vary greatly depending on where exposure takes place. For instance, exposures on or near methomyl use sites are at higher levels than exposures that occur in areas far away from use sites. Based on available toxicity data, we anticipate insects are highly sensitive to methomyl at estimated environmental concentrations and are likely to experience high levels of mortality, even in habitats that only accumulate low levels. While sublethal effects, such as reduced growth or reproduction, are also possible with methomyl exposure, we do not anticipate sublethal effects are likely to occur before the onset of mortality for insects.

We anticipate species that only rely on plant-based resources, such as nectar for food or vegetation as habitat, are not likely to experience any indirect adverse effects, as available toxicity data in plants indicate no reductions in plant survival or growth are likely to occur with methomyl exposure. In contrast, species that rely on other arthropods for food resources may experience high levels of indirect adverse effects as methomyl exposure will likely reduce the abundance and availability of prey.

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[1] While our Opinion considers all consequences of the proposed action (per the definition of effects of the action at 50 CFR Part 402.02), the terms "direct" and "indirect" effects were used in EPA's BE, and are used in environmental risk assessment terminology in general, and do not have the same meaning as used in ESA regulations. As used in the effects analysis section, direct effects to species are those caused by the pesticide itself through dietary, dermal, or inhalation routes of exposure. Indirect effects occur when the pesticide acts on elements of the ecosystem that are required by the species, such as alterations to prey or shelter. Thus, in the effects analysis section, we may use these terms to link back to the analysis in EPA's BE.

We determine the overall toxicity ranking for insects by qualitatively assessing both the expected levels of direct adverse effects (e.g., mortality) and indirect effects (e.g., prey loss). Given that mortality is the most adverse of direct effects to an individual of a species, we assign the most weight to direct adverse effects resulting in mortality when determining the toxicity ranking. As mentioned previously, available toxicity data indicate insects are highly sensitive to methomyl and are likely to experience high levels of mortality, even in habitats that only accumulate low levels. As such, all insects will have a high toxicity ranking.

Summary of Insect Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of methomyl, and the cumulative effects, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. It is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence the 59 insect species in this Appendix.

In our analysis below, some species that had the same or very similar rationales for their conclusions were grouped together, to increase efficiency and avoid repetition. Relevant information and data unique to each individual species was considered when assigning species to groups and incorporated into the rationales as appropriate. Species-specific information (e.g., environmental baseline, cumulative effects, status of the species, exposure, and toxicity) was considered for all species, including those species in the grouped analyses, and are presented in full in Appendices B and E. Species with rationales that did not fit in a group, or warranted a separate rationale because of their life history, conservation status, or other information indicated that effects could be different, have an individual discussion to provide additional explanation. This approach allowed us to streamline our discussion in this Opinion by avoiding repeating our findings when species in the respective groupings would be expected to be affected similarly. The use of these groupings, therefore, does not mean that our evaluation failed to evaluate each individual species. On the contrary, our process and analysis for each species remained the same, regardless of the format of the discussion presented below.

Experimental, non-essential populations

The EPA included the experimental, non-essential populations for the following insect species in the consultation: American burying beetle and Oregon silverspot butterfly. We do not provide separate analyses and make jeopardy determinations for these populations independently. Rather, we treat any experimental and non-experimental populations as a single listed species for the purposes of conducting jeopardy analyses and making jeopardy determinations. By definition, a "non-essential experimental population" is not essential to the continued existence of the species. In cases where our assessment of the non-experimental population(s) of the species leads to a “not likely to jeopardize” determination, we generally assume any added effects to the experimental population will not change these determinations. However, we consider the role of the experimental population in the survival and recovery of the species and consider this information in our jeopardy analyses as appropriate.

Species with Individual Integration and Synthesis summaries

For the species in Table 1, our preliminary exposure and toxicity rankings indicate that the proposed action may result in moderate to high adverse effects. As such, we discuss each species in more detail in individual Integration and Synthesis summaries below. In some cases, we modified initial exposure and toxicity rankings due to additional information regarding exposure and effects for individual species, as described below.

Table 1. Insects with moderate to high adverse effects anticipated from the proposed action. We addressed each species in individual Integration and Synthesis summaries.

Scientific Name	Common Name	Draft Determination
Lycaeides melissa samuelis	Karner blue butterfly	No Jeopardy
Apodemia mormo langei	Lange's metalmark butterfly	No Jeopardy
Lycaeides argyrognomon lotis	Lotis blue butterfly	No Jeopardy
Icaricia icarioides missionensis	Mission blue butterfly	No Jeopardy
Neonympha mitchellii mitchellii	Mitchell's satyr butterfly	No Jeopardy
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	No Jeopardy
Euphydryas editha quino (=E. e. wrighti)	Quino checkerspot butterfly	No Jeopardy
Callophrys mossii bayensis	San Bruno elfin butterfly	No Jeopardy
Euphilotes enoptes smithi	Smith's blue butterfly	No Jeopardy
Heraclides aristodemus ponceanus	Schaus swallowtail butterfly	No Jeopardy
Speyeria callippe callippe	Callippe silverspot butterfly	No Jeopardy
Speyeria zerene hippolyta	Oregon silverspot butterfly	No Jeopardy
Euproserpinus euterpe	Kern primrose sphinx moth	No Jeopardy
Elaphrus viridis	Delta green ground beetle	No Jeopardy
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	No Jeopardy
Boloria acrocnema	Uncompahgre fritillary butterfly	No Jeopardy
Euphydryas editha bayensis	Bay checkerspot butterfly	No Jeopardy
Nicrophorus americanus	American burying beetle	No Jeopardy
Habroscelimorpha dorsalis dorsalis	Northeastern beach tiger beetle	No Jeopardy
Ellipsoptera puritana	Puritan tiger beetle	No Jeopardy
Speyeria zerene behrensii	Behren's silverspot butterfly	No Jeopardy
Somatochlora hineana	Hine's emerald dragonfly	No Jeopardy
Manduca blackburni	Blackburn's sphinx moth	No Jeopardy
Icaricia icarioides fenderi	Fender's blue butterfly	No Jeopardy
Neonympha mitchellii francisci	Saint Francis' satyr butterfly	No Jeopardy
Polyphylla barbata	Mount Hermon June beetle	No Jeopardy
Cicindela ohlone	Ohlone tiger beetle	No Jeopardy
Trimerotropis infantilis	Zayante band-winged grasshopper	No Jeopardy
Pseudocopaeodes eunus obscurus	Carson wandering skipper	No Jeopardy
Drosophila heteroneura	Hawaiian picture-wing fly	No Jeopardy
Drosophila mulli	Hawaiian picture-wing fly	No Jeopardy
Lednia tumana	Meltwater lednian stonefly	No Jeopardy
Megalagrion pacificum	Pacific Hawaiian damselfly	No Jeopardy
Lycaena hermes	Hermes copper butterfly	No Jeopardy
Hesperia dacotae	Dakota skipper	No Jeopardy
Drosophila digressa	Hawaiian picture-wing fly	No Jeopardy

Appendix C-A6. Insects: Integration and Synthesis Summaries

Scientific Name	Common Name	Draft Determination
Hypolimnas octocula marianensis	Mariana eight-spot butterfly	No Jeopardy
Megalagrion leptodemas	Crimson Hawaiian damselfly	No Jeopardy
Cyclargus (=Hemiargus) thomasi bethunebakeri	Miami blue butterfly	No Jeopardy
Cicindela nevadica lincolniana	Salt Creek tiger beetle	No Jeopardy
Bombus franklini	Franklin's bumble bee	No Jeopardy
Strymon acis bartrami	Bartram's scrub-hairstreak butterfly	No Jeopardy
Vagrans egistina	Mariana wandering butterfly	No Jeopardy
Euchloe ausonides insulanus	Island marble butterfly	No Jeopardy
Megalagrion oceanicum	Oceanic Hawaiian damselfly	No Jeopardy
Euphydryas editha taylori	Taylor's (=whulge) checkerspot	No Jeopardy
Anaea troglodyta floridalis	Florida leafwing butterfly	No Jeopardy
Dinacoma caseyi	Casey's June beetle	No Jeopardy
Ischnura luta	Rota blue damselfly	No Jeopardy
Atlantea tulita	Puerto Rico harlequin butterfly	No Jeopardy
Zapada glacier	Western glacier stonefly	No Jeopardy
Oarisma poweshiek	Poweshiek skipperling	No Jeopardy
Bombus affinis	Rusty patched bumble bee	No Jeopardy
Cicindelidia floridana	Miami tiger beetle	No Jeopardy
Rhaphiomidas terminatus abdominalis	Delhi Sands flower-loving fly	No Jeopardy
Euphydryas anicia cloudcrofti	Sacramento Mountains checkerspot butterfly	No Jeopardy
Brychius hungerfordi	Hungerford's crawling water beetle	No Jeopardy
Heterelmis comalensis	Comal Springs riffle beetle	No Jeopardy
Stygoparnus comalensis	Comal Springs dryopid beetle	No Jeopardy

Integration and Synthesis Summary: Karner blue butterfly

Scientific Name:	Common Name:	Entity ID:
Lycaeides melissa samuelis	Karner blue butterfly	420

Species Overview

In reviewing the status of the species, the environmental baseline, for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a high extent of exposure due to high overlap and high past usage of methomyl on use sites within the species' range (Figure 1). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. Vulnerability, toxicity, and exposure are anticipated to be high. Thus, we determined the risk of adverse effects to the species is high. As such, we expected large numbers of individuals were likely to be exposed and die over the project duration.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate species-specific conservation measures as part of the action. We now expect exposure for the Karner blue butterfly to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Karner blue butterfly. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Last updated: 7/11/2022; Wherever found; *States within the range:* IL, IN, MI, MN, NH, NY, OH, WI

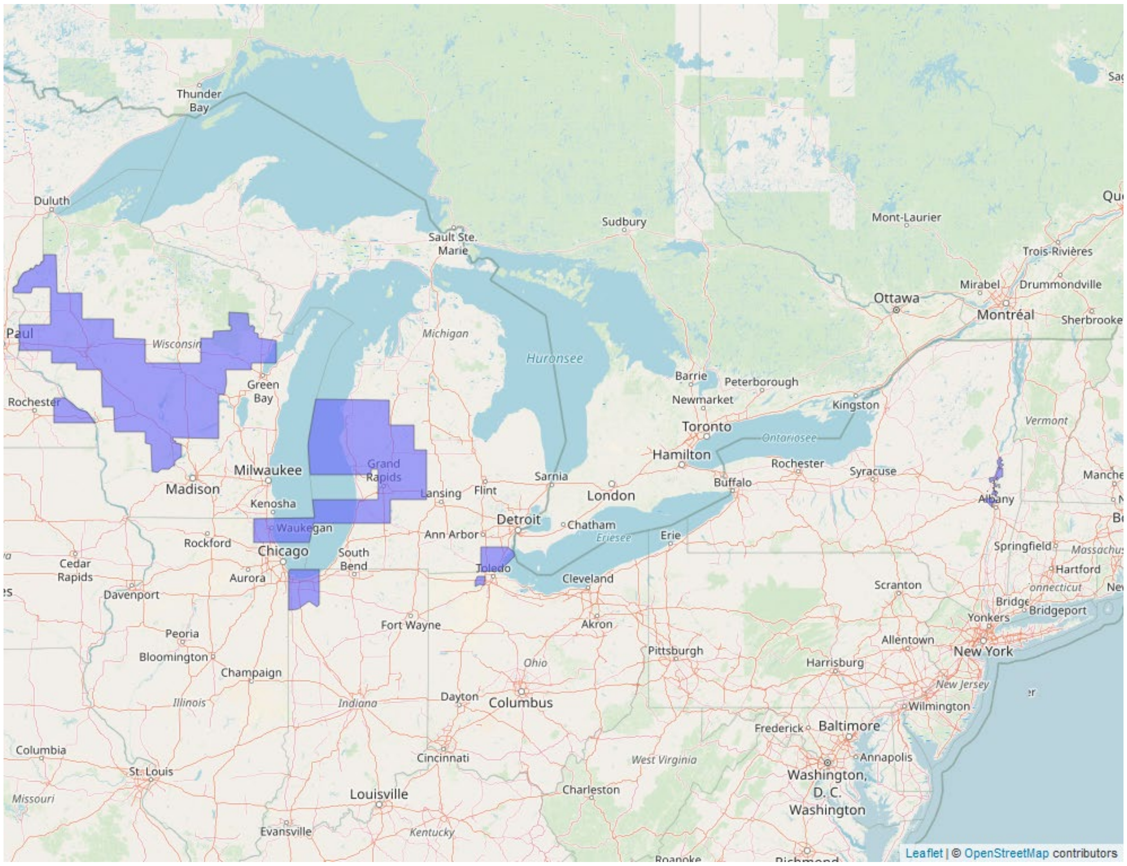

Figure 1. Range map of Karner blue butterfly (blue polygons). Range map at https://ecos.fws.gov/ecp/species/6656.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status*:* Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 12/17/2019

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Variable; a few populations are increasing, the remainder have low numbers or are declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Changes in the distribution of the species within its historic range have occurred since listing. The species formerly occurred in a band extending across 12 states from Minnesota to Maine and in the province of Ontario, Canada. Karner blue butterflies are likely extirpated from Illinois, Minnesota, Indiana, and Ontario. In New Hampshire, New York, and Ohio, Karner blue butterfly populations are declining and/or are found in very low numbers. Wisconsin populations are the largest and most widespread, and as of the 2019 5-Year Review, Wisconsin populations were reported to be rebounding from a population decrease in 2012 due to widespread drought.

Karner blue butterflies show two distinct population clusters. The eastern population historically consisted of occurrences in Illinois, Indiana, Michigan, Ohio, New York, and New Hampshire and Ontario, Canada and the western population consisted of occurrences in Minnesota and Wisconsin. Wisconsin supports the largest and most widespread Karner blue butterfly populations range wide. Survey trends were compared on Wisconsin sites over 17 years for the Karner blue butterfly. Although declines were found for the species, higher trends in abundance were found at “reserve” properties (those “where recovery will be expected to occur”) than rights-of-way and forestry land and suggested a higher level of habitat management as the reason for this result.

The Karner blue butterfly is dependent on wild lupine (*Lupinus perennis*) as a larval host plant and as a nectar source. These plants historically occurred in savanna and barrens habitats typified by dry sandy soils, and now occur in remnants of these habitats, as well as locations such as roadsides, military bases, and some forest lands.

Decline and loss of populations and habitat in Minnesota, Indiana, and New York are not compensated for by the more numerous populations in Wisconsin. Threats persist for the species in all states including loss of habitat due to natural succession, lack of management, invasive species and commercial, industrial and residential development. The Recovery Plan (2003) recommends avoidance of insecticide use in association with the Karner blue butterfly, particularly during flight season (mid-May through mid-June and in July). In addition, certain biopesticides can be toxic to larvae.

The Karner blue butterfly is now thought to be extirpated at the southern edge of its range in Indiana. The population at Indiana Dunes National Park declined in conjunction with documented warming conditions, despite habitat management, restoration, and population augmentation efforts. Due in part to this discovery, the Karner blue butterfly recovery team recently designated a climate change sub-team tasked with exploring the species’ sensitivity to climate change and its adaptive capacity. As discussed in their draft report, the Karner blue butterfly likely has low adaptive capacity to tolerate changes associated with climate change, due to the limited capacity to adapt via dispersal, behavior (e.g., single larval host plant), or evolving in place. Further, the species’ and its host plant’s vulnerability to the direct and indirect effects of climate change is high (USFWS 2003, 2012, 2019).

Michigan has a state-wide Habitat Conservation Plan in place for this species (Wisconsin’s Habitat Conservation Plan appears to have expired).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 100% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 2). Approximately 42.8% of the species' range overlaps with methomyl use sites and 70.1% of the range that occurs off-field is likely to be exposed to spray drift or runoff. Alfalfa and corn use sites are the most prevalent within the species' range, with 36.4% and 48.5% overlap, respectively. However, overlap with other use sites may also contribute to the overall exposure of the species, as shown in Table 2 below.

Usage

Past usage data indicate that up to 23.3% of the species' range has been treated with methomyl annually. Usage data indicates that methomyl applications to vegetables and ground fruit account for the highest past usage, with 10.4% of the species' range treated on these crops alone. However, usage on other crop types may also contribute to the overall exposure of the species, as shown in Table 2 below.

Table 2. Overlap and annual usage data (% Range Treated) for the Karner blue butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	11.6	24.8	36.4	1.8	3.7	5.5
Citrus	NA	NA	NA	NA	NA	NA
Corn[2]	25.2	23.3	48.5	1.2	1.2	2.4
Cotton	0	0	0	0	0	0
Other Grains	2	11.2	13.2	0.1	0.6	0.7
Other Orchards	0.7	3.4	4.1	0.7	3.4	4.1

[2] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Row Crops	<0.1	0.4	0.5	<0.1	0.2	0.2
Soybeans	16.2	21.8	38.0	0.8	1.1	1.9
Vegetables and Ground Fruit	3.3	7.1	10.4	3.3	7.1	10.4
Wheat	NA	NA	NA	NA	NA	NA
Total[3]	**42.8**	**70.2**	**100**	**7.2**	**16.1**	**23.3**

Additional exposure considerations

Based on the species' life history, we do not expect individuals will occur on agricultural use sites. Thus, we only consider exposure that occurs off-site as relevant to the species. While individuals are typically found in remnant habitat and locations such as roadsides, military bases, and some forested lands, exposure may still occur through spray drift from adjacent use sites.

As stated above in the Vulnerability section, the Recovery Plan for the Karner blue butterfly (USFWS 2003) recommends avoidance of insecticide use, particularly during flight season (mid-May through mid-June and July). Larvae can be present from mid-April through July Mid-April through July is the height of breeding activity and larval hatching and is expected to coincide with active periods of pesticide application (i.e., spring through summer) in nearby agricultural areas. Thus, pesticide exposure is likely throughout some of the most critical time periods in the Karner blue butterfly's life cycle.

Exposure Summary

While the entire species' range is likely to overlap with methomyl use sites or areas that may be exposed to spray drift, we anticipate only off-site exposure is relevant to the species as we do not expect individuals are likely to occur on agricultural use sites. There is a high degree of overlap between off-site exposure areas and the species' range, with 70.2% overlap between off-site areas and the species' range. While past usage data suggests that only up to 16.1% of the species' range is likely to be exposed to methomyl through spray drift annually, this still represents a high extent of usage. Additionally, given that methomyl use likely coincides with periods of high larval and adult activity, we determined that the species has a high exposure ranking.

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[3] Total overlap is capped at 100%.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host, wild lupine) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Karner blue butterfly has a high exposure ranking as both off-field overlap and usage are likely to be high, indicating that a potentially large proportion of individuals of the species will experience exposure. We also anticipate the Karner blue butterfly has a high toxicity ranking as available toxicity data indicates that insect species are highly sensitive to methomyl exposure, indicating that any individuals exposed to methomyl are likely to die. Additionally, we anticipate methomyl usage will likely coincide with periods of high larval and adult activity (such as periods of breeding and hatching), indicating that exposure during key life stages is likely to occur. As such, we anticipate that the effects of the proposed action will be high, resulting in the exposure and subsequent mortality of a large number of individuals.

Preliminary Conclusion

The Karner blue butterfly is listed as endangered and is a narrow endemic species that exists in two distinct, but disjunct population clusters. There is no known connectivity between the population clusters, thus if individuals are lost from one population due to methomyl exposure, the species cannot recover by gaining individuals from a nearby population. The species is likely extirpated from Ontario and three of the twelve states in its historical range. Several populations of the Karner blue butterfly are declining or are found in very low numbers, though populations at “reserve” sites in Wisconsin are showing increasing levels of abundance. However, decline and loss of populations and habitat in Minnesota, Indiana, and New York are not compensated for by the more numerous populations in Wisconsin. Threats persist for the species in all states and the Recovery Plan (2003) recommends avoidance of insecticide use in areas supporting the

Karner blue butterfly, particularly during the flight season (mid-May through mid-June and in July).

The species range occurs in close proximity to methomyl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range (70.2%). Additionally, methomyl exposure and resultant mortality is likely throughout some of the most critical time periods in the Karner blue butterfly's life cycle. Past methomyl usage suggests that 16.1% or more of the species' range will be treated with methomyl in the future. Due to the fragmented and isolated nature of Karner blue butterfly habitat and populations, in addition to low numbers of individuals and declining trends in many populations, the species is unlikely to regain most individuals lost due to methomyl exposure.

We determined the species has a high exposure ranking and we anticipated that a large number of individuals would experience exposure and die from the proposed action. Karner blue butterfly have a high toxicity ranking because we expect any direct exposure to result in mortality.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Karner blue butterfly:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Karner blue butterfly by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Do not apply methomyl from two hours after sunrise until two hours before sunset on cucurbits and tomatoes. Do not apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on blueberries, dry beans, fresh beans, lima beans, peas, and snap beans and all methomyl registered crops in the 'other orchards' UDL. We expect these mitigations to reduce on-field exposure.*

The PULA for the Karner blue butterfly will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action (including the species-specific conservation measures) and cumulative effects to the environmental baseline and in light of the status of the species, we do not anticipate the registration of methomyl will appreciably reduce the survival and recovery of the Karner blue butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2019. Karner Blue Butterfly (*Lycaeides melissa samuelis*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 27 pp.

U.S. Fish and Wildlife Service. 2012. Karner Blue Butterfly (*Lycaeides melissa samuelis*) 5-Year Review: Summary and Evaluation. New Franken, Wisconsin. 129 pp.

U.S. Fish and Wildlife Service. 2003. Karner Blue Butterfly Recovery Plan (*Lycaeides melissa samuelis*). Fort Snelling, Minnesota. 293 pp.

Integration and Synthesis Summary: Lange’s metalmark butterfly

Scientific Name:	Common Name:	Entity ID:
Apodemia mormo langei	Lange's metalmark butterfly	421

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species’ vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is high, the species has a very limited distribution and past usage of methomyl is low on use sites within the species’ range (Figure 2). Most individuals, if exposed, are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to be exposed and die over the project duration. Based on our analysis of the consequences of the action on the likelihood of both the survival and recovery of this species, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Lange's metalmark butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 11/1/2021; Wherever found; *States within the range:* CA

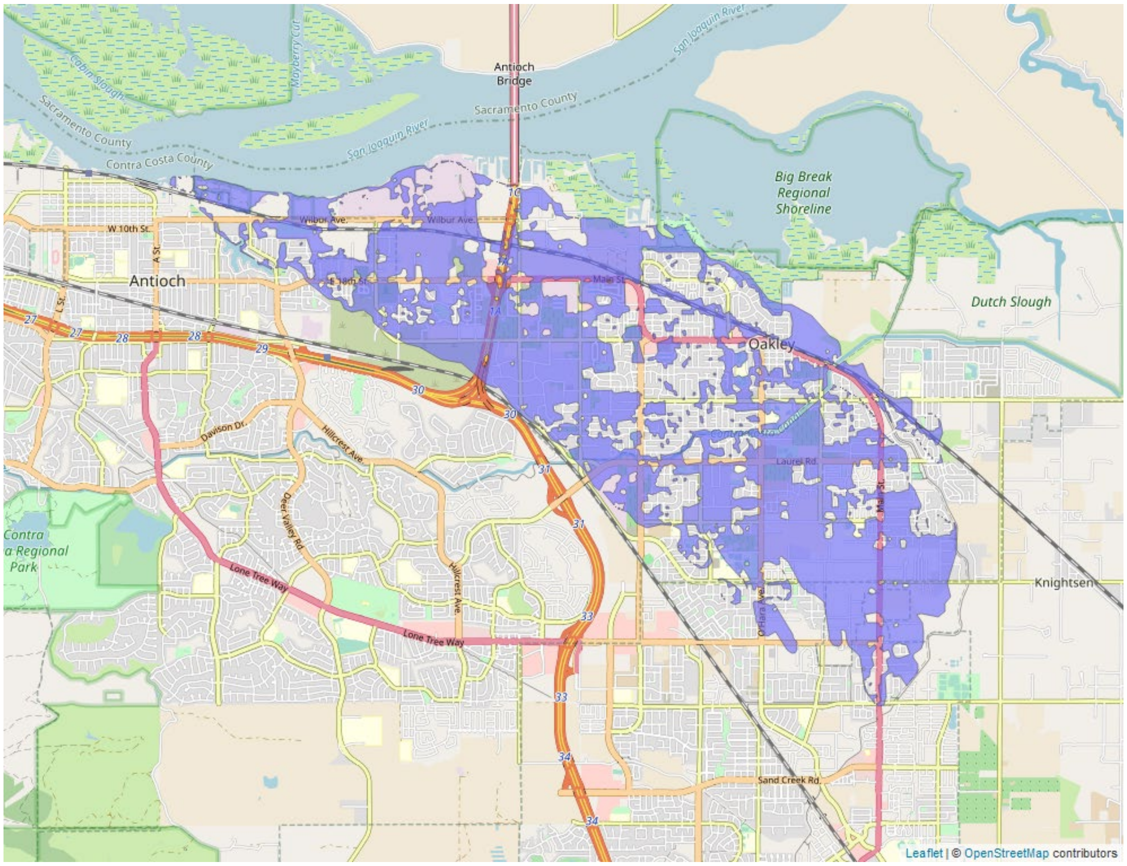

Figure 2. Range map of Lange's metalmark butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4382.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/31/2020

Distribution*:* Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends*:* Declining population(s) - one or more populations declining (population not self-sustaining)

Pesticides noted in Service documents as a threat to the species: Yes (from mosquito adulticide)

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Lange's metalmark is a relatively small butterfly endemic to the Antioch Dunes in Contra Costa County, California. The species is univoltine, meaning it only produces one brood per year. All life stages of Lange's metalmark are closely tied to Antioch Dunes buckwheat (*Eriogonum nudum var. Psychicola).* This host plant, also endemic to the Antioch Dunes, serves as the primary nectar source for adult butterflies, as sites for oviposition, and as the larval foodplant. However, Antioch Dunes buckwheat may not be utilized by the Lange's metalmark until plants are about three years old, when it is able to produce robust flowers. Antioch Dunes buckwheat is a perennial forb that requires sandy, well-drained soils and some form of disturbance, preferably by natural processes such as wind or erosion, to shift the sand for seedling establishment. Flowering of Antioch Dunes buckwheat begins in July or August, just prior to the emergence of Lange's metalmarks.

As of the 2020 5-Year Review, Lange's metalmark is only found within the Antioch Dunes National Wildlife Refuge, which encompasses 67 acres; the 41-acre Stamm Unit, owned by the Service, and the 26-acre Sardis Unit, of which 14 acres are owned by the Service and 12 acres are owned by Pacific Gas and Electric. Thus, most of the mapped range is unoccupied. Lange's metalmark is associated with Antioch Dunes, a riverbank dune system that historically reached heights of over 100 feet, but historic specimens suggest the subspecies may not have been confined to the Antioch Dunes. The Lange's metalmark is now considered entirely restricted to the remaining Antioch Dunes habitat at the National Wildlife Refuge (currently only the Sardis Unit). The subspecies has not been observed at the Stamm Unit since 2010. Based on surveys conducted since 1986, peak counts have ranged from as high as 2,342 adult butterflies in 1999, to below 50 adult butterflies in every year since 2009. In 2018, surveys resulted in a total count of nine individuals and group surveys resulted in a total of 20 observations. In 2019, surveys resulted in a total count of only five butterflies, and the group surveys resulted in a total of 10 observations.

In 2007, a captive breeding program was established for Lange's metalmark. However, breeding in captivity has generally been unsuccessful and the program has shifted to a head- starting approach: annually collecting three to five females and rearing their offspring in captivity to later be released back into the wild. Unfortunately, only seven larvae were released in 2018 due to an unexplained die-out in the captive population, and none were released in 2017 due to early eclosion (emergence from the pupal case) of the captive population, putting them out of sync with the mating period of the wild population. As the wild population continues to decline, captive-reared individuals begin to account for a greater percentage of the population. Lange's metalmark butterfly will soon become extinct if aggressive and systematic recovery measures are not implemented at the Antioch Dunes National Wildlife Refuge. Specifically, the proliferation and overgrowth of invasive, non-native grasses and forbs, such as rip-gut brome, star thistle, and vetch, affect nearly every acre of the Antioch Dunes National Wildlife Refuge. Endemic plants at the Antioch Dunes National Wildlife Refuge depend on sandy dune habitat that is constantly disturbed and replenished by winds, and these endemics cannot compete with invasive plants. Aggressive eradication of these invasive plants and follow-up maintenance to ensure that they do not re-establish will be an ongoing and dedicated effort for many years to come if the recovery of the Lange’s metalmark butterfly is to succeed. The threat of non-native, invasive plants is a new threat identified since listing of this species. Other newly identified threats include wildfires, which have continued to destroy the species’ habitat despite the installation of fencing to exclude trespassers who may inadvertently or purposefully ignite fires.

The Antioch Dunes habitat has been mostly destroyed and degraded by sand mining for various commercial uses, conversion to other land uses, invasion by non-native vegetation, and recreational uses. These habitat alterations have also largely eliminated the wind-blown disturbance regime that helps maintain the openness of the dunes in the remaining small and fragmented habitat units. Climate change is an emerging threat to Lange’s metalmark. The Lange’s metalmark as a relatively sedentary subspecies, endemic to a fragmented habitat, surrounded by developed lands, and highly dependent on an endemic plant, will likely be unable to relocate to suitable habitat or conditions elsewhere. Per the 2019 Recovery Plan Amendment, Lange’s metalmark is threatened by possible insecticide drift from mosquito abatement spraying on neighboring properties. The Mosquito Abatement District allows for spraying of insecticides to reduce the incidence of West Nile Virus at a wetland adjacent to the Stamm Unit of the National Wildlife Refuge. The spray could drift on to the refuge and affect pollinators, such as Lange’s metalmark. Refuge staff have worked with county mosquito control staff to minimize effects from this potential threat (USFWS 2008, 2019, 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect up to 31.7% of the species range will overlap with the action area or is likely to be exposed through off-site transport in the action area. Up to 4.1% of the species’ range overlaps with methomyl use sites while 27.9% of the range occurs off-field but may still be exposed to spray drift or runoff. Alfalfa, other orchards, and other grains use sites are the most prevalent within the species’ range, with 10.2%, 12%, and 6.1% overlap, respectively (Table 3).

Table 3. Overlap data for the Lange’s metalmark butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	1.3	8.9	10.2
Citrus	<0.1	0.2	0.2

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Corn[4]	0.1	2.1	2.2
Cotton	0	0	0
Other Grains	0.4	5.7	6.1
Other Orchards[5]	2	10.1	12.0
Other Row Crops	<0.1	0.1	0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	1.0	1.1
Wheat	NA	NA	NA
Total	**4.1**	**27.9**	**31.7**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-20121 the maximum percent of the species' range treated with any pesticide was 8.2% (Table 4). Within the range of the species, up to 6.2% of the range was treated with any insecticide, and 4.5% of the range had been treated with methomyl. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 4. Annual percent of the Lange's metalmark butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
25.5	24.0	4.5

[4] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[5] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Additional Exposure Considerations

Lange's metalmark is only found within the bounds of the Antioch Dunes National Wildlife Refuge and methomyl has not been used on National Wildlife Refuges since 2009. As methomyl is only registered for use on agriculture, we do not anticipate future use on this primarily sand dune refuge established to protect endangered plants and insects. Industrial development and a railway line border the southern edge of the wildlife refuge and make it unlikely that individuals will successfully move beyond the refuge's borders. It is also unlikely Lange's will use these areas unless their host plant, Antioch Dunes buckwheat, were found in that area. Visual inspection of satellite imagery of areas adjacent to the refuge where the species is located show little to no agriculture in adjacent areas, indicating a low likelihood of spray drift from methomyl use in other areas drifting into the refuge and exposing individuals.

Lange's metalmark produces one brood in a season when adults will emerge in August and fly until September. Peak populations exist two to three weeks after emergence. Eggs remain attached and are dormant until the rainy season, larvae hatch and overwinter at the base of the plant, feeding on buckwheat from hatching from December-February until pupation approximately 240-270 days later.

Larvae appear the following summer, usually occurring in late June and July in the dead foliage at the base of their food plant. Based on the life history of Lange's metalmark, this butterfly is vulnerable to the effects of methomyl throughout most of its lifecycle; especially vulnerable are the larval and adult stages if applications are made from March through September.

Based on information provided by USFWS field office staff, we do not expect Lange's metalmark to occur anywhere except for Antioch Dunes National Wildlife Refuge over the next 15 years (Albertson, J., personal communication, 2023).

Exposure Summary

A large portion of the species' range will be exposed to methomyl give the high overlap between the action area and the species' range. Mandatory pesticide usage reporting data from the state of California confirms a medium (4.5%) portion of the range has been treated with methomyl in recent years. However, we are aware that Lange's metalmark butterfly currently only exists within the confines of the Antioch Dunes National Wildlife Refuge based on the availability of its host plant to be located there. There has been no reported use of methomyl within the refuge and it is unlikely that it will be used in the future on the National Wildlife Refuge. Additionally, we do not expect methomyl will be used in adjacent areas as visual inspection of satellite imagery shows no agricultural areas near areas where the butterfly might occur. This indicates a low likelihood of individuals experiencing methomyl exposure. As such, we expect very small numbers of individuals will experience exposure, which will be limited to rare instances where an individual disperses outside of the refuge.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any plant species that this butterfly species is reliant on for food such as flowers that provide nectar for adults or host plants that provide food and shelter for larvae, or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Lange's metalmark butterfly has a low exposure ranking. While there is a 31.7% overlap between the action area and the species' range, and up to 4.5% of the range is likely to be treated annually according to data from the California Department of Pesticide Regulation, individual butterflies are only found within the Antioch Dunes National Wildlife Refuge, where no methomyl has been used in the past. The Lange's metalmark butterfly has a high toxicity ranking as available data shows that insect species are highly sensitive to methomyl exposure and are likely to die at predicted environmental concentrations. While we expect toxicity to exposed individuals will be high, we anticipate very few individuals are likely to experience toxic effects as exposure will be limited to very rare instances where an individual may disperse outside of the refuge boundaries. As such, we expect the overall risk of adverse effects to the Lange's metalmark butterfly will be low.

Conclusion

The Lange's metalmark butterfly is a narrow endemic species that is currently extant only within the Antioch Dunes National Wildlife Refuge in California, on a total of 41 acres. The species relies on its host plant, the endemic Antioch Dunes buckwheat, in all stages of its life cycle. The host plant, and thus the butterfly, is threatened by non-native, invasive plants and wildfire, which have continued to degrade and destroy suitable habitat for the species. Very few individuals remain in the population (only 10 from the last recorded survey in 2019) and the species requires intense augmentation from captive rearing in order to survive.

While toxicity is expected to be high for this species, we anticipate little to no exposure due to the extant population's existence entirely within the Refuge. Agriculture does not occur within Refuge boundaries, nor is spray drift from agricultural use sites outside the Refuge expected to reach individuals in the extant population. Thus, we anticipate very minimal to no methomyl exposure to this species, and thus mortality is expected to rarely occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Lange's metalmark butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2020. Lange's Metalmark Butterfly (*Apodemia mormo langei*) 5-Year Review. Sacramento California. 30 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for Three Endangered Species Endemic to Antioch Dunes, California: Lange's metalmark butterfly (*Apodemia mormo langei*), *Oenothera deltoide*s subsp. *howellii* (Antioch Dunes evening-primrose), and *Erysimum capitatum* var. *angustatum* (Contra Costa wallflower) – Amendment. Sacramento, California. 64 pp.

U.S. Fish and Wildlife Service. 2008. Lange's metalmark butterfly (*Apodemia mormo langei*), Antioch Dunes evening-primrose (*Oenothera deltoides* subsp. *howellii*), Contra Costa wallflower (*Erysimum capitatum* var. *angustatum*) 5-Year Review: Summary and Evaluation. Sacramento, California. 42 pp.

Integration and Synthesis Summary: Lotis blue butterfly

Scientific Name:	Common Name:	Entity ID:
Lycaeides argyrognomon lotis	Lotis blue butterfly	422

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure due to low overlap and low past usage of methomyl on use sites within the species' range (Figure 3). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. Based on our analysis of the consequences of the action on the likelihood of both the survival and recovery of this species, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the lotis blue butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 4/14/2021; Wherever found; *States within the range:* CA

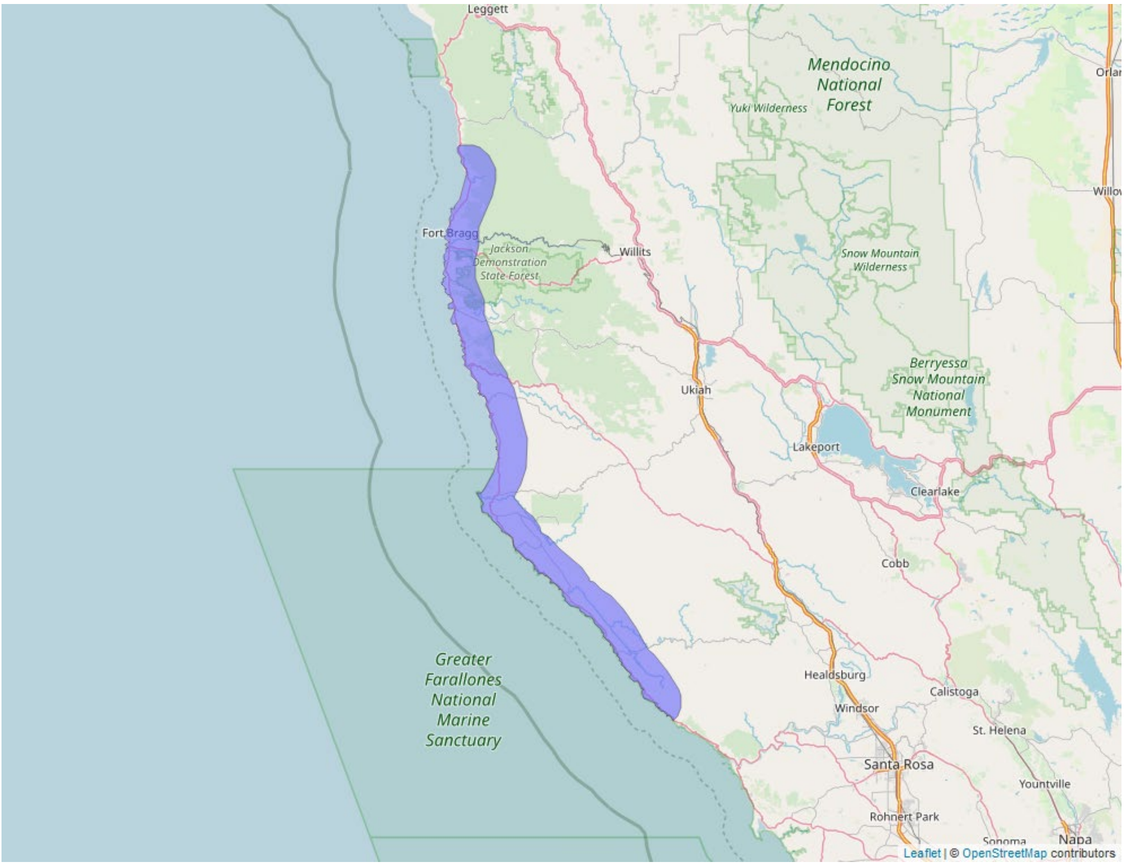

Figure 3. Range map of lotis blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5174.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/12/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Declining population(s) - one or more populations declining (none detected since 1983)

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The lotis blue butterfly appears to be a naturally rare insect with low population densities, and the reasons for its decline are largely speculative. However, changes in vegetation, perhaps exacerbated by drought or vulnerability due to small population sizes, are the prime suspects in the decline. No individuals have been recorded since 1983 at the last known occurrence site, owned by PG&E, despite focal surveys. Extensive surveys were conducted for lotis blue around 2004 under contract from the Arcata Fish and Wildlife Office; however, no butterflies, eggs, or larvae were detected. During at least 6 years between 1990 and 2008, surveys were conducted of the lotis blue's last known remaining site under contract with PG&E, and in 2006, searched for lotis blue where appropriate habitat overlapped with the Behrens' silverspot butterfly. No lotis blue butterflies, eggs, or larvae were detected. While these surveys covered a large area of potential habitat over many sites, most survey effort has been limited to State-owned lands where permission to access the sites is easily obtained. Large areas within the species' historic range are in private ownership, including moist coastal prairie and other potential habitats for the species. The status of the species on private lands is unknown, as most sites on private property where suitable habitat might be found have not been surveyed. As of the 2020 5-Year Review, the species is still undetected. The lotis blue likely inhabits wet meadows and possibly sphagnum bogs. Larvae probably feed on native plants in the pea family (Fabaceae), with coast trefoil (*Lotus formosissimus*) the most likely candidate. An additional host plant, *Hosackia rosea* (rose flowered lotus) has been suggested for the species, although its distribution is more limited than the primary host plant, *H. gracilis*.

The most recent literature on climate change includes predictions of hydrological changes, higher temperatures, and expansion of drought areas, resulting in a northward and/or upward elevation shift in range for many species. In the coastal zone this butterfly inhabits, some studies predict increases in coastal upwelling and associated coastal fog frequency in the region. However, a more recent evaluation of historic climate data from coastal northern California found that summer conditions have become warmer and drier, with less fog, since the early 20th century, suggesting increased drought stress for vegetation. While it appears reasonable to assume that the lotis blue butterfly may be affected by such changes, we lack sufficient certainty to know the extent to which climate change will affect particular species at this time (USFWS 2011, 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 1.2% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 5). Approximately 0.2% of the species' range overlaps with methomyl use sites and 1% of the range that occurs off-field is likely to be exposed to spray drift or runoff.

Table 5. Overlap data for the lotis blue butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	0.1	0.1
Citrus	0	0	0
Corn[6]	<0.1	<0.1	<0.1
Cotton	0	0	0
Other Grains	0.1	0.9	1
Other Orchards[7]	<0.1	<0.1	<0.1
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	<0.1	<0.1
Wheat	NA	NA	NA
Total	**0.2**	**1**	**1.2**

Usage

Mandatory reporting data from the state of California indicates that between 2012-2021 the maximum percent of the species' range treated with any pesticide was 5.5% (Table 6). Up to 0.1% of the range was treated with any insecticide, and none of the range had been treated with methomyl. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 6. Annual percent of the lotis blue butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

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[6] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap.
[7] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
5.5	0.1	0

Additional exposure considerations
Lotis blue butterfly adults are active from mid-April to early July, during which, breeding and egg laying likely occur. Larvae hatch shortly after laying, begin feeding, and go dormant over winter. Larvae resume feeding in the spring for four to six weeks before pupating. Given that methomyl applications likely take place during periods of adult and larval activity, we expect individuals could be exposed throughout their life cycle.
The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the lotis blue butterfly's range occurs, with only 0.49% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with no methomyl usage reported in the same period. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as the plants it relies on for food or habitat (such as flowers that provide nectar for adults or those that larvae feed on) are not expected to experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The lotis blue butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-2021, with no methomyl usage reported in the same period. The lotis blue butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

The lotis blue butterfly is listed as endangered. No individuals have been observed since 1983, despite extensive surveys on publicly owned lands within this species' restricted range in a small area of coastal California. However, surveys have not been conducted on private lands where butterflies occurred historically. Considering information about the species status, we have determined that the species has a high vulnerability.

Methomyl use sites overlap with a very small portion, 1.2%, of the lotis blue butterfly's range, indicating a low potential for exposure. In addition, mandatory pesticide usage reporting data from the state of California confirms low insecticide usage overall, further indicating a low likelihood of individuals experiencing methomyl exposure. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, minimal exposure to methomyl on field and through spray drift is anticipated to occur, and impacts are expected to be highly localized and affect only a very small number of individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the lotis blue butterfly in the wild.

Conclusion: No Jeopardy

References

U.S. Fish and Wildlife Service. 2020. Lotis Blue Butterfly (*Lycaeides argyrognomon lotis*) 5-Year Review: Summary and Evaluation. Arcata, California. 2 pp.

U.S. Fish and Wildlife Service. 2011. Lotis Blue Butterfly (*Lycaeides argyrognomon lotis*) 5-Year Review: Summary and Evaluation. Arcata, California. 14 pp.

Integration and Synthesis Summary: Mission blue butterfly

Scientific Name:	Common Name:	Entity ID:
Icaricia icarioides missionensis	Mission blue butterfly	423

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a low overlap and usage within the species' range (Figure 4), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the mission blue butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 6/11/2021; Wherever found; *States within the range:* CA

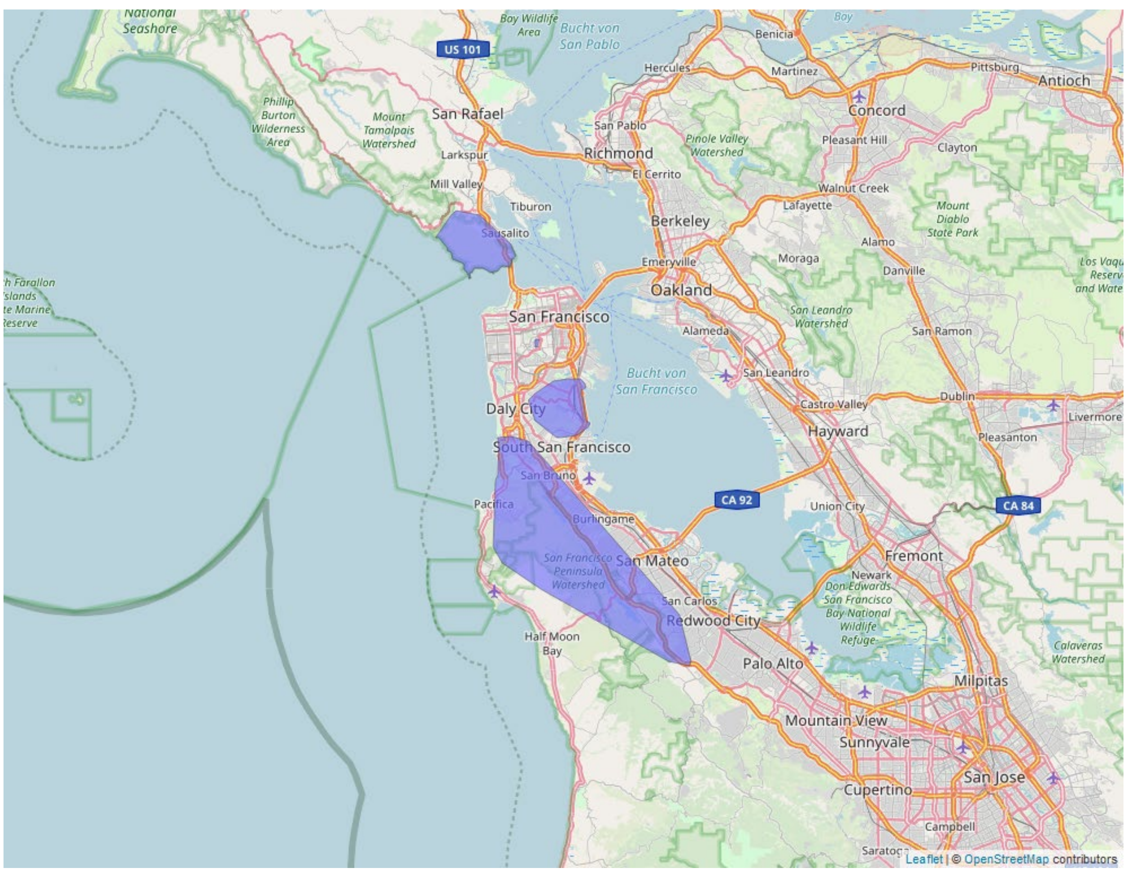

Figure 4. Range map of mission blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6928.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 3/31/2022

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

At the time of its listing in 1976, we considered there to be only two locations with metapopulations of mission blue butterflies: Twin Peaks in San Francisco County and San Bruno Mountain in San Mateo County. In the recovery plan we also included a metapopulation at Fort Baker in Marin County. Since then, additional metapopulations have been documented in San Mateo and Marin Counties. A population at Twin Peaks may have been extirpated due to a reduction in host plant density caused by a fungal pathogen exacerbated by an El Niño event and recreation impacts that directly affected host plants.

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 the purple variety of yellow bush lupine (*L. arboreus*) for reproductive activities in the Marin headlands area. Adults feed on a variety of nectar flowers, but do not tend to wander far from areas containing the larval host plants.

As of 2019, threats included permanent and temporary loss of habitat due to public infrastructure development, poaching, small population size, isolation, the effects of reduced host plant density due to exotic invasive plants and a fungal pathogen (*Colletotrichum lupini*), grassland succession to chaparral, recreational impacts that reduce habitat quality and quantity, and the undetermined effects of global climate change. Although the threat of urban and suburban development has been reduced and the number of known colonies has increased, the threats of grassland succession to chaparral, host plant competition with exotic invasive plant species, and small population sizes remain substantial threats to this species. The ability of this species to persist, unaided by human intervention and management, is unlikely. Translocations of adults occurred from 2017-2020 to supplement the Twin Peaks and Milagra Ridge populations.

As a result of the 1982 amendment to the Act, allowing for the “incidental take” of listed species by non-federal entities, the first ever Habitat Conservation Plan (HCP) was prepared and approved for San Bruno Mountain. The HCP allows limited development of endangered species habitat in exchange for implementation of a long-term program, funded by development, to protect and enhance the remaining portions of the Mountain as habitat. The HCP allows for the take of mission blue butterfly habitat on San Bruno Mountain. As of June 2009, there were 19.64 acres of mission blue butterfly habitat that had been authorized for, but not yet, developed.

Pesticide use poses a potential threat to mission blues if used in proximity to occupied habitat. Vole herbivory threatens the host plants of the mission blue butterfly, with herbivory in some years causing severe declines in available lupine. In addition, a fungal pathogen (*Colletotrichum lupini*) threatens the host plants and lupine diversification, and mapping is becoming more important (USFWS 2010, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect up to 1% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport in the action area. Less than 0.1% of the species’ range overlaps with methomyl use sites while 0.9% of the range occurs off-field but may still be exposed to spray drift or runoff (Table 7).

Table 7. Overlap for the mission blue butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	0.1	0.1
Citrus	<0.1	<0.1	<0.1
Corn	0	0	0
Cotton	0	0	0
Other Grains	<0.1	0.3	0.4

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Other Orchards[8]	<0.1	0.3	0.3
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	0.1	0.1
Wheat	NA	NA	NA
Total	**<0.1**	**0.9**	**1**

Usage

Mandatory pesticide usage reporting data gathered by the state of California indicates that very little insecticides are used within the mission blue butterfly's range; between 2012-2021, only 0.1% of the species' range was treated with insecticide of any sort, and no methomyl use within the range was recorded in that same time period (Table 8). Given that this usage data collected by the state of California is mandatory and is geographically specific to agricultural sections, we have high confidence that there is low methomyl usage within the species' range.

Table 8. Pesticide usage data within the range of the mission blue butterfly collected by the California Department of Pesticide Regulation. The data presented in this table are from 2012-2021.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
0.2	0.1	0

Additional exposure considerations

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 0.1% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of

8 We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with no methomyl usage reported in the same period. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

The mission blue butterfly is a facultative myrmecophile; it has a symbiotic relationship with ants that tend to the developing larvae (USFWS 2010). We expect these symbiotic ants are similarly sensitive to methomyl exposure as the mission blue butterfly is. As such, we anticipate methomyl use will result in mortality of any symbiotic ants within the mission blue butterfly's range.

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat, such as flowering plants that provide nectar for adults or host plants that provide shelter and food for larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die. Similarly, we anticipate any symbiotic ants exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The mission blue butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-2021, with no methomyl usage reported in the same period. The mission blue butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

The mission blue butterfly is listed as endangered, and only a few metapopulations exist in a restricted range limited to a few counties surrounding San Francisco, California. Although the threat of urban and suburban development has been reduced and the number of known colonies has increased, the threats of grassland succession to chaparral, host plant competition with exotic invasive plant species, and small population sizes remain substantial threats to this species. The ability of this species to persist, unaided by human intervention and management, is unlikely. Thus, we have determined that the species has a high vulnerability.

Based on our understanding of the mission blue butterfly's preference for coastal scrubland and grassland habitats, we expect overlap or adjacency with agricultural fields will be very restricted. Thus, we do not expect on-field exposure to spray application. Overlap between the mission blue butterfly's range with potential spray drift areas (up to 90m) is 0.4%, indicating that only a very few individuals are likely to be exposed. In addition, this low level of usage is confirmed by reporting mandated by the state of California, which indicates no methomyl was used in the most recent years of data available.

In summary, minimal exposure to methomyl spray drift is anticipated to occur, and impacts are expected to be highly localized and affect only a very few individuals, at most, over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the mission blue butterfly.

References

U.S. Fish and Wildlife Service. 2019. Recovery Plan for San Bruno Elfin Butterfly (*Callophyrs mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*) – Amendment. Sacramento, California. 25 pp.

U.S. Fish and Wildlife Service. 2010. Mission Blue Butterfly (*Icaricia icariodes missionensis*) 5-Year Review: Summary and Evaluation. Sacramento, California. 39 pp.

Integration and Synthesis Summary: Mitchell's satyr butterfly

Scientific Name:	Common Name:	Entity ID:
Neonympha mitchellii mitchellii	Mitchell's satyr butterfly	424

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is high overlap of the action area with the species' range (Figure 5), and high past usage of methomyl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that both exposure and toxicity are high, we determined the risk of adverse effects to the species is high. As such, we expected a large number of individuals were likely to be exposed and die over the project duration.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Mitchell's satyr butterfly to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mitchell's satyr butterfly. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated 2/24/2021; Wherever found; States within the range: AL, IN, MI, MS, OH, VA

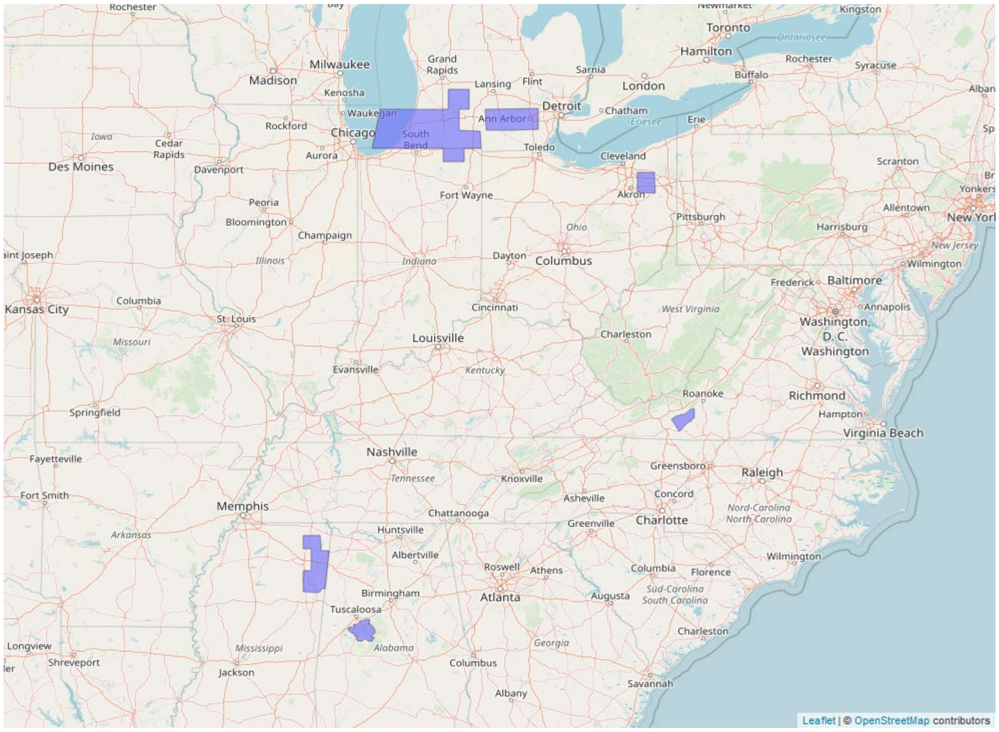

Figure 5. Range map of Mitchell's satyr butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8062.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 3/2/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Mitchell's satyr is a rare butterfly and fen habitat specialist (in the northern portion of its range – Michigan and Indiana) that is threatened with, among other things, the loss and disruption of suitable fen habitats. The adult butterflies tend to be sedentary and do not wander far from suitable habitat, thus potentially limiting their ability to disperse (USFWS 1998). Prairie fen is also a rare wetland and vegetation community. New information suggests the status of the species has worsened at some locations since its last status review. While the range and number of known colonies of Mitchell's satyr has expanded significantly with the discovery of the southern populations, the size and status of these populations are not well known. In addition, the species was extirpated in three counties in Michigan (as of 2014).

The number of *viable* populations reported in the 2021 5-year review include six in Michigan, three in Virginia, none in Indiana, and an unknown number in Mississippi and Alabama.

Known threats have not diminished and new threats to habitat and the species have been documented. These threats include development and resultant loss or degradation/destruction of habitat, succession within suitable habitat, other hydrologic disturbances, and climate change. In addition, pesticides and neonicotinoid insecticide use may also be contributing to decline of Mitchell's satyr as has been suspected of other native butterfly populations (USFWS 2021). Furthermore, an intracellular bacterial parasite, Wolbachia, could possibly reduce the already decreasing Mitchell's satyr population by half. Populations are isolated from each other, and habitat is extremely fragmented, which leads to increased inbreeding and decreased population viability. These threats, compounded with a warming climate, makes the species even more susceptible to stochastic events that could result in extinction.

The Great Lakes Recovery Initiative (GLRI) has worked to protect and restore several federally listed species within the Great Lakes Basin, including the Mitchell's satyr. Since 2010 GLRI has provided approximately $1.9 million to support habitat restoration, land acquisition, monitoring, research, and captive rearing efforts for Mitchell's satyr. Most of these funds have been spent in the past five years (i.e., 2015-2020, the time covered by the most recent 5-Year Review in 2021), with just over $1 million spent on Mitchell's satyr recovery efforts during this time period. There are also several Safe Harbor Agreements and Habitat Conservation Plans in place to help conserve and recover this butterfly species (these cover Michigan and Indiana populations) (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect up to 97% of the species range will overlap with the action area (Table 9). Up to 34.1% of the species' range overlaps with methomyl use sites while 63.4% of the range occurs off-field but may still be exposed to spray drift or runoff. Corn, soybean, and alfalfa stand out as the use types with the largest overlaps with the species' range, with 44.6%, 46.1%, and 25.1% overlap, respectively. However, overlap with other use sites may also contribute to the overall exposure of the species.

Usage

Past usage data indicate that up to 24% of the species range has been treated with methomyl annually. Usage data indicates that vegetables and ground fruit and other orchards contribute most to exposure as these use types have the greatest usage, which could result in up to 9.6% and 7.6% of the range treated with methomyl, respectively. Usage on other use sites contributes to the total annual past usage in the species range, as shown in Table 9 below.

Table 9. Overlap and annual usage data for the Mitchell's satyr butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	5.7	19.4	25.1	0.9	2.9	3.8
Citrus	NA	NA	NA	NA	NA	NA
Corn	23.5	21.0	44.6	1.2	1	2.2
Cotton	0.4	1.3	1.7	<0.1	<0.1	0.1
Other Grains	0.7	5.6	6.4	<0.1	0.3	0.3
Other Orchards	1.4	6.2	7.6	1.4	6.2	7.6
Other Row Crops	0.1	0.5	0.6	<0.1	0.2	0.3
Soybeans[9]	23.0	23.2	46.1	1.1	1.2	2.3
Vegetables and Ground Fruit	2.3	7.3	9.6	2.3	7.3	9.6
Wheat	NA	NA	NA	NA	NA	NA
Total	**34.1**	**63.4**	**97.0**	**5.8**	**18.2**	**24.0**

[9] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Additional exposure considerations

The Mitchell's satyr butterfly known habitats are all peatlands but range along a continuum from prairie/bog fen to sedge meadow/swamp.

During the flight period, which generally lasts only two weeks in the spring, the butterflies mate, lay eggs, and die. Under laboratory conditions, larvae fed through the summer until reaching the fourth instar, diapause (a period of suspended development) in the fourth instar, and resume feeding the following spring (though this has yet to be confirmed in the wild) (USFWS 1998). We expect these periods of peak adult and larval activity will coincide with active periods of pesticide application (i.e., spring through summer) in nearby agricultural areas.

Exposure Summary

There is a high degree of overlap between the action area and the species' range. While usage data indicate that only a smaller proportion the range is likely to be treated with methomyl (up to 24% annually), we still expect that a large portion of the range will likely experience exposure. Additionally, we anticipate the timing of methomyl applications likely coincides with periods of high larval and adult activity. As such, we anticipate a large number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat, such as flowering plants that provide nectar for adults or shelter and food for larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Overlap and usage within the range are likely to be high, indicating that a potentially large proportion of individuals of the species will experience exposure. We also anticipate the species has a high toxicity ranking as available toxicity data indicates that insects are highly sensitive to methomyl exposure, suggesting exposed individuals are likely to die. Additionally, we anticipate methomyl usage will likely coincide with periods of high larval and adult activity (such as periods of breeding and hatching), indicating that exposure during key life stages is likely to occur. As such, we anticipate that the effects of the proposed action will be high, resulting in the exposure and subsequent mortality of a large number of individuals.

Preliminary Conclusion

The Mitchell's satyr is a rare butterfly and fen habitat specialist that is threatened with, among other things, the loss and disruption of suitable habitat. New information suggests the status of the species has worsened at some locations since its last status review. While the range and number of known colonies of Mitchell's satyr has expanded significantly with the discovery of the southern populations, the size and status of these populations are not well known. In addition, the species was extirpated in three counties (five populations) in Michigan as of 2014.

We found that 97% of the Mitchell's satyr butterfly's range overlaps with potential use sites in the action area. Past usage data indicate that up to 24% of the species' range will be treated annually. Suitable fen habitat for the species occurs in close proximity or adjacent to use sites, thus we expect exposure is likely from spray drift. Additionally, agricultural applications are likely to occur during the spring and summer, coinciding with the breeding and flight season of adults, resulting in exposure and resultant mortality of individuals during a critical time in the species' life cycle. This exposure and mortality are significant for a rare species of limited distribution and ability to disperse, declining populations, and ongoing threats.

We determined the species has a high exposure ranking and we anticipated that a large number of individuals would experience exposure from the proposed action. Mitchell's satyr butterflies have a high toxicity ranking because we expect any direct exposure to result in mortality.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Mitchell's satyr butterfly:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Mitchell's satyr butterfly by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Do not apply methomyl from two hours after sunrise until two hours before sunset on cucurbits, peppers, and tomatoes. Do not apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on blueberries, dry beans, and snap*

beans and all methomyl registered crops in the 'other orchards' UDL. We expect these mitigations to reduce on-field exposure.

The PULA for the Mitchell's satyr butterfly will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mitchell's satyr butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2021. Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*) 5-Year Review: Summary and Evaluation. East Lansing, Michigan. 31 pp.

U.S. Fish and Wildlife Service. 1998. Mitchell's satyr butterfly (N*eonympha mitchellii mitchellii*) Recovery Plan. Ft. Snelling, Minnesota. 81 pp.

Integration and Synthesis Summary: Myrtle's silverspot butterfly

Scientific Name:	Common Name:	Entity ID:
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	425

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is low overlap and usage within the species' range (Figure 6), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Myrtle's silverspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 6/11/2021; Wherever found; *States within the range:* CA

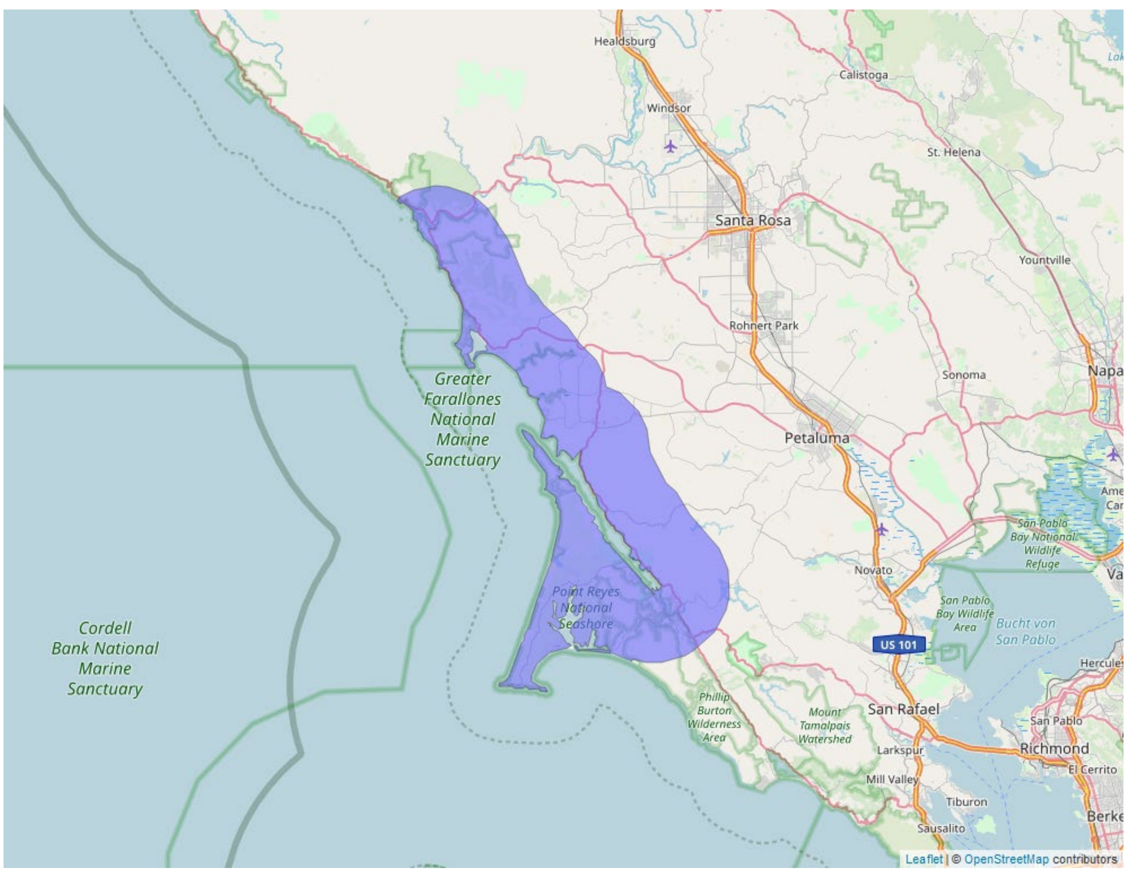

Figure 6. Range map of Myrtle's silverspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6929.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 3/22/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

At the time of listing, four populations of Myrtle's silverspot butterfly were known and described, and included the sighting of a single animal that was assumed to be part of a larger population near Valley Ford. Its distribution and abundance have not changed significantly since listing. It appears that at least three stable populations of Myrtle's silverspot butterfly currently exist. Two populations are protected within the Point Reyes National Seashore at North Beach and at the Tomales Bay headlands, while another relatively dense population remains unprotected on private lands in the area west of the small town of Valley Ford. There may be up to three more separate populations at the Point Reyes National Seashore, but this cannot be determined without a mark-recapture study, though recent observations have occurred in this location. In addition, populations may occur at Bodega Head and along the coastal terrace southward to Dillon Beach, but these areas have not been recently surveyed.

There have been no thorough surveys or consistent annual monitoring of this species, so population numbers and trends are unclear.

It was believed at the time of listing that cattle grazing significantly decreased the habitat quality of the Myrtle's silverspot butterfly; however, a study revealed that the cattle grazing regime currently used at the Point Reyes National Seashore does not significantly affect the distribution of Myrtle's silverspot butterfly at that site. Current threats to the Myrtle's silverspot butterfly include urban or industrial development of property with suitable habitat for the butterfly, poaching, small population size, the effects of reduced host and nectar plant density due to invasive plants and forbs, road mortalities during the adult flight season, and the probable constriction of the range and distribution of this butterfly due to global climate change.

Coastal dune restoration at Point Reyes National Seashore continues to remove invasive plant species, and efforts undertaken between 2001 and 2020 removed 271 acres of non-native invasive plants from approximately 525 acres of coastal dunes. Restoration projects benefit Myrtle's silverspot butterfly by opening up habitat for native plants such as the nectar plant curlyleaf monardella (*Monardella sinuata ssp. nigrescens*) (USFWS 2009, 2021). As noted in the 2009 5-year Review, restoration at Point Reyes National Seashore is intended to maintain native coastal habitats but is not specifically targeted for Myrtle's silverspot butterfly habitat maintenance and restoration.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 2.6% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 10). Up to 0.3% of the species' range overlaps with methomyl use sites while 2.3% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 10. Overlap and usage data for the Myrtle's silverspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	0.2	0.2
Citrus	0	0	0
Corn[10]	<0.1	<0.1	<0.1
Cotton	0	0	0
Other Grains	0.2	1.8	2

[10] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Other Orchards[11]	<0.1	0.1	0.1
Other Row Crops	<0.1	<0.1	<0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	0.1	0.1
Wheat	NA	NA	NA
Total	**0.3**	**2.3**	**2.6**

Usage

Mandatory pesticide usage reporting data gathered by the state of California indicates that very little insecticides are used within the mission blue butterfly's range; between 2012-2021, none of the species' range was treated with any insecticides, including methomyl (Table 11). Given that this usage data collected by the state of California is mandatory and is geographically specific to agricultural sections, we have high confidence that there is low methomyl usage within the species' range, if any.

Table 11. Annual percent of the Myrtle's silverspot butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
1.1	0	0

Additional Exposure Considerations

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used in the counties where the species' range occurs, with only 0.26% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of

11 We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Mandatory pesticide reporting data collected by the state of California indicate no insecticide usage within the species' range in recent years, including methomyl. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows little insecticide usage within the species' range. While past usage data indicate that exposure is not likely to happen, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects:

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as the plants it relies on for food or habitat (such as flowers that provide nectar for adults or those that larvae feed on) are not expected to experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Myrtle's silverspot butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate no insecticides have been used within the species' range from 2012-2021, including methomyl. The Myrtle's silverspot butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with exposure to methomyl at estimated environmental concentrations. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

The Myrtle's silverspot butterfly is listed as endangered, and only three populations of Myrtle's silverspot butterfly currently exist in western Marin and Sonoma counties, California. There have been no thorough surveys or consistent annual monitoring of this species, so population numbers and trends are unclear. Two populations are protected within the Point Reyes National Seashore at North Beach and at the Tomales Bay headlands, while another relatively dense population remains unprotected on private lands in the area west of the small town of Valley Ford, California.

There is overlap of 2.6% of the species' range with methomyl use sites. However, past usage data mandated by the state of California indicates there has been no usage any insecticides, including methomyl, in the species range from 2012-2021. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

In summary, exposure to methomyl on field and through spray drift is expected to be highly localized and affect only a very few individuals, if any, over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Myrtle's silverspot butterfly.

References

U.S. Fish and Wildlife Service. 2021. Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) 5-Year Review: Summary and Evaluation. Sacramento, California. 8 pp.

U.S. Fish and Wildlife Service. 2009. Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*) 5-Year Review: Summary and Evaluation. Sacramento, California. 28 pp.

Integration and Synthesis Summary: Quino checkerspot butterfly

Scientific Name:	Common Name:	Entity ID:
Euphydryas editha quino (=E. e. wrighti)	Quino checkerspot butterfly	426

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed Action to the species, we determined that there is a low overlap and usage within the species' range (Figure 7), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Quino checkerspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 11/4/2020; Wherever found; *States within the range:* CA

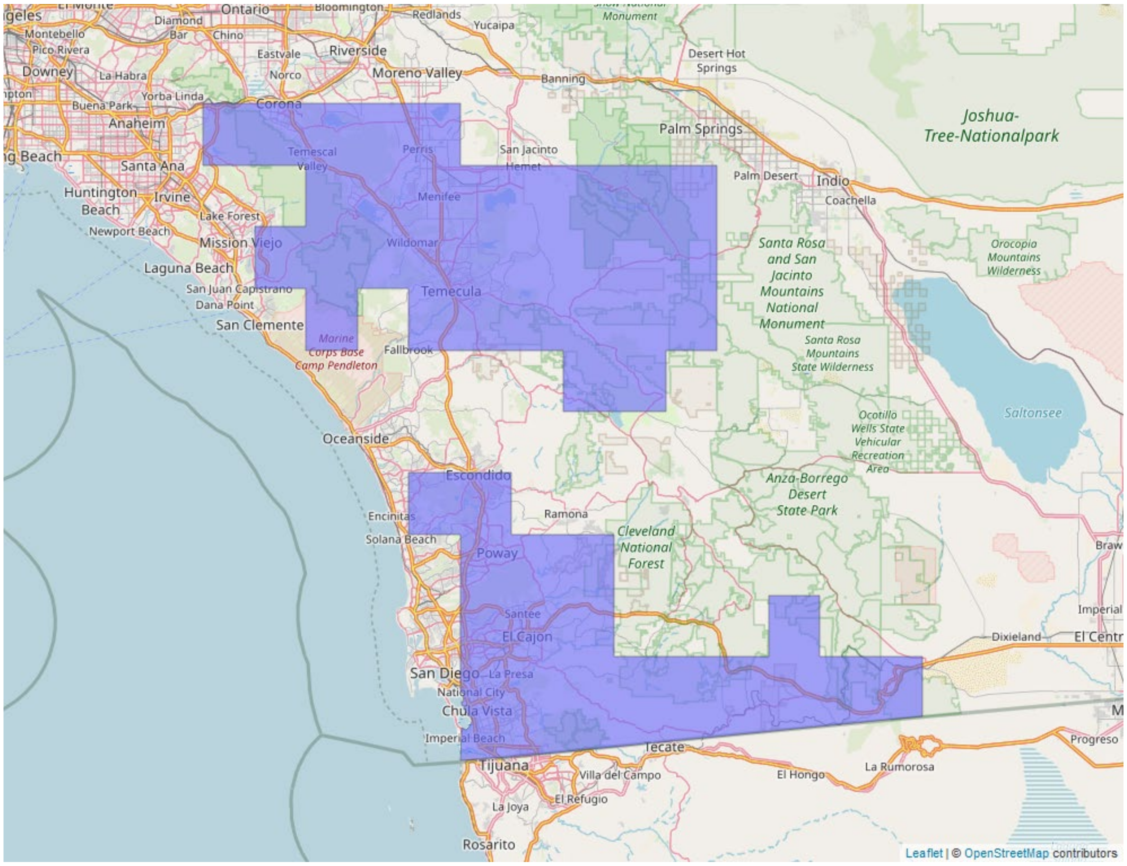

Figure 7. Range map of Quino checkerspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5900.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: August 2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Quino checkerspot butterfly is found in association with topographically diverse open woody canopy landscapes containing low to moderate levels of non-native vegetation compared to disturbed habitat in Riverside and San Diego Counties, California. Vegetation types that support the Quino checkerspot butterfly include coastal sage scrub, open chaparral, juniper woodland, and native grassland. More than 75% of the species' historic range has been lost.

The life cycle of the Quino checkerspot butterfly typically includes one generation of adults per year, with a 4-to-6-week flight period beginning from late January to early March and continuing as late as early May, depending on weather conditions. If sufficient rain falls in late summer or early fall, a rare second generation of reduced numbers may occur. Adults live from 10 to 14 days; however, adult emergence from pupae is staggered, resulting in a 1-to-2-month flight season. Peak emergence in most brush-footed butterfly species, and probably for the Quino checkerspot butterfly as well, occurs shortly after the beginning of the flight season, usually in the second week. Eggs hatch in 10 to 14 days.

Since the 2003 Recovery Plan, surveys have discovered additional occurrence complexes and expanded some, while others have been lost or significantly reduced in distribution.

The entire Northwest Riverside Recovery Unit, out of five total Recovery Units, is now believed to be unoccupied, and not likely to be recolonized without assistance. Furthermore, one of the two core occurrence complexes in the Southwest Riverside Recovery Unit is likely extirpated; in fact, all mapped occurrence complex areas in the western half of the unit are believed to be unoccupied. Despite planning efforts to enhance resilience such as the soon-to-be constructed Quino habitat bridge to enhance landscape connectivity, recovery unit 4 functionality is irreversibly compromised due to loss of landscape and ecological connectivity. These two recovery units are not only highly affected by climate change and drought, but habitat loss and degradation has been concentrated in these areas, including non-native plant invasion enhanced by nitrogen deposition. In western Riverside County, approximately a dozen occurrence complexes are believed to have been extirpated by habitat loss, isolation, or both since recovery plan publication. It will require intensive management to meet recovery criteria in these compromised recovery units, if that is possible; including measures such as habitat restoration, weed control, and assisted recolonization. Therefore, despite the discovery of new occupied areas since publication of the 2003 recovery plan, past and future population loss should be a subject of significant concern where development is reducing and fragmenting habitat, and subpopulations have already been lost.

Population reduction was primarily due to direct and indirect human impacts including habitat loss and fragmentation, invasion of non-native plant species, and catastrophic natural events such as increased frequency of drought and wildfire. The species is still vulnerable to extinction with current habitat destruction, altered habitat suitability due to climate change, non-native species invasions, and population losses.

Through Service partnership activities such as the San Diego National Wildlife Refuge Quino Augmentation Project, and research funded through mitigation projects and grant programs, we have made strides toward meeting the research needs for delisting criteria development, especially in the Southwest San Diego Recovery Unit. For example, areas within and among occurrence complexes are being surveyed on a project-by project basis, and areas where intervening and/or additional landscape connectivity is needed are being identified. We are mapping habitat patch distributions, tracking habitat loss through GIS databases, developing a preliminary metapopulation model, and investigating key natural history questions and threats through a rearing and population augmentation program (USFWS 2003, 2009, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 12). Up to 0.5% of the species' range overlaps with methomyl use sites while 1.5% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 12. Overlap data for the Quino checkerspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0.1	0.5	0.6
Citrus[12]	<0.1	<0.1	<0.1
Corn[13]	<0.1	<0.1	<0.1
Cotton	<0.1	<0.1	<0.1
Other Grains	0.3	0.9	1.3
Other Orchards	<0.1	<0.1	<0.1
Other Row Crops	0	0	0
Soybeans	0	0	0

[12] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[13] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Vegetables and Ground Fruit	<0.1	<0.1	0.1
Wheat	0	0	0
Total	**0.5**	**1.5**	**2**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 1.5% (Table 13). Up to 0.5% of the range was treated with any insecticide, and none of the range had been treated with methomyl. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 13. Annual percent of the Quino checkerspot butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
1.5	0.5	0

Additional Exposure Considerations

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 1.48% of the species range reported to be treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with no methomyl usage reported in the same period. This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as the plants it relies on for food or habitat (such as flowers that provide nectar for adults or those that larvae feed on) are not expected to experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Quino checkerspot butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-2021, with no methomyl usage reported in the same period. The Quino checkerspot butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

The Quino checkerspot butterfly is listed as endangered, and only a few populations exist in a restricted range in Riverside and San Diego Counties, California. Since the 2003 Recovery Plan, surveys have discovered additional occurrence complexes and expanded some, while others have been lost or significantly reduced in distribution, mainly due to the ongoing threat of urban and suburban development and climate change. Recovery efforts are underway, and areas within and among occurrence complexes are being surveyed on a project-by project basis, and areas where intervening and/or additional landscape connectivity is needed are being identified. However, the species' overall vulnerability remains high.

A very small portion of the species' range is likely to be exposed to methomyl given the low overlap between the action area and the species' range. Mandatory pesticide usage reporting data from the state of California confirms no areas within the species' range have been treated with methomyl in recent years, further indicating a very low likelihood of individuals experiencing methomyl exposure.

In summary, minimal exposure to methomyl on field and through spray drift is anticipated to occur, and impacts are expected to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Quino checkerspot butterfly.

References

U.S. Fish and Wildlife Service. 2019. Recovery Plan for Quino checkerspot butterfly (*Euphydryas editha quino*) – Amendment. Carlsbad, California. 22 pp.

U.S. Fish and Wildlife Service. 2009. Quino Checkerspot Butterfly (*Euphydryas editha quino*) 5-Year Review: Summary and Evaluation. Carlsbad, California. 57 pp.

U.S. Fish and Wildlife Service. 2003. Recovery Plan for the Quino Checkerspot Butterfly (*Euphydryas editha quino*). Portland, Oregon. 179pp.

Integration and Synthesis Summary: San Bruno elfin butterfly

Scientific Name:	Common Name:	Entity ID:
Callophrys mossii bayensis	San Bruno elfin butterfly	427

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a low overlap and usage within the species' range (Figure 8), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the San Bruno elfin butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 6/14/2021; Wherever found; *States within the range:* CA

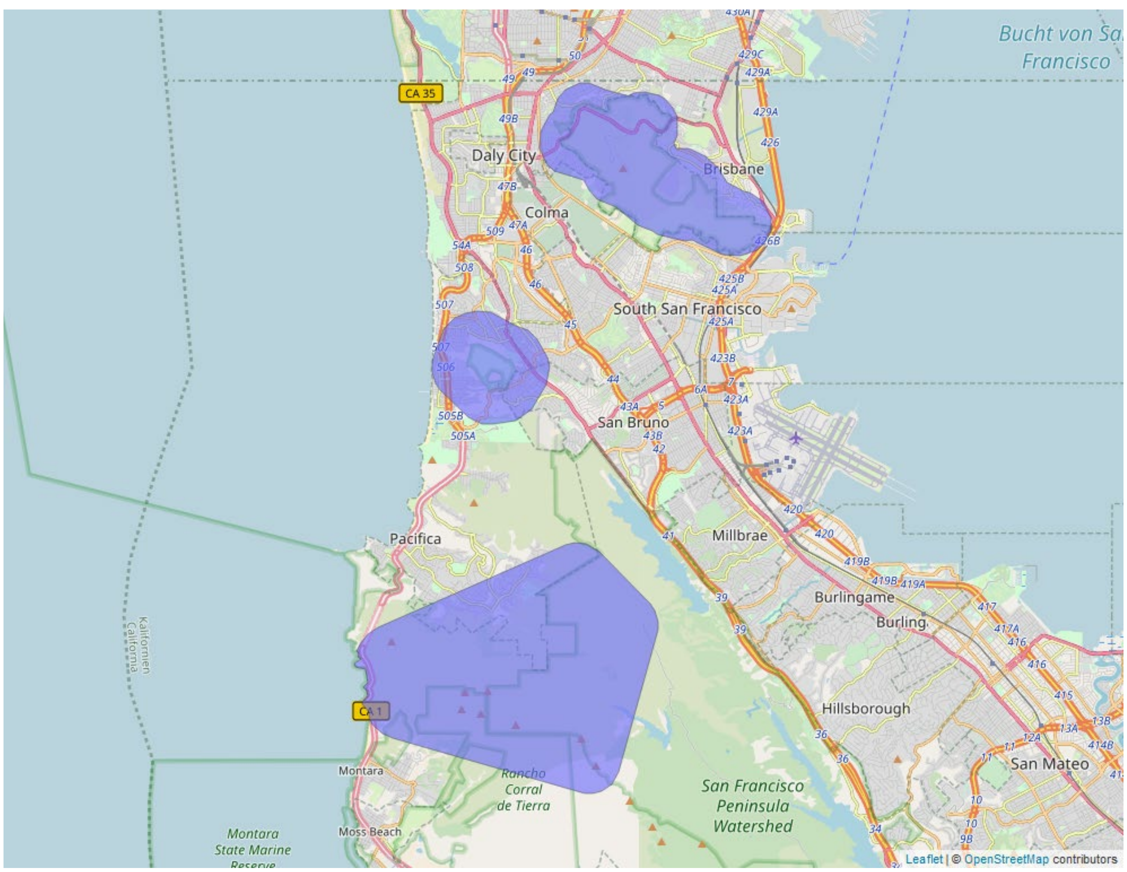

Figure 8. Range map of San Bruno elfin butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3394.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 4/13/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Population size/location(s) unknown

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

This small, diurnally active, and univoltine (one generation each year) butterfly is endemic to San Mateo County just south of the city of San Francisco in California. The species' courtship, mating, and reproduction are all carried out in the immediate space surrounding the only known larval host plant, stonecrop (*Sedum spathulifolium*), within coastal grasslands and low scrub of north-facing slopes within the fog belt where the larval host plant grows.

Metapopulations occur on San Bruno Mountain, the Montara Mountain region, and Milagra Ridge. The number of known San Bruno elfin butterfly populations has likely increased since the final listing rule was written and the population on San Bruno Mountain appears to have remained stable, however survey protocols across sites and years are variable which makes it difficult to establish trends in abundance. The population at Milagra Ridge is small and fragile and its ability to persist into the future is not known. The current status of the Montara Mountain population and associated colonies is unknown, but viable colonies are believed to persist.

Current threats include public infrastructure development (except on San Bruno Mountain where take as a result of development is not permitted), poaching, small population size, the effects of reduced host and nectar plant density due to exotic invasive plants and forbs, and the undetermined effects of global climate change. The threat of suburban and urban development poses less of a threat as most populations are now located on publicly protected lands. However, the amount of area occupied by the host plant is not increasing and the sustainability of the Milagra Ridge population calls into question the ability of any of the smaller and isolated populations to sustain themselves in perpetuity without reintroduction efforts in the event of extirpation.

Additional impacts to the species may occur from other sources. Pesticide use poses a potential threat to San Bruno elfin butterflies if used in proximity to occupied habitat. In some cases, 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 (USFWS 2011, 2019, 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.9% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 14). Up to 0.1% of the species' range overlaps with methomyl use sites while 0.7% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 14. Overlap data for the San Bruno elfin butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	<0.1	0.1
Citrus	0	0	0
Corn	0	0	0
Cotton	0	0	0
Other Grains	<0.1	0.3	0.3
Other Orchards[14]	<0.1	<0.1	<0.1
Other Row Crops	0	0	0
Soybeans	0	0	0

[14] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Vegetables and Ground Fruit	<0.1	0.3	0.3
Wheat	NA	NA	NA
Total	**0.1**	**0.7**	**0.9**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 0.3% (Table 15). Up to 0.1% of the range was treated with any insecticide, and none of the range had been treated with methomyl. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 15. Annual percent of the San Bruno elfin butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
0.3	0.1	0

Additional Exposure Considerations

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 0.25% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with no methomyl usage reported in the same period. This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

The San Bruno elfin butterfly is a facultative myrmecophile; it has a symbiotic relationship with ants that tend to the developing larvae (USFWS 2010). We expect these symbiotic ants are similarly sensitive to methomyl exposure as the mission blue butterfly is. As such, we anticipate methomyl use will result in mortality of any symbiotic ants exposed within the mission blue butterfly's range.

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat, such as flowering plants that provide nectar for adults or host plants that provide shelter and food for larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die. Similarly, we anticipate any symbiotic ants exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The San Bruno elfin butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-2021, with no methomyl usage reported in the same period. The San Bruno elfin butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects from the proposed action, and the cumulative effects, it is our biological opinion that the registration of methomyl is not likely to jeopardize the continued existence of the San Bruno elfin butterfly. As discussed below, while the vulnerability is high, given the low overlap with the action area and very low usage within the range, there is a low likelihood of exposure and resultant mortality from the proposed action. Thus, while we anticipate a very small number of individuals will be affected over the duration of the proposed action, we do not expect species-level effects will occur.

The San Bruno elfin butterfly is listed as endangered, and a small number of populations exist in a very restricted range in San Mateo County just south of the city of San Francisco in California. The species' courtship, mating, and reproduction are all carried out in the immediate space surrounding the only known larval host plant, stonecrop (*Sedum spathulifolium*). The threat of suburban and urban development poses less of a threat as most populations are now located on publicly protected lands. However, the amount of area occupied by the host plant is not increasing and the sustainability of the Milagra Ridge population calls into question the ability of any of the smaller and isolated populations to sustain themselves in perpetuity without reintroduction efforts in the event of extirpation. Thus, the species' overall vulnerability is high.

A very small portion of the species' range is likely to be exposed to methomyl given the low overlap between the action area and the species' range. Mandatory pesticide usage reporting data from the state of California confirms no areas within the species' range have been treated with methomyl in recent years, further indicating a very low likelihood of individuals experiencing methomyl exposure.

In summary, minimal exposure to methomyl on field and through spray drift is anticipated to occur, and impacts are expected to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the San Bruno elfin butterfly.

References

U.S. Fish and Wildlife Service. 2021. San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) 5-Year Review. Sacramento, California. 14 pp.

U.S. Fish and Wildife Service. 2019. Recovery Plan for San Bruno Elfin Butterfly (*Callophyrs mossii bayensis*) and Mission Blue Butterfly (*Icaricia icariodes missionensis*) – Amendment. Sacramento, California. 25 pp.

U.S. Fish and Wildlife Service. 2011. San Bruno Elfin Butterfly (*Callophrys mossii bayensis*) and Mission Blue Butterfly (*Icaricia icarioides missionensis*) 5-Year Review: Summary and Evaluation. Sacramento, California. 39 pp.

Integration and Synthesis Summary: Smith's blue butterfly

Scientific Name:	Common Name:	Entity ID:
Euphilotes enoptes smithi	Smith's blue butterfly	428

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a low overlap and usage within the species' range (Figure 9), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Smith's blue butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 9/22/2021; Wherever found; *States within the range:* CA

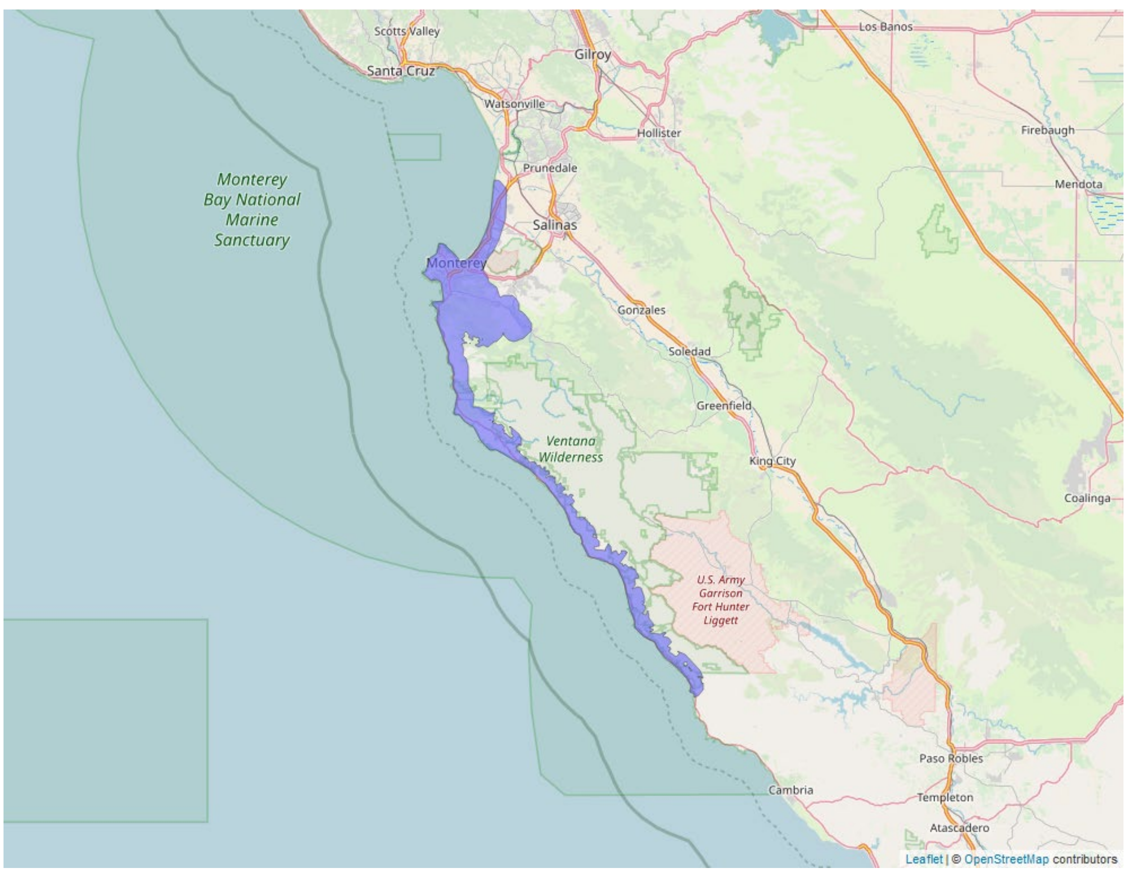

Figure 9. Range map of Smith's blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4418.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/3/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Smith's blue butterfly is endemic to approximately 93 miles of the central coast of California, within Monterey and northern San Luis Obispo Counties. The Smith's blue butterfly is an annual subspecies that primarily uses two species of buckwheat (*Eriogonum latifolium* and *E. parvifolium*) as host plants that grow in sand dunes and scrub, chaparral habitats. Each of its life stages relies upon the buckwheat, with adults feeding on nectar from the flowers and depositing eggs on the flowerheads, larvae feeding on the flowers and seeds, and pupae either forming in the soil or directly on the plants before dropping to the ground where they overwinter in leaf litter. In order for Smith's blue butterfly populations to maintain viability, they need healthy populations of their buckwheat host plants, coastal habitats with adequate levels of appropriate disturbance regimes to support the buckwheat, and connectivity between occupied spaces to facilitate natural recolonization.

The occupied range of the Smith's blue butterfly is larger than was known at the time the subspecies was listed, and numerous new occupied sites have been found throughout the southern part of its range. The best available locality information indicates that the subspecies' range has contracted substantially in the northern portion of its range area, with historic localities from the Salinas River to the city of Monterey (approximately 18.5 km) and current localities only from the Salinas River to Sand City (approximately 14.5 km). Most of the occupied sites have been surveyed only once, and we have no substantial information on the persistence of such occurrences in the southern portion of the range. The species is currently thought to occur in scattered colonies in Monterrey and San Luis Obispo Counties in two metapopulations. These two metapopulations are now likely isolated from one another, with the northern metapopulation inhabiting the dunes along Monterey Bay and the southern metapopulation reaching from the Carmel Valley, south into Big Sur. The two metapopulations are separated by development around the City of Monterey and the Monterey Peninsula. Smith's blue butterfly has never been documented in the gap between the two metapopulations and current habitat conditions indicate that development, tree planting, and fire suppression have likely reduced habitat suitability for Smith's blue butterfly in this area. The most recent survey efforts, described in the 2020 SSA and 2020 5-Year Review, indicate that the gap between metapopulations is expanding.

The 2020 SSA reports a declining population trend in the northern metapopulation, from approximately 1,483 individuals in 2015 to 395 in 2019. There is almost a complete lack of data from population monitoring for the southern metapopulation, which limits our ability to make assumptions or predictions regarding abundance.

We remain concerned that threats to the Smith's blue butterfly in the northern portion of its range, along the coast of Monterey Bay from the Salinas River to Sand City, could result in extirpation of the subspecies from this area. This area is highly fragmented due to residential and industrial development, is isolated from the larger southern portion of the subspecies' range and is threatened by planned future development and by ongoing habitat degradation due to invasive, non-native plants and industrial and recreational use. Further, the northern portion of the range continues to be threatened by urban development activities. The larger, southern portion of the Smith's blue butterfly's range faces different threats than the northern portion. Habitat loss due to residential and commercial development is present but does not appear to be as imminent or large-scale as in the north. Invasive, non-native plants, which are largely unmanaged in the southern range, are widespread, and have been shown to cause local extirpations of suitable butterfly habitat. However, we consider this threat to be less imminent than it was at the time of listing due to the greatly increased number of known butterfly occurrences. A likely benefit to the Smith's blue butterfly population in this area is that it faces a lower level of threat due to the substantial amount of habitat found on public lands, especially the Los Padres National Forest (containing approximately 22% of the land area in the southern metapopulation). The coastal habitat formerly encompassed by the Fort Ord Army Base is now owned and managed by California State Parks (Fort Ord Dunes State Park), where we anticipate reduced impacts to the species due to changes in land use and management.

In addition to the threats identified in the 2006 5-year review, we now consider the potential impacts of wildfire and factors related to climate change, especially increasing temperatures, drought, and sea level rise to be additional threats to the species. Warmer and dryer conditions and increased wildfire are also expected to lead to a reduction in shrub dominated habitats in the California Coast Ranges, including the scrub and chaparral habitats of the Smith's blue butterfly, favoring increased spread of invasive, non-native vegetation (USFWS 2006, 2020a, 2020b).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 3.8% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 16). Less than 0.1% of the species' range overlaps with methomyl use sites while up to 3.8% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 16. Overlap data for the Smith's blue butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0	0.7	0.7
Citrus	<0.1	0.2	0.2
Corn[15]	0	0.1	0.1
Cotton	0	0	0
Other Grains	0	1.2	1.2
Other Orchards[16]	<0.1	0.3	0.4
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	0	1.4	1.4
Wheat	NA	NA	NA
Total	**<0.1**	**3.8**	**3.8**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 2.8% (Table 17). Up to 2.6% of the range was treated with any insecticide, and 1.2% of the range had been treated with methomyl. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

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[15] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[16] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Table 17. Annual percent of the Smith's blue butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
2.8	2.6	1.2

Additional Exposure Considerations

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the Smith blue butterfly's range occurs, with only 1.85% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with very low levels of methomyl usage reported in the same period. This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

The Smith's blue butterfly is a facultative myrmecophile; it has a symbiotic relationship with ants that tend to the developing larvae. We expect these symbiotic ants are similarly sensitive to methomyl exposure as the mission blue butterfly is. As such, we anticipate methomyl use will result in mortality of any symbiotic ants exposed within the Smith's blue butterfly's range.

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat, such as flowering plants that provide nectar for adults or host plants that provide shelter and food for larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die. Similarly, we anticipate any symbiotic ants exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Smith's blue butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate little insecticides have been used within the species' range from 2012-2021, with very low levels of methomyl usage reported in the same period. The Smith's blue butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

The Smith's blue butterfly is listed as endangered and is endemic to approximately 93 miles of the central coast of California, within Monterey and northern San Luis Obispo Counties. The species is currently thought to occur in scattered colonies in these counties in two metapopulations. These two metapopulations are now likely isolated from one another, separated by development around the City of Monterey and the Monterey Peninsula. The most recent survey efforts, described in the 2020 SSA and 2020 5-Year Review, indicate that the gap between metapopulations is expanding. Threats from urban development and invasive plants continue. Thus, the species' overall vulnerability is high.

A small portion of the species' range is likely to be exposed to methomyl given the low overlap between the action area and the species' range. Mandatory pesticide usage reporting data from the state of California indicates 1.2% of the species' range has been treated with methomyl in recent years, further indicating a very low likelihood of individuals experiencing methomyl exposure.

In summary, minimal exposure to methomyl on field and through spray drift is anticipated to occur, and impacts are expected to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Smith's blue butterfly.

References

U.S. Fish and Wildlife Service. 2020a. Smith's blue butterfly (*Euphilotes enoptes smithi*) 5-Year Review: Summary and Evaluation. Ventura, California. 8 pp.

U.S. Fish and Wildlife Service. 2020b. Species Status Assessment for Smith's Blue Butterfly (*Euphilotes enoptes smithi*). Version 1.0. Ventura, California.

U.S. Fish and Wildlife Service. 2006. Smith's blue butterfly (*Euphilotes enoptes smithi*) 5-Year Review: Summary and Evaluation. Ventura, California. 29 pp.

Integration and Synthesis Summary: Schaus swallowtail butterfly

Scientific Name:	Common Name:	Entity ID:
Heraclides aristodemus ponceanus	Schaus swallowtail butterfly	429

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a low overlap and usage within the species' range (Figure 10), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Schaus swallowtail butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 2/10/2022; Wherever found; *States within the range:* FL

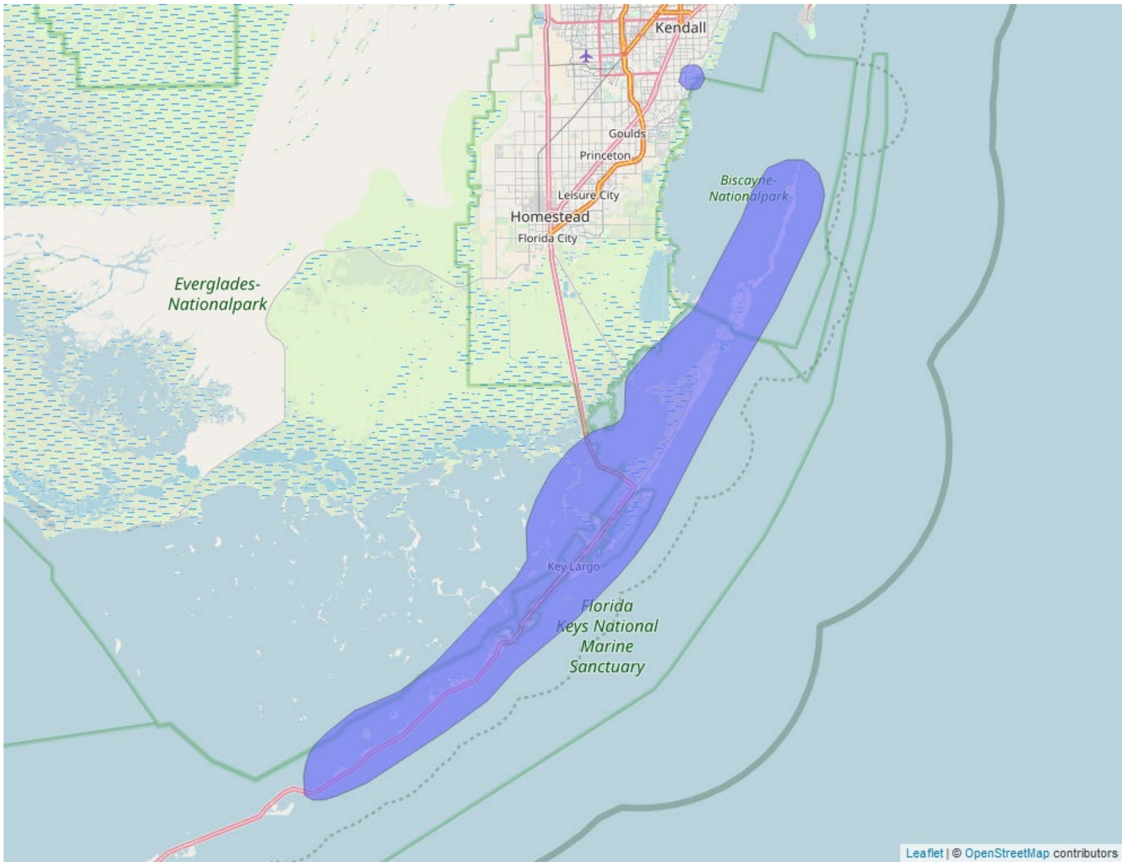

Figure 10. Range map of Schaus swallowtail butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1951.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 2/26/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: All populations stable, with none known to be increasing or decreasing

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Schaus swallowtail is a large blackish brown, univoltine (single brood) butterfly that occurs exclusively in subtropical dry forests (hardwood hammocks) in the Florida Keys. Adults use at least 30 different wild plant species for nectaring, while eggs are laid and larvae feed on torchwood and wild lime (*Zanthozylum fagara*).

The species is currently extant on several islands within Biscayne National Park and on north Key Largo (Crocodile Lake National Wildlife Refuge; Dagny Johnson Key Largo Hammock State Park). However, at the time of listing the historical range was believed to have included the entire Florida Keys and southern tip of Florida (namely all hardwood hammocks from Everglades National Park south to Key West).

Although Schaus' populations have been monitored for several decades, it has only been since 2011 that the subspecies' range-wide abundance and distribution have been evaluated in a consistent manner from year-to-year. A total of 4 and 32 individuals were encountered range-wide in 2012 to 2013, respectively. However, as a result of captive releases and normal seasonal conditions (rainfall, abundant fresh host plant growth), observations of Schaus' densities increased in subsequent years. Naturally occurring Schaus' numbers increased to 438 individuals in 2018 and 523 in 2019, but then decreased to 382 in 2020 within the stronghold regions (Elliott Key within Biscayne and northern Key Largo). Therefore, captive-reared stock has or will be used to augment populations on other islands within Biscayne, as well as at locations on central Key Largo (e.g., John Pennekamp Coral Reef State Park).

Predominant threats described at the time Schaus swallowtail butterfly was listed were habitat destruction, mosquito control practices, and illegal collecting. None of these threats has been eliminated, although each has been reduced. Habitat destruction due to human population growth and associated development has been significantly reduced. However, detrimental habitat effects associated with earlier development, including fragmentation, persist over much of the historic range. Invasive, exotic plants are largely actively controlled and currently do not appear to be an imminent threat. Poaching has the potential to be a significant threat. Predation due to fire ants appears to remain at least a moderate threat, while the threat of predation from twig ants appears to be high. In fact, non-native predators, including Mexican twig ants, fire ants, and other tramp ants, may be among the greatest threats. Hurricanes and tropical storms, depending on location and intensity of catastrophic winds, could result in extirpation or extinction. The species appears to be vulnerable to extinction due to limited range, number of populations, and abundances. Additionally, information spanning at least 70 years indicates that the extent of the range has consistently declined without any significant and enduring reversals (USFWS 1999, 2008, 2021).

As described in the Recovery Plan Amendment (2019), although mosquito management efforts are believed to have historically contributed to Schaus' declines, ongoing coordination between the Service, its partners, and mosquito control districts have greatly reduced this threat. Mosquito control pesticides are restricted from the islands of Biscayne, as well as within Crocodile Lake National Wildlife Refuge on northern Key Largo. However, the Service and Florida Keys Mosquito Control District have coordinated (in order avoid or minimize any impacts to occupied hardwood hammocks and butterfly habitat) to allow limited treatments in these areas during emergency situations (such as post-Irma). That said, occupied and suitable Schaus' habitat on

State lands on northern Key Largo and southward in the keys remain subject to mosquito control pesticide applications.

Several habitat restoration projects have occurred within Schaus' habitat. Projects within Crocodile Lake and Dagny Johnson Key Largo Hammock Botanical State Park, where current Schaus' populations occur, have included the filling of the 2.16-acre Keystone (quarry) pit, the removal of debris piles at the former Nike Missile Site, and the removal of 32 acres of old buildings, roads, and infrastructure at the abandoned Port Bougainville site. As of 2018, hardwood hammock vegetation appeared to have taken hold within the restoration areas, including an increase in butterfly hostplant density (torchwood). In addition, Schaus' has been observed at these sites since restoration commenced, suggesting the restoration is allowing the species to expand.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.5% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 18). Less than 0.1% of the species' range overlaps with methomyl use sites while up to 0.5% of the range occurs off-field but may still be exposed to spray drift or runoff.

Usage

While 0.5% of the species' range overlaps with methomyl the action area, past usage data indicates that only up to 0.4% of the species range has been be treated with methomyl annually (Table 18).

Table 18. Overlap and annual usage data for the Schaus swallowtail butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	0	0	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn	0	0	0	0	0	0
Cotton	0	0	0	0	0	0

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Grains	0	<0.1	<0.1	0	0	0
Other Orchards	<0.1	0.3	0.3	<0.1	0.3	0.3
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0	<0.1	<0.1	0	<0.1	0.1
Wheat	NA	NA	NA	NA	NA	NA
Total	**<0.1**	**0.5**	**0.5**	**<0.1**	**0.4**	**0.4**

Additional Exposure Considerations

The Schaus swallowtail butterfly flight season is May – June. Surveys conducted from 2014-2017 found adults in August and September, suggesting this species may be bivoltine (multiple broods) (USFWS 2021). This butterfly uses torchwood and wild lime (*Zanthoxyum fagara*) to deposit eggs in sub-tropical dry forests (hardwood hammock). Single eggs are laid on the upper surface of the tips of the leaves and take 3 to 5 days to hatch. The chrysalis stage can last either one or two years. Therefore, the Schaus swallowtail butterfly is potentially vulnerable to the effects of methomyl throughout is entire lifecycle. The larval and adult stages are especially vulnerable if applications are made from May through July, and potentially through September given the results from the surveys discussed above.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Past usage data further indicate that methomyl usage is unlikely to occur within the species' range. While we cannot completely rule out the possibility of an individual experiencing exposure to methomyl, we expect the likelihood of exposure is low for any individual given the low level of agricultural activity occurring within the species' range. While overlap and past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat, such as flowering plants that provide nectar to adults or food and shelter to larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Schaus swallowtail butterfly has a low exposure ranking. Only a small portion of the species' range overlaps with the action area (0.5%) and past usage data indicates very little of the range has been treated in the past (up to 0.4% annually). However, we cannot completely discount exposure from occurring in the future, particularly as the timing of methomyl applications typically coincide with periods of high larval and adult activity. As such, we anticipate, at most, only a small number of individuals are likely to experience exposure. We expect any individuals that are exposed to methomyl are likely to die as available toxicity data indicates that insects are highly sensitive to methomyl. However, we anticipate exposure will be a rare occurrence given the very low overlap and usage within the species' range. As such, we anticipate only a small number of individuals, at most, are likely to experience adverse effects from the proposed action.

Conclusion

The Schaus' swallowtail is a large blackish brown butterfly that occurs exclusively in subtropical dry forests (hardwood hammocks) in the Florida Keys. The species is currently extant in low numbers on several islands within Biscayne National Park and on north Key Largo (Crocodile Lake National Wildlife Refuge; Dagny Johnson Key Largo Hammock State Park). Detrimental habitat effects associated with earlier development, including fragmentation, persist over much of the historic range. Poaching has the potential to be a significant threat. Non-native predators, including Mexican twig ants, fire ants, and other tramp ants, may be among the greatest threats to Schaus' swallowtail butterfly. Thus, the species' overall vulnerability is high.

We anticipate that a small portion of the species' range will be exposed to methomyl given the low overlap between the action area and the species' range. Past usage data further indicates that very little methomyl has been used within the species range, indicating that, at most, only a few individuals are likely to experience exposure. While insecticide use for mosquito control is identified as a concern for this species, methomyl is not registered for use as a mosquito control agent.

In summary, minimal exposure to methomyl on field and through spray drift is anticipated to occur, and impacts are expected to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Schaus' swallowtail butterfly.

References

U.S. Fish and Wildlife Service. 2021. Schaus' swallowtail butterfly (*Heruclides aristodenius ponceanus*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 27 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for the endangered Schaus' swallowtail butterfly (*Heruclides aristodenius ponceanus*). Atlanta, Georgia. 9 pp.

U.S. Fish and Wildlife Service. 2008. Schaus' swallowtail butterfly (*Heruclides aristodenius ponceanus*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 29 pp.

U.S. Fish and Wildlife Service. 1999. Multi-Species Recovery Plan for South Florida. Vero Beach, Florida.

Integration and Synthesis Summary: Callippe silverspot butterfly

Scientific Name:	Common Name:	Entity ID:
Speyeria callippe callippe	Callippe silverspot butterfly	430

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is estimated to be high, we anticipate low past usage of methomyl on use sites within the species' range (Figure 11). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Callippe silverspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 6/10/2021; Wherever found; *States within the range:* CA

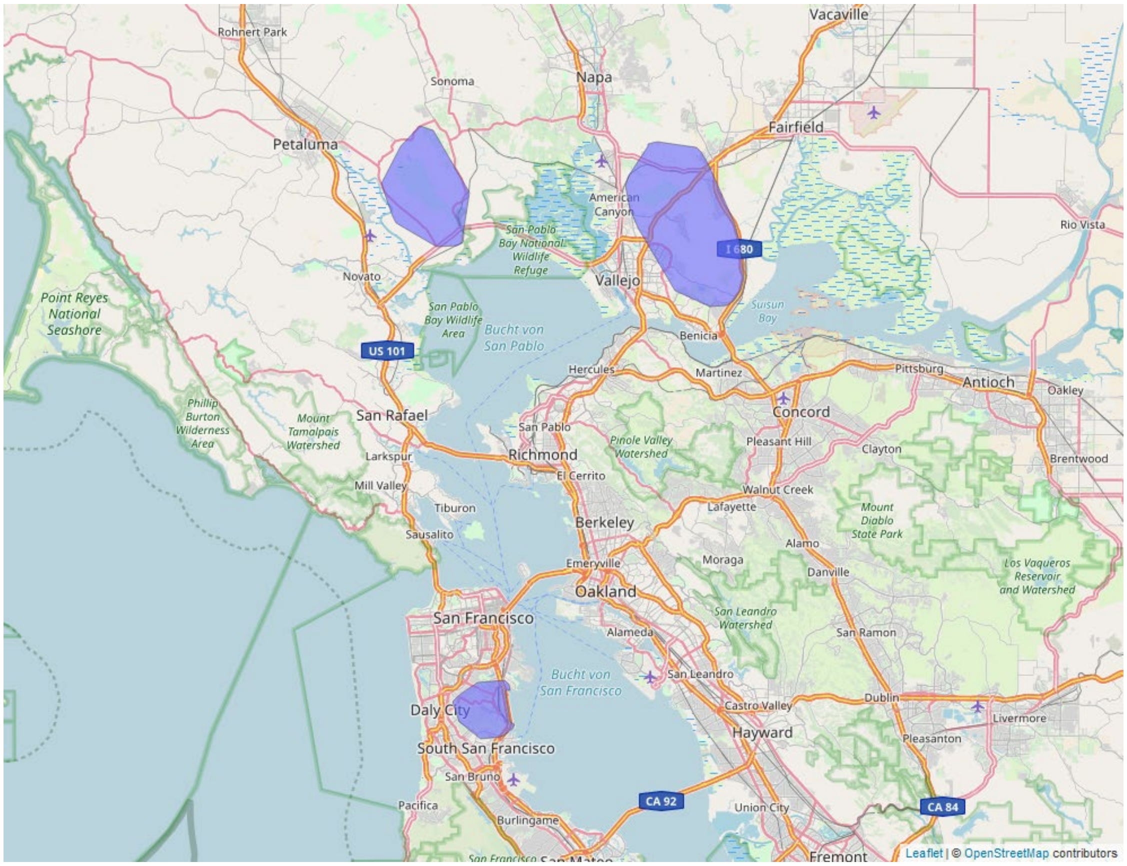

Figure 11. Range map of Callippe silverspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3779.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 7/22/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: San Bruno Mountain population stable; other populations unknown

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The callippe silverspot butterfly is a subspecies within a 19 subspecies complex of *Speyeria callippe.* It is a medium-sized, univoltine (one generation per year) butterfly subspecies that occurs on grasslands and associated habitats in the San Francisco Bay Area. Adults emerge in early summer and lay eggs, eggs hatch into larva and remain in this state until the following spring. The host plant used by larvae is the California golden violet (*Viola pedunculata*) which tends to be associated with established grass cover, although the species can be found on disturbed roadsides. Adults are typically seen from mid-May to mid-July (USFWS 2009, 2020a).

The SSA for this species identified and evaluated four populations (San Bruno Mountain, Ferrari Ranch, Cordelia Hills, and Sears Point). Only the San Bruno Mountain population is considered in moderate current condition, while the remaining three are in low condition. Populations in San Francisco County and Alameda County are thought to be extirpated. Currently protected populations of Callippe silverspot butterfly include the population found in the hills between Vallejo and Cordelia on a preserve managed by the Solano Land Trust and the population at San Bruno Mountain that is protected through a Habitat Conservation Plan. Habitat for this butterfly has been fairly well-defined. The following factors are necessary components of suitable habitat for the Callippe silverspot butterfly: grasslands with proper topography in the San Francisco Bay area, with sufficient larval host plant (*Viola pedunculata*), adequate nectar sources, within the area influenced by coastal fog, and hilltops for mating congregations (USFWS 2020b).

Threats to the Callippe silverspot butterfly that were identified when the butterfly was listed (1997) and that still persist include the loss of suitable habitat to urbanization and fragmentation in the San Francisco Bay area, grassland conversion, habitat modification through non-native plants (and subsequent elimination of *Viola pedunculata* host plants through competition), pesticide use (considered a threat if used in proximity to occupied habitat), fire, small population size, and climate change. Predation, poaching by insect collectors, human recreation, road mortalities, deposition of nitrogen from local traffic that encourages invasive plants, and dust from the San Bruno Mountain quarry are also considered threats to individuals (USFWS 2009, 2020a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 15.3% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area**.** Data indicate that 4.1% of the species' range overlaps with methomyl use sites while 11.2% of the range occurs off-field but may still be exposed to spray drift or runoff.

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 12.8% annually (Table

20). Within the range of the species, up to 4.8% of the range was treated with any insecticide annually, and up to 0.1% of the range was treated with methomyl annually. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 19. Overlap data for the Callippe silverspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0	0.8	0.8
Citrus	0	0	0
Corn[17]	0	0.1	0.1
Cotton	0	0	0
Other Grains	0	6.2	6.2
Other Orchards[18]	4.1	3.7	7.8
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	0	0.3	0.3
Wheat	NA	NA	NA
Total	**4.1**	**11.2**	**15.3**

[17] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[18] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Table 20. Annual percent of the Callippe silverspot's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
12.8	4.8	0.1

Additional Considerations for Risk

The Callippe silverspot lays eggs in the dried remains of their host plant, *Viola pedunculata* (Johnny Jump Up) or on the surrounding debris. Within a week the larvae hatch and eat their eggshells, wander a short distance, and spin a silk pad upon which they pass the summer and winter in diapause (a period of suspended development). Upon termination of diapause in the spring, the larvae search for food plants, grow through five larval stages or instars, and pupate in a composite leaf and silk chamber. Adults emerge in about 2 weeks and fly for about 3 weeks from about mid-May to about late July. Because the height of feeding and reproductive activities for this butterfly occurs from mid-May through July, it may be more vulnerable to the effects of methomyl during the larval and adult stages if applications are made at this time, however it is potentially exposed throughout its entire lifecycle.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 3.98% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

While a large portion of the range overlaps with methomyl use sites or adjacent areas that are likely exposed through off-site transport, mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with up to 4.8% of the range having been treated with any insecticide annually, and up to 0.1% of the range treated with methomyl annually. This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows very little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of insecticide usage within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including their host plant, *Viola pedunculata* (Johnny Jump Up), that this butterfly species is reliant on for food as nectar for adults or sheltering for larvae, within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Callipe silverspot butterfly has a low exposure ranking as mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-2021, with very low levels of methomyl usage reported in the same period (up to 0.1% of the range treated with methomyl annually). The Callipe silverspot butterfly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with exposure to methomyl at estimated environmental concentrations. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a small number of individuals, we do not expect this is likely to occur. As such, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Callippe silverspot butterfly is listed as endangered and is a narrow endemic that exists in four populations in the San Francisco Bay area. Only the San Bruno Mountain population is considered in moderate current condition, while the remaining three are in low condition. Populations in San Francisco County and Alameda County are thought to be extirpated. The San Bruno Mountain and Vallejo populations are currently protected and managed by the Solano Land Trust While 15.3% of the range overlaps with the action area and has the potential for methomyl use, mandatory pesticide usage reporting data from the state of California indicates <1% of the species' range has been treated annually with methomyl, indicating a very low extent of methomyl exposure.

In summary, we expect a very low extent of methomyl exposure to occur. If usage patterns change in the future, we expect any impacts to be highly localized and affect only a very few individuals, at most, over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Callippe silverspot butterfly.

References

U.S. Fish and Wildlife Service. 2020a. Callippe silverspot butterfly (*Speyeria callippe callippe*) 5-Year Review. Sacramento, California. 4 pp.

U.S. Fish and Wildlife Service. 2020b. Species Status Assessment for the Callippe silverspot butterfly (*Speyeria callippe callippe*) Version 1.0. Sacramento, California. 79 pp.

U.S. Fish and Wildlife Service. 2009. Callippe silverspot butterfly (*Speyeria callippe callippe*) 5-Year Review. Sacramento, California. 30 pp.

Integration and Synthesis Summary: Oregon silverspot butterfly

Scientific Name:	Common Name:	Entity ID:
Speyeria zerene hippolyta	Oregon silverspot butterfly	431

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure due to low overlap and low past usage of methomyl on use sites within the species' range (Figure 12). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Oregon silverspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 2/2/2022; Wherever found; *States within the range:* CA, OR

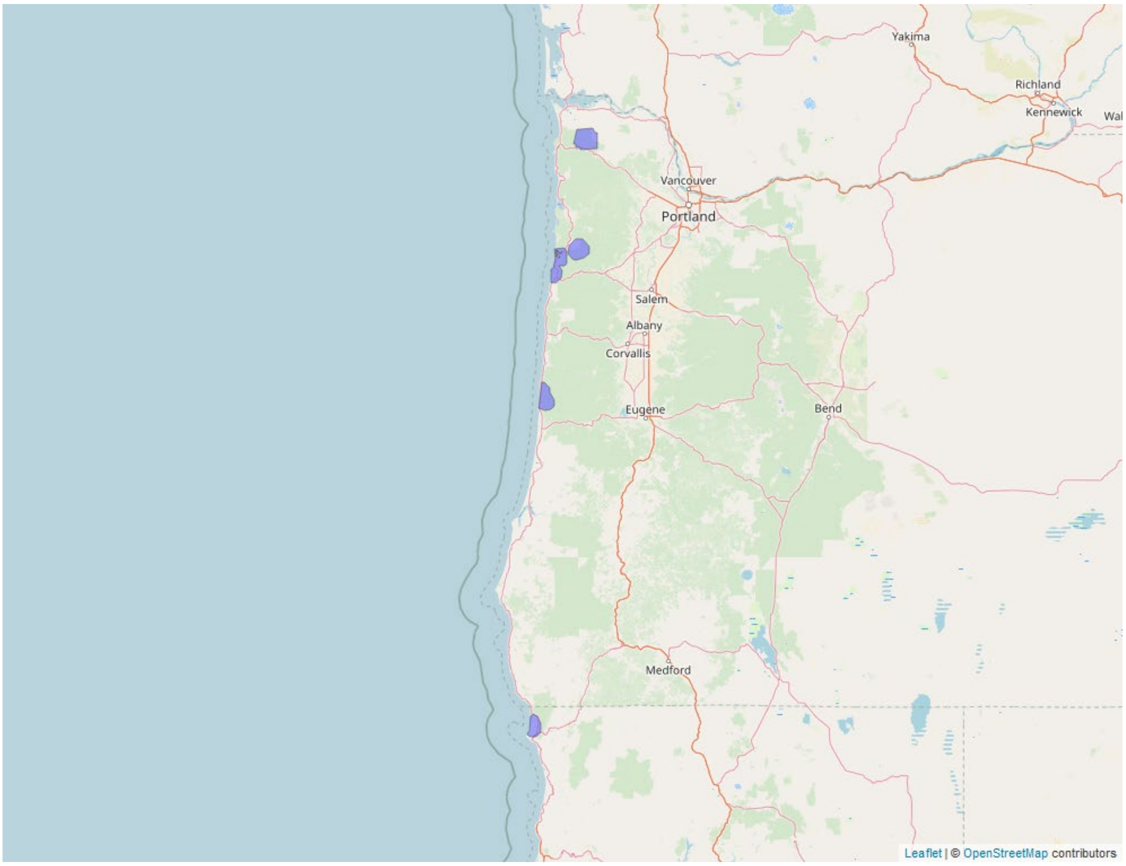

Figure 12. Range map of Oregon silverspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6930.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: Uplist to Endangered

Date of most recently completed 5-Year Review: 11/23/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Oregon silverspot butterflies inhabit three types of early successional grassland habitats near the coast of Oregon and northern California. One habitat type consists of marine terrace and coastal headland "salt spray" meadows as exhibited at Cascade Head, Bray Point, Rock Creek-Big Creek, Nestucca Bay National Wildlife Refuge, and portions of the Del Norte site. The second consists of stabilized dunes as found at the Long Beach Peninsula, Clatsop Plains, and the remainder of the Del Norte site. Both habitats are strongly influenced by proximity to the ocean, with mild temperatures, high rainfall, and persistent fog. The third habitat type consists of montane grasslands found on Mount Hebo and Saddle Mountain. Conditions at these sites include colder temperatures, frequent orographic cloud cover, significant snow accumulations, less coastal fog, and no salt spray. Each of these habitat types must provide two essential resources — caterpillar host plants and adult nectar sources — as well as other suitable environmental conditions. Stands of early blue violets (*Viola adunca*), the caterpillar host plant, sufficient to provide enough food for Oregon silverspot butterfly caterpillars occur only in relatively open and low growing grasslands (USFWS 2012).

Currently, just five wild populations are known to be extant, located at Rock Creek-Big Creek, Bray Point, Cascade Head and Mount Hebo, Oregon; and Del Norte County, California. As of the 2020 5-Year Review (USFWS 2020), the Mount Hebo and Lake Earl populations have declined and are no longer considered stable or self-sustaining, as previously described in the 2012 5-Year Review (USFWS 2012). Recovery efforts have included captive-rearing and the establishment or augmentation of existing populations with captive-reared individuals. Two non-essential experimental populations were established at Saddle Mountain State Natural Area and Nestucca Bay National Wildlife Refuge in Oregon (under one non-essential experimental population designation, EXPN Entity ID: 11398). These populations had 41 and 17 individuals in the population index count in 2019, respectively. The most abundant population by far is a wild population that occurs on Mount Hebo in Siuslaw National Forest in Oregon, with a population index count of 1,171 in 2019, while other population counts ranged from 1 to 151 (USFWS 2020).

Central to the life cycle of the Oregon silverspot butterfly is the abundance of the caterpillar host plant, the early blue violet (USFWS 2020). Field studies have demonstrated that female butterflies select areas with high violet densities for egg-laying. Based on laboratory studies, 200-300 violets leaves are needed to allow an Oregon silverspot butterfly to develop from caterpillar to pupae. In the wild, a caterpillar will require a clump of approximately 16 violet plants for development, assuming each violet could provide about 12 to 20 leaves. Based on studies of other butterflies, nectar abundance and quality are also important to adult survival and particularly fecundity (USFWS 2012). Plants that provide nectar to adult butterflies include yarrow (*Achillea millefolium*), pearly everlasting (*Anaphalis margaritacea*), Pacific aster (*Aster chilensis*), Canada goldenrod (*Solidago canadensis*), tansy ragwort (*Senecio jacobaeae*) and edible thistle (*Cirsium edule*).

The combined threats of isolated and small populations, lack of population stability, limited availability of suitable habitat (especially lack of high-density concentrations of the larval host plant), habitat degradation from succession and invasive plants, and vulnerability to extreme weather events (e.g., drought, sea-level rise, other climate change effects) continue to endanger the species throughout its range. Genetic diversity that may previously have resided within various populations of the subspecies has likely been reduced by significant population declines as well as the necessity of augmenting populations throughout the range with individuals captured at the one large population at Mount Hebo (USFWS 2020). The Rock Creek and Lake Earl populations may still contain a limited reservoir of genetic variability, but these populations are extremely small, thus the likelihood that they may still preserve unique genes is greatly reduced.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 1.2% of the species range overlaps with areas that are likely to be exposed to methomyl in the action area (Table 21). Less than 0.1% of the species' range overlaps with methomyl use sites while up to 1.2% of the range occurs off-field but may still be exposed to spray drift or runoff.

Usage

Past usage data indicate that up to 0.6% of the species range will likely be treated with methomyl annually (Table 21).

Table 21. Overlap and usage data for the Oregon silverspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	0.1	0.1	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn[19]	0	0.3	0.3	0	0	0
Cotton	0	0	0	0	0	0

[19] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Grains	0	<0.1	<0.1	0	0	0
Other Orchards	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Row Crops	0	<0.1	<0.1	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0	0.4	0.4	0	0.4	0.4
Wheat	0	0	0	0	0	0
Total	**<0.1**	**1.2**	**1.2**	**<0.1**	**0.6**	**0.6**

Additional Exposure Considerations

The Oregon silverspot deposits eggs during late August-September, which hatch approximately 16 days after deposition. Newly hatched larvae wander a short distance to find shelter where they suspend growth during their overwintering period. In late spring and early summer, the larvae emerge, feed, and grow for two months before pupation in the summer. Adult emergence starts in July and extends into September. Mating usually takes place in relatively sheltered areas. Adults will often move long distances for nectar or to escape windy and foggy conditions (Recovery Plan 2001). The height of feeding and reproductive activities for this butterfly is from May through September, indicating that individuals are vulnerable to methomyl exposure throughout their lifecycle as we expect most methomyl applications will coincide with these active periods. The low level of past usage data reported above is further corroborated by data from the USDA’s Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species’ range occurs, with only 0.16% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. Past usage data indicate only a small portion of the range is likely to be treated with methomyl. This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows little insecticide usage within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Oregon silverspot butterfly has a low exposure ranking. Only a small portion of the species' range overlaps with the action area (1.2%) and past usage data indicates very little of the range has been treated in the past (up to 0.6% annually). Thus, we cannot discount exposure from occurring in the future, particularly as the timing of methomyl applications typically coincide with periods of high larval and adult activity. As such, we anticipate a small number of individuals are likely to experience exposure. We expect any individuals that are exposed to methomyl are likely to die as available toxicity data indicates that insects are highly sensitive to methomyl. However, we anticipate exposure will be a rare occurrence given the low overlap and low usage within the species' range. As such, we anticipate a small number of individuals in a small portion of the range are likely to experience adverse effects from the proposed action.

Conclusion

Considering information about the species status, we have determined that the species has a high vulnerability. The Oregon silverspot butterfly is listed as threatened, but it was recommended for reclassification as endangered in the most recent 5-year species status review (in 2020). There are currently just seven known extant populations, with two no longer considered stable or self-sustaining due to declines. Two of the populations are experimental populations established from captive-reared individuals on conservation lands where methomyl use is not anticipated. The largest wild population occurs on National Forest lands where exposure to methomyl is not expected to occur. Threats to the species include isolated and small populations, lack of population stability, limited availability of suitable habitat, habitat degradation from succession and invasive plants, and vulnerability to extreme weather events (e.g., drought, sea-level rise, other climate change effects). Pesticides are not a known threat to the species.

Methomyl use sites overlap with a small portion, 1.2%, of the Oregon silverspot butterfly's range. Pesticide usage data indicates low methomyl usage in the range annually (in 0.6% of the range), indicating a low level of methomyl exposure. As such, we anticipate a very small number of individuals are likely to experience exposure in a small portion of the species range from the proposed action.

In summary, minimal exposure to methomyl on field and through spray drift is anticipated to occur. While we anticipate exposure will lead to mortality, impacts are expected to be highly localized and affect a very small number of individuals over the duration of the proposed action. While the species is highly vulnerable, pesticides are not a known threat to the species, and we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Oregon silverspot butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2020. Oregon silverspot butterfly (*Speyeria zerene hippolyta*) 5-Year Review: Summary and Evaluation. Newport, Oregon. 41 pp.

U.S. Fish and Wildlife Service. 2012. Oregon silverspot butterfly (*Speyeria zerene hippolyta*) 5-Year Review: Summary and Evaluation. Newport, Oregon. 40 pp.

Integration and Synthesis Summary: Kern primrose sphinx moth

Scientific Name:	Common Name:	Entity ID:
Euproserpinus euterpe	Kern primrose sphinx moth	433

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is estimated to be high, we anticipate low past usage of methomyl on use sites within the species' range (Figure 13). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Kern primrose sphinx moth. We discuss our rationale for the species in the sections below.

Species range

Last updated: 9/7/2021; Wherever found; *States within the range:* CA

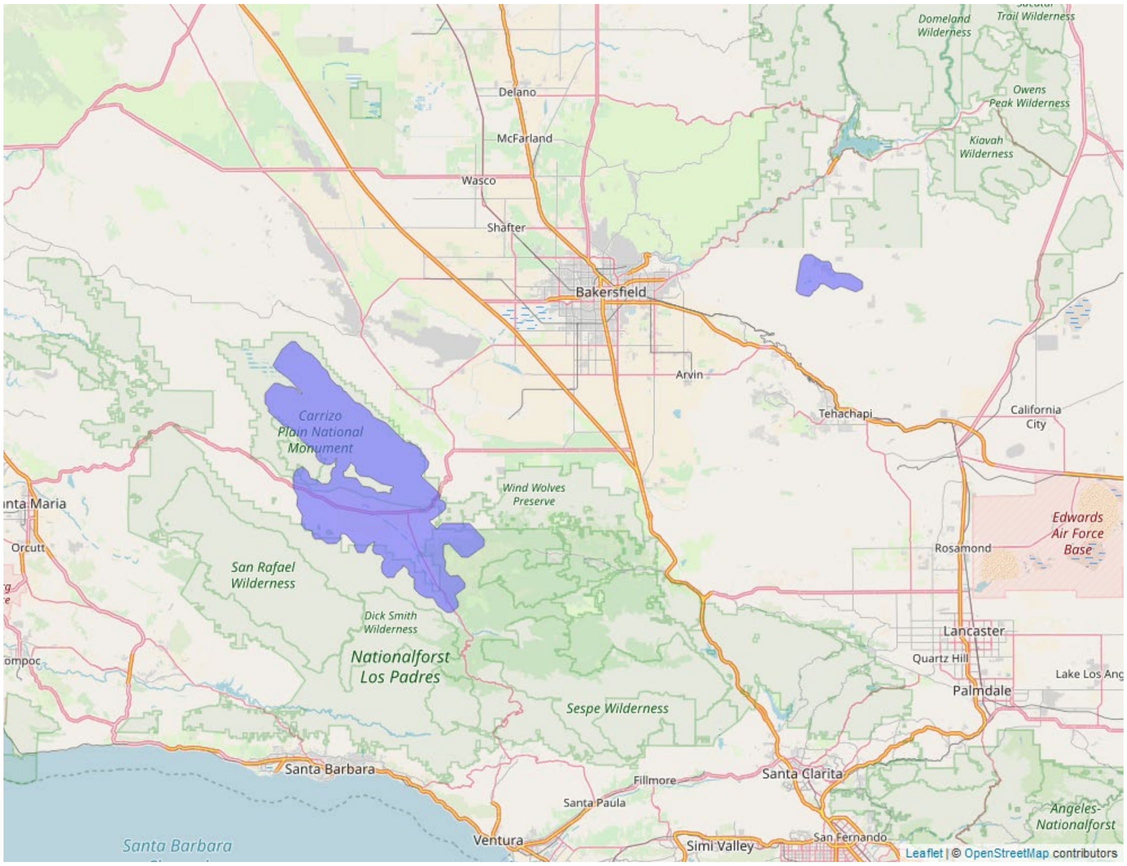

Figure 13. Range map of Kern primrose sphinx moth (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7881.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 7/20/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Kern primrose sphinx is a moderately sized moth and a member of the family Sphingidae, commonly called hawk moths or sphinx moths. Flight periods for the adults range from late February to early April; however, pupae are known to diapause (a period of suspended development) underground for multiple years during drought periods. Larvae are capable of short forays in search of their essential host plant, *Camissonia* sp. (certain primrose and sun cup species).

When the Kern primrose sphinx moth was listed in 1980, the only known locations of the species occurred in Kern County, California. Since then, six populations have been identified in San Luis Obispo County (Carrizo Plain National Monument) and five in Santa Barbara and Ventura Counties (Cuyama Valley). In 2015, two new occurrence locations were found within the Carrizo Plain population and the latest survey completed in 2019 found an overall average flight season with moths continuing to be observed in all known locations.

The Kern primrose sphinx moth is a species confronted with a high degree of threats, primarily from habitat loss due to grazing, disking, herbicide and pesticide use, and development; collection of individuals, and non-native plants. New threats identified in the 2020 5-Year Review include succession of alluvial fans, roadkill of basking moths, trampling from grazing, and off-road vehicle use. Many known populations of Kern primrose sphinx moth are not adequately protected, mainly because the majority of populations at the Carrizo Plain, at the Cuyama Valley, and at Walker Basin exist on private lands. The Kern primrose sphinx moth population at Walker Basin is threatened by residential development, vehicular strikes of basking adult Kern primrose sphinx moths, and agricultural disking practices. The Kern primrose sphinx moth populations at the Carrizo Plain are threatened by habitat degradation due to sheep grazing and by off-road vehicle use. The Kern primrose sphinx moth populations in the Cuyama Valley are threatened by habitat degradation due to agricultural use, sheep penning, road maintenance, and off-road vehicle traffic. Agricultural practices in the Central Valley include spreading pesticides and herbicides annually, which can be spread beyond the target area by prevailing winds and have been implicated in affecting animals many miles downwind of applications. For example, in New Mexico, pesticide intended to eliminate grasshoppers was inadvertently oversprayed onto a population of *Euproserpinus weisti* owing to wind gusts, which subsequently killed nearly the entire sphinx moth population. All Kern primrose sphinx moth populations are potentially at risk from this effect.

The Kern primrose sphinx moth is considered to have a high potential for recovery because there exists suitable habitat on public lands at the Carrizo Plain and Cuyama Valley that have yet to be subjected to a concentrated survey and may reveal new populations of the Kern primrose sphinx moth. Also, owing to the capability of Kern primrose sphinx moth pupae to diapause for several years, this animal has a chance for continued survival under adverse conditions. However, despite the discovery of new populations and suitable habitat, the existing threats listed above and the fact that the majority of the Kern primrose sphinx moth populations exist on private land seriously complicate the recovery of the Kern primrose sphinx moth (USFWS 2007, 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 24% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 22). Up to 9.2% of the species' range overlaps with methomyl use sites while 15% of the range occurs off-field but may still be exposed to spray drift or runoff. Vegetables and ground fruit and other grains are the methomyl use sites with the greatest overlaps with the species' range with 8% and 7% overlap, respectively. However, overlap with other use sites may also contribute to the overall exposure of the species.

Table 22. Overlap data for the Kern primrose sphinx moth. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	1.8	3.1	4.8
Citrus	0.5	0.5	0.9
Corn[20]	0.2	1.0	1.2
Cotton	0.5	1.5	2.1
Other Grains	1.4	5.6	7.0
Other Orchards[21]	1.0	1.1	2.0
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	4.8	3.3	8.0
Wheat	NA	NA	NA
Total	**9.2**	**15**	**24**

[20] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[21] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 7.1% (Table 23). Within the species' range, up to 5.7% of the range has been treated with any insecticide annually, and 0.6% of the range has been treated with methomyl during that time period. Based on this reporting data, we expect methomyl exposure to be limited to a small portion of the species' range.

Table 23. Annual percent of Kern primrose sphinx moth's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
7.1	5.7	0.6

Additional exposure considerations

The Kern primrose sphinx moth deposit eggs on the underside of the evening primrose and filaree leaves. Eggs will hatch after eleven days and there are five larval instars before pupation occurs in May. Larvae feed on sun cup or evening primrose (*Camissonia contorta*). The adults may emerge the following year or may remain in the pupal stage for an undetermined number of years during dry periods (USFWS 1984). It is not known how long pupae can survive. The flight period is from late February to early April with the peak period during mid-March. Because the height of feeding and reproductive activities for this moth occurs from February through April and May, it may be more vulnerable to the effects of methomyl during the larval and adult stages if applications are made during this time.

Adult Kern primrose sphinx moths will travel through agricultural fields (Timothy Ludwick, pers. comm. USFWS species co-occurrence Ask to Field 2016). Therefore, adults may be more likely to be exposed to methomyl than larvae in these areas.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 3.66% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

While there is a large portion of the species' range overlapping with methomyl use sites and adjacent areas likely to experience exposure through off-site transport, mandatory pesticide usage reporting data from the state of California indicates that very little of the species' range has been treated, annually, with insecticides. Furthermore, state data shows only a very small portion of the species' range has been treated annually with methomyl. This low level of past usage is corroborated by data from the USDA Census of Agriculture, which shows very little insecticide usage within the species' range. As such, we determined that the species has a low exposure ranking and anticipate only a small number of individuals are likely to experience exposure.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

We determined that the Kern primrose sphinx moth has a low exposure ranking as pesticide usage data from the state of California indicate that only a small portion of the range has been treated with any insecticides in the past. Furthermore, state data shows that only a very small portion of the species' range has been treated with methomyl in the past, indicating that only a small number of individuals are likely to experience any exposure to methomyl. While the species has a high toxicity ranking, indicating that any individuals exposed to methomyl will likely die, we anticipate only a small number of individuals will die given the low extent of past methomyl usage within the range. As such, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Kern primrose sphynx moth is listed as threatened and is a narrow endemic that, at the time of listing, was only known to exist in Kern County, California. Since then, six populations were identified in San Luis Obispo County (Carrizo Plain National Monument) and five in Santa Barbara and Ventura Counties (Cuyama Valley). The latest survey completed in 2019 observed moths in all known locations (USFWS 2020). However, many known populations of Kern primrose sphinx moth are not adequately protected, mainly because the majority of populations at the Carrizo Plain, the Cuyama Valley, and Walker Basin exist on private lands. The Kern primrose sphinx moth is also confronted with a high degree of threats, primarily from habitat loss due to grazing, disking, herbicide and pesticide use, and development, collection of individuals, and non-native plants.

While 24% of the range overlaps with the action area and has the potential for methomyl use, mandatory pesticide usage reporting data from the state of California indicates 0.6% of the species' range has been treated with methomyl in recent years, indicating a very low likelihood of individuals experiencing methomyl exposure.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Kern's primrose sphynx moth.

References

U.S. Fish and Wildlife Service. 2020. Kern primrose sphinx moth (*Euproserpinus euterpe*) 5-Year Review: Summary and Evaluation. Sacramento, California. 21 pp.

U.S. Fish and Wildlife Service. 2007. Kern primrose sphinx moth (*Euproserpinus euterpe*) 5-Year Review: Summary and Evaluation. Sacramento, California. 21 pp.

U.S. Fish and Wildlife Service. 1984. Recovery Plan Kern primrose sphinx moth. Portland, Oregon. 48 pp.

Integration and Synthesis Summary: Delta green ground beetle

Scientific Name:	Common Name:	Entity ID:
Elaphrus viridis	Delta green ground beetle	435

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is estimated to be high, we anticipate low usage of methomyl on use sites within the species' range (Figure 14). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Delta green ground beetle. We discuss our rationale for the species in the sections below.

Species range

Last updated: 6/7/2022; Wherever found; *States within the range:* CA

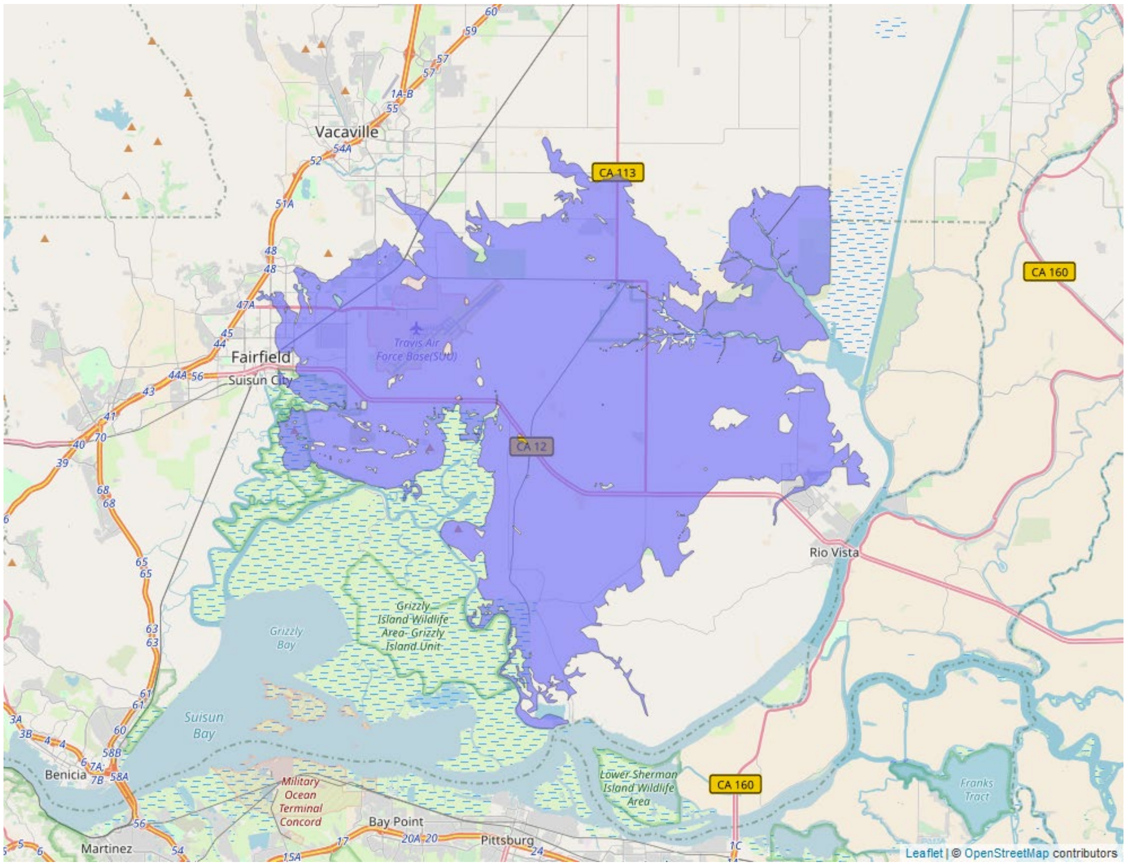

Figure 14. Range map of Delta green ground beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2319.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 3/23/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The delta green ground beetle is a member of the ground beetle family (Carabidae) in the order Coleoptera. The beetle was known only from a single museum specimen until the species was "incidentally rediscovered" in 1974 at the Jepson Prairie in Solano County, California.

The delta green ground beetle is about 0.25 inch long and is a brilliant metallic green and bronze color. Much about its life cycle and habitat affinities remain unknown, but experts hypothesize that adults undergo a period of dormancy or delayed development called diapause until the early winter when they emerge and females lay their eggs. Individuals again disappear from view until active adults reappear the following winter. Experts also believe that as vernal pool habitats become dry, the beetle larvae crawl into cracks in the soil, and survive the hot, dry summer and fall as diapausing pupae. The beetle is typically found along the margins of vernal pools, particularly large pools known as playa pools, where individuals often hide in cracks in the mud and under low-growing vegetation, and in bare areas scattered throughout the Jepson Prairie grassland exposing themselves to the sun. Based on observations of beetles in the field, researchers believe that delta green ground beetles are predators that feed on many kinds of prey. The most important food source is believed to be springtails. The delta green ground beetle has also been observed eating larvae and adult midges, as well as beetle larvae of other undetermined species.

Currently, there are seven occurrences of delta green ground beetle, six that are presumed extant and one that is extirpated. In addition to these records, there are additional occurrences documented in the literature. Although these additional records provide insight on the distribution of the species within its range, it does not expand the species' known range. Monitoring continues to occur in portions of the species range; however, past, and current surveys do not provide adequate information to reveal trends in the distribution of the beetle.

Since the delta green ground beetle was listed as threatened in 1980, the greatest change that has occurred is the acquisition of key property around the Jepson Prairie Preserve, which holds significant vernal pool and upland habitat for the beetle and for many other listed species. Unfortunately, the population sizes and trends of delta green ground beetle populations are not currently known, owing to the difficulty in visually locating these beetles during surveys and the lack of continuous and consistent monitoring.

Currently, about 11,047 acres of delta green ground beetle habitat are protected, or about 54% of the suitable habitat known to be available. Not only has a substantial portion of the Wilcox Ranch, which is inhabited by populations of the delta green ground beetle, been secured, but several conservation banks for mitigation involving vernal pool species are available. However, these new acquisitions need to be considered in light of two factors. First, these acquisitions were the result of the loss or degradation of vernal pool habitat at some other location, some of which may have contained suitable delta green ground beetle habitat and may not always amount to a net increase in protected habitat for this species. Second, there are still large parcels of private land that may have suitable habitat for the delta green ground beetle or have recorded occurrences of the species but remain unprotected. The implementation of adaptive habitat management, restoration, and monitoring of preserved lands is important for the delta green ground beetle. One of the most important aspects of habitat management now is the control of invasive plants, particularly in that they adversely affect the feeding regime of the beetle. There is a draft management plan that incorporates adaptive strategies to maintain and restore the Jepson Prairie Preserve, including the Wilcox Ranch. All of the local conservation banks are required to have USFWS approved management plans before they can sell credits.

At this time, the most serious threat to the delta green ground beetle is habitat degradation caused by the rapid dispersal and overgrowth of invasive plants, as well as the build-up of thatch, which interferes with the beetle's feeding regime. Another significant threat to the beetle is the continued encroachment of development projects that impact its habitat, such as: (1) maintenance activities for facilities such as electrical transmission lines located on or crossing suitable beetle habitat; (2) urban and commercial developments, including the proposed Travis Air Force Base runway expansion and the ongoing Highway 12 expansion; and (3) the possible expansion of exploratory drilling for natural gas into the Jepson Prairie Preserve. Additionally, application of wastewater sludge and global climate change threaten the delta green ground beetle. The effects of the threat from wastewater sludge and climate change are not as immediate (USFWS 2009, 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 100% of the species range will overlap with methomyl use sites or is likely to be exposed by off-site transport within the action area (Table 24). Data indicate 47.2% of the species' range overlaps with methomyl use sites while 68.3% of the range occurs off-field but may still be exposed to spray drift or runoff. Alfalfa, corn, other orchards, and vegetables and ground fruit use sites are the most prevalent within the species' range, with 30.7%, 14.3%, 15%, and 13.2% overlap, respectively. However, overlap with other use sites may also contribute to the overall exposure of the species.

Table 24. Overlap data for the Delta green ground beetle. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	14.2	16.5	30.7
Citrus	<0.1	<0.1	<0.1

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Corn[22]	7.1	7.1	14.3
Cotton	<0.1	0.1	0.1
Other Grains	14.4	21.9	36.2
Other Orchards[23]	4.3	10.7	15
Other Row Crops	2.5	3.5	6
Soybeans	0	0	0
Vegetables and Ground Fruit	4.7	8.5	13.2
Wheat	NA	NA	NA
Total[24]	**47.2**	**68.3**	**100**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 17.4% (Table 25). Within the range of the species, up to 6.5% of the range has been treated with any insecticide annually, and up to 1.1% of the range has been treated with methomyl annually. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

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[22] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

[23] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[24] Total overlap is capped at 100%.

Table 25. Annual percent of the Delta green ground beetle range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
17.4	6.5	1.1

Additional exposure considerations
The delta green ground beetle lives in vernal pool systems and surrounding grassland (from water's edge with sightings hundreds of meters from shoreline during wet season). The Delta green ground beetle prefers more open habitats in the grassland-playa pool matrix where the beetle is found, such as edges of pools, trails, roads, and ditches. Adults may also occur in the surrounding grasslands (USFWS 2015). Currently, these beetles are found only in the greater Jepson Prairie area in south-central Solano County, California (USFWS 2005). It is not known to occur in agricultural areas (No name. pers. comm. USFWS species co-occurrence Ask to Field 2016). As such, we only consider off-site overlap in our analyses.

Exposure Summary

While there is a large extent of overlap between the action area and species' range, mandatory pesticide usage reporting data collected by the state of California indicates only a small portion of the species' range has been treated with any insecticides from 2012-2021. In that same time period, only a very small portion of the species range (up to 1.1% annually) has been treated with methomyl. Based on this reporting data, we determined that the overall exposure ranking for the Delta green ground beetle is low. As such, we anticipate only a small number of individuals are likely to experience exposure to methomyl.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We expect that exposure to methomyl will result in adverse effects to springtails (mentioned above as one of the main food sources of the delta green ground beetle) as well as any other aquatic or terrestrial invertebrates that may be a food source for this beetle.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

While there is a high extent of overlap between the action area and the species' range, mandatory pesticide usage reporting data in the state of California indicates that a smaller portion of the species' range has been treated with insecticides in recent years (2012-2021). Furthermore, only a very small portion of the species' range has been treated with methomyl in that same time period (up to 1.1% annually). As such, we anticipate only a small number of individuals are likely to experience exposure. The delta green ground beetle has a high toxicity ranking as we anticipate individuals exposed to methomyl are likely to die. Additionally, we anticipate that there will be decreases in the availability of insect prey for individuals to use as food resources. However, given the very low level of methomyl usage in the species' range that has been reported by the state of California, we anticipate a low level of adverse effects that will affect, at most, only a small number of individuals. As such, we determine the overall risk of adverse effects to the species is low.

Conclusion

The delta green ground beetle is listed as threatened and is a narrow endemic found only in the Jepson Prairie area of Solano County, California. Key properties around the Jepson Prairie Preserve have been acquired and protected, which holds significant vernal pool and upland habitat for the beetle and for many other listed species. Currently, there are seven occurrences of delta green ground beetle, six that are presumed extant and one that is extirpated. Past and current surveys do not provide adequate information to reveal trends in the distribution of the beetle.

Currently, about 54% of the suitable habitat known to be available is protected. Not only has a substantial portion of the Wilcox Ranch, which is inhabited by populations of the beetle, been secured, but several conservation banks for mitigation involving vernal pool species are available. While 100% of the range overlaps with the action area and has the potential for methomyl use, the species is not known to occupy or use agricultural areas, thus exposure is expected only through spray drift, that overlaps with 68% of the range. Importantly, mandatory pesticide usage reporting data from the state of California indicates only a very small portion, up to 1.1%, of the species' range has been treated with methomyl annually, indicating a very low extent of methomyl exposure.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the delta green ground beetle.

References

U.S. Fish and Wildlife Service. 2021. Delta green ground beetle (*Elaphrus viridis*) 5-Year Review: Summary and Evaluation. Sacramento, California. 9 pp.

U.S. Fish and Wildlife Service. 2009. Delta green ground beetle (*Elaphrus viridis*) 5-Year Review: Summary and Evaluation. Sacramento, California. 29 pp.

Integration and Synthesis Summary: Valley elderberry longhorn beetle

Scientific Name:	Common Name:	Entity ID:
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	436

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a high overlap of the action area with the species' range and low past usage of methomyl within the species' range (Figure 15). However, given the high extent of insecticide usage reported within the species' range, we determined that the species has a medium exposure ranking. Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. As toxicity is high and exposure is anticipated to be medium, we determined the risk of adverse effects to the species is medium. As such, we expected a moderate number of individuals were likely to die from exposure to methomyl over the project duration.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the valley elderberry longhorn beetle to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the valley elderberry longhorn beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Last updated: 11/12/2021; Wherever found; *States within the range:* CA

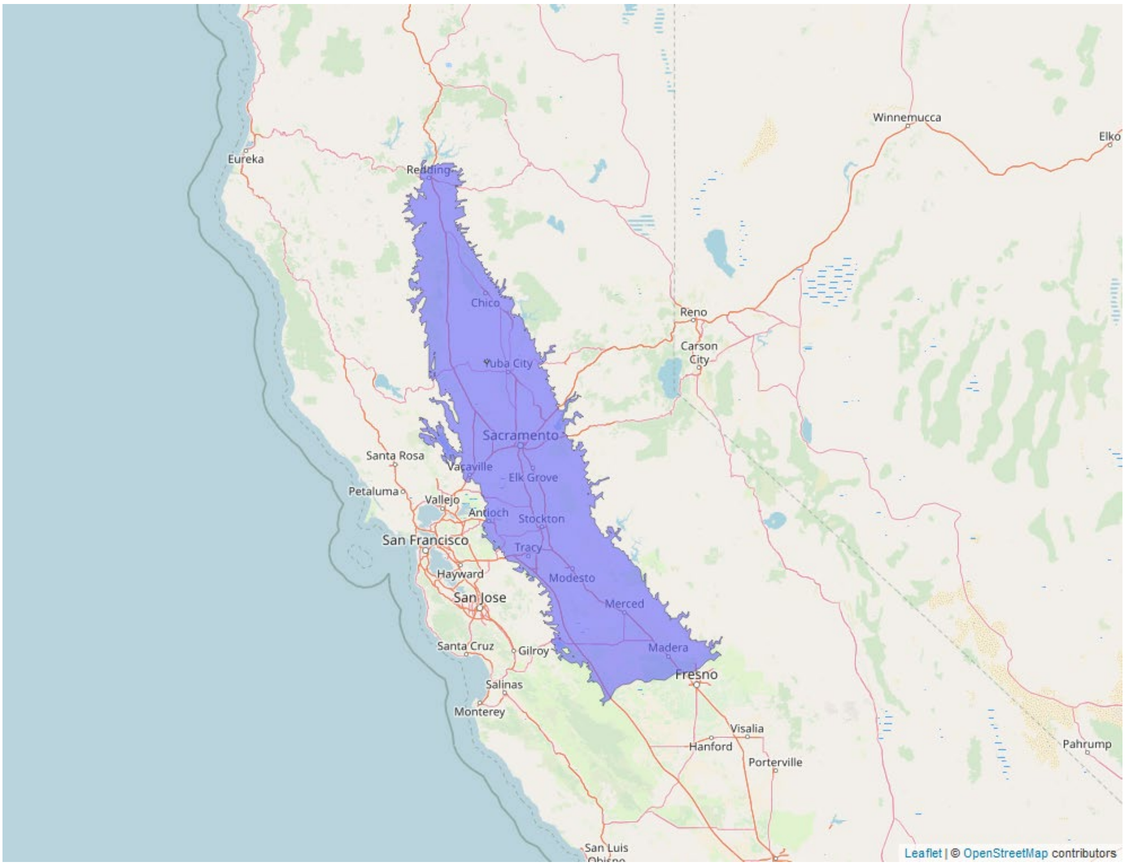

Figure 15. Range map of valley elderberry longhorn beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7850.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/17/2014

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (numerous)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The valley elderberry longhorn beetle is endemic to the Central Valley of California. The valley elderberry longhorn beetle feeds exclusively on the elderberry shrub (*Sambucus* spp.) throughout all stages of its life. Adults feed on the leaves, flowers, and nectar of the host plant. The shrub blooms from March through early June. Females lay eggs singly on elderberry leaves and at the junction of leaf stalks and main stems, with all eggs laid on new growth at the outer tips of elderberry branches. After hatching, the larva creates a feeding gallery (set of tunnels) in the pith at the stem center. While only one larva is found in each feeding gallery, multiple larvae can occur in one stem if the stem is long enough to accommodate multiple galleries. Adult beetles emerge from the pith just as the shrub begins to bloom. Because elderberry is the host plant for the beetle, environmental and habitat conditions that favor a robust elderberry community also benefit the beetle. Elderberry is an important component of riparian ecosystems in California. Occupancy of elderberry by the valley elderberry longhorn beetle is generally low but tends to be highest in riparian communities.

Abundance data for the species is unknown because finding an adult is rare; most occurrences are based on the presence of exit holes and not actual individuals. There are three Management Units for the species: Putah Creek (31 occurrences), Sacramento River (145 occurrences), and San Joaquin River (44 occurrences). The valley elderberry longhorn beetle is distributed throughout available habitat in a widely dispersed metapopulation. At local scales, the valley elderberry longhorn beetle occupies elderberry plants in clumps at scales that vary with the watershed. Local aggregations generally cover 25-50-m scales along the American River and Putah Creek but are more spread out (200-300 m) along the Cosumnes River. Groups of local aggregations vary as well, but overall separate aggregations occur at scales of 200-800 m along all three river systems. These clumps of local aggregations appear more likely to represent discreet demographic units for the valley elderberry longhorn beetle. Defining the population at landscape scales is more challenging, but the data suggest that the occupancy status of a particular area of suitable habitat (occupied or unoccupied) is spatially correlated across distances of 10-20 kilometers within the same drainage. That is, a patch of habitat is more likely to be occupied if there are other occupied habitats within 10-20 km. At landscape scales of 10 km or less, occupancy appears random.

Threats to the valley elderberry longhorn beetle's host plant due to effects related to levee vegetation management are likely to continue. A levee vegetation strategy defined by California Department of Water Resources for some facilities in the Central Valley may, in the short term, result in fewer impacts to elderberry shrubs found on flood control levees. However, we are uncertain if this strategy will be effective in providing protection to elderberry shrubs found within these areas of the Central Valley. Loss of habitat at locations adjacent to roads, trails, and associated infrastructure remains a threat. Pruning activities, if conducted appropriately, can result in a temporary loss of the host plant of the valley elderberry longhorn beetle and monitoring of these activities is necessary to ensure that elderberry characteristics important to the life history of the beetle are preserved. Invasive non-native plants may be impacting the species through modification or loss of habitat due to competition for space and resources with its host plant, but additional information is needed to evaluate the magnitude of this threat. Climate models developed for evaluating climate change effects in California, including the Central Valley, indicate increased temperatures and significant changes to hydrologic conditions as a result of the effects of climate change. These changes are expected to affect riparian systems and other habitats where the presence of the valley elderberry longhorn beetle has been observed in the Central Valley and will be compounded by water supply needs for urban and agricultural uses. Drought conditions are also likely to become more common in California and will affect the survival of elderberry.

Invasive Argentine ants have been confirmed at several locations occupied by the valley elderberry longhorn beetle. Projections from climate change modeling indicate suitable conditions will occur for Argentine ants to continue to spread in California during the next several decades. Studies show that Argentine ants will attack and consume exposed insect larvae, including valley elderberry longhorn beetle larvae. The predation threat from Argentine ants is likely to increase in the Central Valley as colonies further expand into the species' range unless additional methods of successful control within natural settings become available.

The best available scientific information indicates potential impacts from pesticides to the valley elderberry longhorn beetle and its habitat; however, further studies are needed to characterize the magnitude or impact of pesticides to the species both in localized areas as well as across the species' range. Pesticide use in the Central Valley remains high and could increase due to climate change effects (e.g., warmer temperatures) that may enhance the pathogenicity of crop pests for agricultural fields that are commonly found adjacent to remnant riparian vegetation.

The California Public Resources Code and Lake and Streambed Alteration Program work synergistically with the Endangered Species Act to provide protections to the species and its habitat. Without the protections provided to the valley elderberry longhorn beetle under the Endangered Species Act (that is, if the species was delisted), these State regulatory mechanisms will not provide an additional level of scrutiny in the evaluation of potential effects to the species or to its habitat from future proposed activities. Under the Natural Community Conservation Planning Program, the valley elderberry longhorn beetle receives protections under permitted plans, including obligations to continue to implement the conservation plans in their entirety under the terms of their permits (USFWS 2014, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 100% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 26). Approximately 60.5% of the species' range overlaps with methomyl use sites while 65.3% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 26. Overlap data for the valley elderberry longhorn beetle. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	8.9	13.1	22
Citrus	0.3	0.6	0.9
Corn[25]	6.6	7.7	14.3
Cotton	2	2.3	4.3
Other Grains	6.7	13.7	20.4
Other Orchards[26]	27.3	15.3	42.6
Other Row Crops	2.2	3	5.2
Soybeans	<0.1	<0.1	<0.1
Vegetables and Ground Fruit	6.8	10.1	16.9
Wheat	NA	NA	NA
Total[27]	**60.5**	**65.3**	**100**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 37.2% (Table 27. Up to 27.3% of the range has been treated annually with any insecticide while up to 0.8% of the range has been treated annually with methomyl in that same time period.

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[25] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

[26] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[27] Total overlap is capped at 100%.

Table 27. Annual percent of the valley elderberry longhorn beetle range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
37.2	27.3	0.8

Additional Exposure Considerations

The Valley elderberry longhorn beetle is an herbivorous specialist that feeds almost exclusively on blue elderberry (*Sambucus cerulea*) and requires the riparian moist woodlands in which the plant grows throughout all stages of its life and as such, we do not expect this species to forage on fields. Therefore, we anticipate spray drift into adjacent habitats to be the most likely route of exposure.

Exposure Summary

The valley elderberry longhorn beetle has a high extent of overlap with off-field areas. Mandatory pesticide usage reporting data from the state of California's Department of Pesticide Regulations indicate that very little of the species' range (up to 0.8% annually) has been treated with methomyl in recent years. However, there is high insecticide usage within the range of the species, with up to 27.3% of the range treated in the past. As such, we determine the overall exposure ranking to be medium and anticipate a moderate number of individuals are likely to experience exposure.

Overall Exposure: Medium

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including the blue elderberry on which the valley elderberry longhorn beetle is dependent.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of Action Summary

While there is a large extent of overlap between the action area and the species' range, state mandated pesticide usage reporting data indicate that only a very small portion of the species' range has been treated with methomyl in the past (up to 0.8% annually). However, given the high insecticide usage reported within the range of the species, up to 27.3% of the range, we anticipate a moderate number of individuals are likely to experience exposure. The species has a high toxicity ranking as available data indicate that exposed individuals are likely to die. We anticipate a moderate number of individuals are likely to experience such levels of adverse effects given the medium exposure ranking. As such, we anticipate the overall risk of adverse effects to the species is medium.

Preliminary Conclusion

The valley elderberry longhorn beetle is listed as threatened and is endemic to the Central Valley, California. They are herbivorous and rely on elderberry for breeding and larvae survival. Valley elderberry longhorn beetles occur in a widely dispersed metapopulation, suggesting the species is able to disperse distances of 10 or more kilometers. The species is threatened primarily by effects to their host plants through levee vegetation management and riparian vegetation removal for development, but pesticides in general are listed as a threat. Magnitude and specific impacts of pesticides on the species are not documented. They are also threatened by invasive Argentine ants, which have expanded into the species' range recently.

Potential methomyl use sites overlap with the entire species' range, indicating a high potential for exposure. Mandatory pesticide usage reporting data from the state of California shows lower insecticide usage overall (27.3%) and low methomyl usage (0.8%). As pest pressures change over time, methomyl usage may increase in the species' range (up to 100%), indicating a medium likelihood of individuals experiencing methomyl exposure. As such, we anticipated a moderate number of individuals were likely to experience exposure and die from the proposed action.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the valley elderberry longhorn beetle:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for valley elderberry longhorn beetle by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

The PULA for the valley elderberry longhorn beetle will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional *mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.*

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the valley elderberry longhorn beetle in the wild.

References

U.S. Fish and Wildlife Service. 2019. Revised Recovery Plan for Valley Elderberry Longhorn Beetle. Pacific Southwest Region, Sacramento, California. 18 pp.

U.S. Fish and Wildlife Service. 2014. Withdrawal of the Proposed Rule to Remove the Valley Elderberry Longhorn Beetle From the Federal List of Endangered and Threatened Wildlife. Federal Register 79(180):55879-55917.

Integration and Synthesis Summary: Uncompahgre fritillary butterfly

Scientific Name:	Common Name:	Entity ID:
Boloria acrocnema	Uncompahgre fritillary butterfly	437

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is medium. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range and no history of methomyl use within the species' range (Figure 16). Any exposed individuals are likely to die due to the high toxicity of methomyl to insects, but exposure is anticipated to be very low. The risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Uncompahgre fritillary butterfly. We discuss our rationale for this conclusion in the sections below.

Species range

Last updated: 4/9/2021; Wherever found; *States within the range:* CO

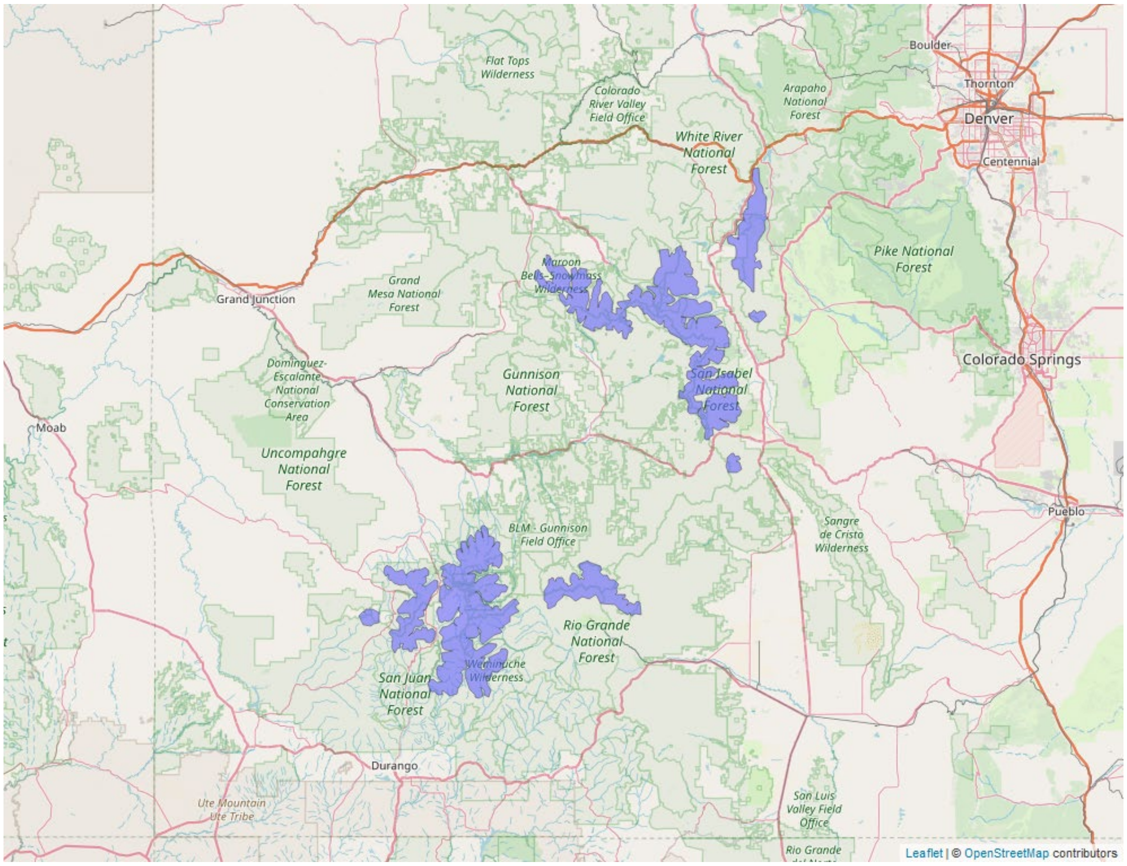

Figure 16. Range map of Uncompahgre fritillary butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4419.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/28/2018

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Increasing population(s)

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Uncompahgre fritillary butterfly is endemic to the San Juan Mountains and southern Sawatch Range in Colorado and exists above treeline patches of its larval host plant, snow willow. This butterfly is most often found on north and east facing slopes, which provide a moist, cool microclimate (USFWS 1994). The species is restricted to elevations of 12,100 to 13,500 feet. Since listing and the completion of the Recovery Plan, the number of confirmed butterfly colonies has increased from two to eleven. Population estimates have increased from about 1,000 to somewhere between 3,400 and 23,000 at three currently monitored colonies (USFWS 2018). Similarly, the other eight qualitatively monitored populations have persisted despite four of the colonies apparently having no butterflies during one or two surveys in different years since 2001.

This butterfly is a specialist and the adult female butterflies lay their eggs individually on snow willow stems and leaves around the middle of July and they do not hatch until numerous weeks later (USFWS 2009). The larvae feed on snow willow leaves throughout their biennial life cycle and overwinter under the snow until they emerge the following spring and molt. Some caterpillars may take two summers to mature, while other slowly developing caterpillars may take up to four years to mature.

The primary threat of collecting appears to have been forestalled by maintenance of collecting closures around the two well-known colonies, regular researcher presence, irregular law enforcement visits, and through prohibition of collection by the Endangered Species Act. The only observable current impacts are caused by relatively minor habitat degradation from hiking trails on the edge of colonies at Mount Uncompahgre and Redcloud Peak and short-term impacts from rapid sheep trailing/grazing through Mount Uncompahgre. Neither of these actions occur at a level to be considered a threat to the species. Climate change has not been an observable threat to either the butterfly or its habitat to date but is a potential future threat that should be monitored. Genetic influences related to population size and isolation are uncertain but are being researched. Although there is fluctuation in the colony population numbers, it does not appear that the butterfly is in danger of extinction. Adequate quality habitat has existed for over 10 years at Mount Uncompahgre and Redcloud Peak producing what appears (non-statistically) to be stable, albeit fluctuating population numbers, and immediate on-the-ground threats have ceased, moderated, or have been determined to have minor impacts (collecting, recreational impacts, and grazing) (USFWS 2018).

In summary, since listing, the only on-the-ground activities that have impacted known Uncompahgre fritillary butterfly colonies are minor habitat modification from hiking and sheep grazing at Mt. Uncompahgre and Redcloud Peak. However, it is not believed that sheep grazing has been, or will be, a threat to the Uncompahgre fritillary butterfly with measures in place to avoid or minimize impact.

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

In total, we expect less than 0.1% overlap between the species' range and methomyl use sites or areas that are likely to be exposed through off-site transport within the action area (Table 28).

Usage

Based on past usage data, we anticipate no methomyl will be used within the species range.

Table 28. Overlap and annual usage data for the Uncompahgre fritillary butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	<0.1	<0.1	<0.1	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn[28]	<0.1	<0.1	<0.1	0	0	0
Cotton	0	0	0	0	0	0
Other Grains	<0.1	<0.1	<0.1	0	0	0
Other Orchards	0	0	0	0	0	0
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0	0	0	0	0	0
Wheat	NA	NA	NA	NA	NA	NA

[28] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Total	**<0.1**	**<0.1**	**<0.1**	**0**	**0**	**0**

Additional exposure considerations

All known populations of the Uncompahgre fritillary butterfly are associated with large patches of snow willow (*Salix reticulata* spp. *nivalis*) above 3,780 m, which provide food and cover. The species has been found only on northeast-facing slopes, which are the coolest and wettest microhabitat available. Because the Uncompahgre fritillary butterfly occurs at such high elevation, it is not known to truly travel through, reproduce, or nectar within agricultural areas, developed areas, or rights of way (no name, pers. comm. USFWS species co-occurrence Ask to Field 2016).

Females lay eggs on snow willow, which is the larval food plant. The species requires two years to complete its life cycle. Eggs laid in 2018 will be caterpillars in 2019 and mature into adults the following even-numbered year (2020). Some caterpillars may take two summers to mature rather than three, and slowly developing caterpillars may take up to four years to mature. The butterflies live as adults for only 1-2 weeks from July into August (NatureServe, 2015). The height of feeding and reproductive activities for this butterfly occurs essentially from March through June.

Exposure Summary

None of the use types within the range of the Uncompahgre fritillary butterfly have much overlap with the species range and with no past methomyl usage within the range, we do not expect exposure to the species. In addition, this butterfly occurs at elevations 3,780 m (12,400 ft.) where we do not expect much methomyl application to occur.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Given the high sensitivity of insects to estimated environmental concentrations of methomyl, we anticipate that any exposure, whether through direct spray application on-field or through spray drift off-field, will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including the snow willow species that this butterfly species is reliant on to provide food and shelter for larvae, or will methomyl impact other vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Uncompahgre fritillary butterfly has a low exposure ranking as only a small portion of the range overlaps with the action area. We do not expect that methomyl usage within the range is likely as there is very little agriculture in the high elevation areas where the range is located. While the toxicity ranking for this species is high, as available data indicate that insects are highly sensitive to methomyl and are likely to die with exposure, we expect this is unlikely to occur given the low overlap and expected usage within the species range. As such, we expect the overall risk of adverse effects to the species is low. As we cannot completely rule out the possibility of exposure given potential changes in pesticide use patterns or the potential for rare vagrants to occur outside their typical habitat, we expect that only a very small number of individuals, at most, are likely to be adversely affected by the proposed action. However, we expect these instances will be rare and infrequent.

Conclusion

The Uncompahgre fritillary butterfly is listed as endangered. It is endemic to high elevations (12,000+ ft) in a few small mountainous areas of Colorado above tree line patches of snow willow. Populations seem to be increasing at several monitored colonies. The species is primarily affected by habitat modification from hiking and sheep grazing on Mount Uncompahgre and Redcloud Peak, but neither is considered a threat. We have determined that the species has medium vulnerability, and it does not appear to be in danger of extinction.

Methomyl use sites overlap with a very small portion, 0.1%, of the Uncompahgre fritillary butterfly's range, indicating a low potential for exposure. In addition, there has been no methomyl use in the range in the past, further indicating a low likelihood of individuals experiencing methomyl exposure. We cannot fully predict future pesticide use so we cannot completely rule out the possibility of exposure given potential changes in pesticide use patterns or the potential for rare vagrants to occur outside their typical habitat. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. We do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Uncompahgre fritillary butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2018. Uncompahgre Fritillary Butterfly (*Boloria acrocnema*) 5-Year Review: Summary and Evaluation. Grand Junction, Colorado. 30 pp.

U.S. Fish and Wildlife Service. 2009. Uncompahgre Fritillary Butterfly (*Boloria acrocnema*) 5-Year Review: Summary and Evaluation. Grand Junction, Colorado. 19 pp.

U.S. Fish and Wildlife Service. 1994. Uncompahgre Fritillary Butterfly Recovery Plan. Denver, Colorado. 20 pp.

Integration and Synthesis Summary: Bay checkerspot butterfly

Scientific Name:	Common Name:	Entity ID:
Euphydryas editha bayensis	Bay checkerspot butterfly	438

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the medium overlap of the action area and low usage within with the species' range (Figure 17). Any exposed individuals are likely to die due to the high toxicity of methomyl to insects, but exposure is anticipated to be very low. The risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Bay checkerspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 6/9/2021; Wherever found; *States within the range:* CA

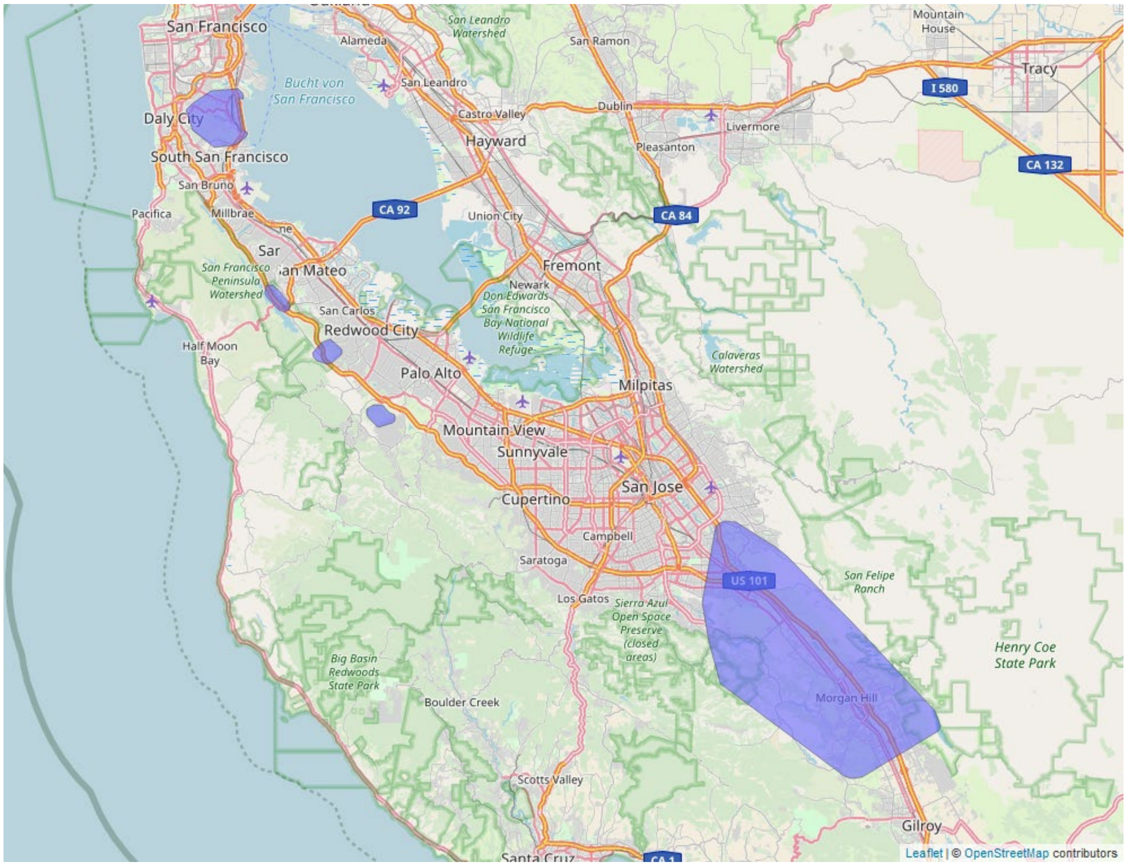

Figure 17. Range map of bay checkerspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2320.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: Uplist to Endangered

Date of most recently completed 5-Year Review: 7/5/2022

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The status of the Bay checkerspot butterfly, which historically occurred in five San Francisco Bay Counties, has declined dramatically since it was listed as threatened in 1987. When the Recovery Plan was finalized in 1998, the butterfly was restricted to San Mateo and Santa Clara Counties, with each county having one core population and a few satellite populations. Since 1998, populations of the butterfly have continued to be lost, including the core population and all satellite populations in San Mateo County. Loss of all populations in Alameda, Contra Costa, and San Mateo Counties, despite most being largely protected from development in City, County, and State Parks, and inclusion of some of the areas within existing or proposed Habitat Conservation Plans, indicates that habitat protection alone is not sufficient to protect the subspecies. The Bay checkerspot butterfly is now restricted to one core population (Coyote Ridge) and a few satellite populations within an approximate 9-mi radius of Coyote Ridge. None of the threats identified in the listing rule or the Recovery Plan have been reduced or eliminated.

The butterfly is still at great risk from invasion of non-native vegetation, exacerbated by nitrogen deposition from air pollution. Despite the use of prescribed burns to control non-native vegetation, wildfires may pose a greater threat now than at the time of listing due to the extremely narrow distribution of the butterfly; a single wildfire across Coyote Ridge could eliminate a large percentage of the remaining individuals. Given the butterfly's much reduced distribution and a life history closely tied to timing of annual rainfall, the butterfly may not be capable of withstanding natural fluctuations in annual weather patterns (periodic droughts) let alone larger variations due to climate change. Pesticides in general were noted as a threat in the 1998 Recovery Plan and subsequent 5-Year Reviews. Finally, the majority of habitat in Santa Clara County is in private ownership and ongoing development pressure will result in additional fragmentation, including fragmentation of the only remaining core population (USFWS 2009).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 15.2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 29). Up to 4.2% of the species' range overlaps with methomyl use sites while 10.9% of the range occurs off-field but may still be exposed to spray drift or runoff. Alfalfa, other grains, other orchards, and vegetables and ground fruit use sites are the most prevalent within the species' range, with 2.8%, 4.8%, 3.8%, and 2.9% overlap, respectively. However, overlap with other use sites may also contribute to the overall exposure of the species.

Table 29. Overlap data for the Bay checkerspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0.7	2.1	2.8
Citrus	<0.1	0.5	0.5
Corn[29]	<0.1	0.6	0.6
Cotton	<0.1	0.2	0.2
Other Grains	1.6	3.3	4.8
Other Orchards[30]	0.7	3.1	3.8
Other Row Crops	<0.1	<0.1	<0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	1.2	1.7	2.9
Wheat	NA	NA	NA
Total	**4.2**	**10.9**	**15.2**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 8.2% (Table 30). Up to 5.8% of the range has been treated annually with any insecticide while up to 0.2% of the range has been treated annually with methomyl in that same time period. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

[29]We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

[30]We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Table 30. Annual percent of the Bay checkerspot butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
8.2	5.8	0.2

Additional exposure considerations

The bay checkerspot butterfly is exclusively a serpentine grassland species. While the adults may travel through/over other areas (including developed areas, orchards, field crops, etc.), and the adults will opportunistically feed on most any flowering plant, their predominant land use should be grasslands, including pasture (Mike Thomas, pers. comm. USFWS species co-occurrence Ask to Field 2016).

The primary larval host plant of the bay checkerspot butterfly is the dwarf plantain (*Plantago erecta*), and the secondary larval host plants are the purple owl's clover (*Castilleja densiflora*) and the exserted paintbrush (*Castilleja exserta*); they are considered to be necessary food sources for completion of juvenile development for the species (66 FR 21450; Natureserve 2015).

Eggs hatch into larvae approximately two weeks after they are laid (between March and May); the larvae feed for another 2 weeks until they reach their fourth instar (larval development stage/molt), at which time they are able to enter summer diapause. Larvae break diapause and resume feeding with the onset of the rainy season and host plant germination, generally between November and January. Post-diapause larvae then feed until reaching sufficient mass to pupate. Pupation occurs from late January to early April (USFWS 2009). Therefore, the bay checkerspot butterfly is vulnerable to the effects of methomyl throughout most of its lifecycle, except when entering diapause when the larvae shelter under rocks or in crevices.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 2.88% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

While there is a high extent of overlap between the species' range and the action area (15.2%), state mandated pesticide usage reporting data indicates that smaller portion of the species' range has been treated with any insecticides (up to 5.8% annually) and only a very small portion of the species' range has been treated with methomyl (0.2% annually). This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows very little insecticide usage within the species' range. This low level of usage within the species' range indicates that only a very small number of individuals are likely to experience exposure to methomyl. As such, we determine the overall exposure ranking to be low.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including dwarf plantain (*Plantago erecta*), and the secondary larval host plants, purple owl's clover (*Castilleja densiflora*) and the exserted paintbrush (*Castilleja exserta*) that this butterfly species is reliant on for food and shelter for larvae, or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

While the Bay checkerspot butterfly has a high extent of overlap between methomyl use sites and associated off-site transport areas, we anticipate the overall exposure to the species will be low as state mandated pesticide usage reporting data indicates that only a very small portion of the range has been treated with methomyl (up to 0.2% annually) in recent years (2012-2021). Given the low level of methomyl and general insecticide use within the species' range, we anticipate only a very small number of individuals are likely to be exposed to methomyl. The species has a high toxicity ranking as available data indicate that insects are highly sensitive to methomyl and are likely to die if exposed. However, based on the very small number of individuals anticipated to experience exposure, we expect very few individuals will die. As such, we anticipate the overall risk of adverse effects to the species is low.

Conclusion

Vulnerability and toxicity are high for this species, but we anticipate the overall exposure to the species will be low as state mandated pesticide usage reporting data indicates that only a very small portion of the range has been treated with methomyl (up to 0.2% annually) in recent years (2012-2021).

We anticipate that a small number of individuals will be affected annually over the duration of the proposed action (exposure through agricultural uses and spray drift resulting in the loss of a small number of individuals). Despite the restricted range and declining population estimates we expect species-level effects to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Bay checkerspot butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2009. Bay checkerspot butterfly (*Euphydryas editha bayensis*) 5-Year Review: Summary and Evaluation. Sacramento, California. 41 pp.

Integration and Synthesis Summary: American burying beetle

Scientific Name:	Common Name:	Entity ID:
Nicrophorus americanus	American burying beetle	440

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is high overlap of the action area with the species' range (Figure 18), but low past usage of methomyl within the species' range, indicating a low extent of exposure. Most exposed individuals are likely to die. Given that exposure is low and toxicity is high, we determined the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the American burying beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 4/15/2022; Wherever found, except where listed as an experimental population; *States within the range:* AR, KS, MA, NE, OH, OK, RI, SD, TX

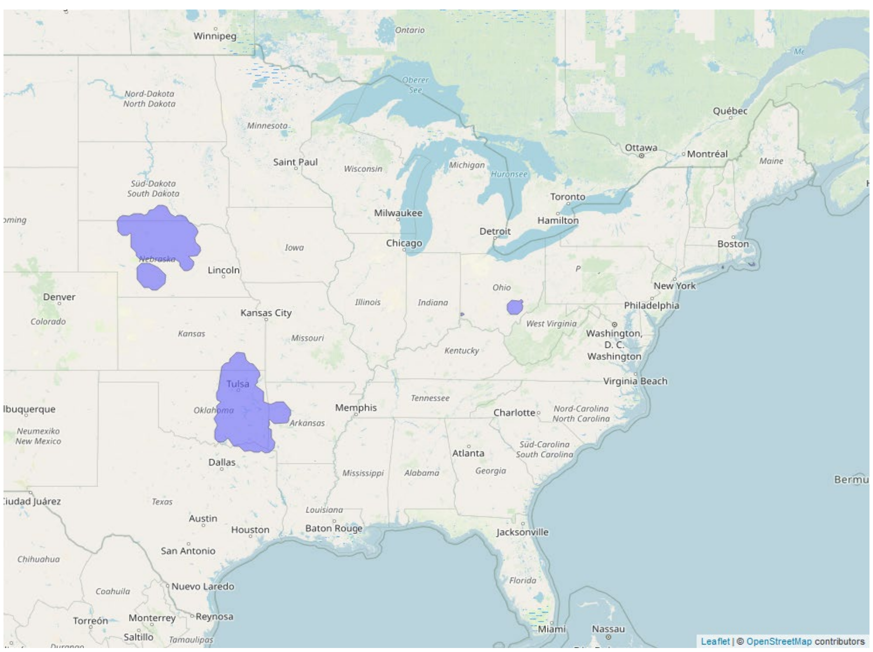

Figure 18. Range map of American burying beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/66.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: Downlist to Threatened

Date of most recently completed 5-Year Review: 10/15/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The American burying beetle is a member of the beetle family Silphidae; these beetles bury vertebrate carcasses for reproductive purposes and exhibit parental care of young. Once widely distributed throughout eastern North America, the American burying beetle has disappeared from most of its historic range. The species is believed to be extirpated from all but nine States in the United States and is likely extirpated from Canada. At the time of listing, only two highly disjunct populations of this formerly widespread species were known to be extant, one on an island in New England and the other in eastern Oklahoma. Based on the last 15 years of surveys, the American burying beetle is known to occur in portions of Arkansas, Kansas, Oklahoma, Nebraska, South Dakota, and Texas; on Block Island off the coast of Rhode Island; and in reintroduced populations on Nantucket Island off the coast of Massachusetts and in southwest Missouri, where a nonessential experimental population was established in 2012 under section 10(j) of the Act (77 FR 16712; EXPN Entity ID 10161).

Reintroduction efforts are also underway in Ohio, but survival of reintroduced American burying beetles into the next year (successful overwintering) has not yet been documented. The species is now known to occur in five of the nine eco-regions where it was once found west of the Mississippi and in one of the seven eco-regions east of the Mississippi; about four eco-regions support American burying beetle populations estimated at >1,000 individuals. Based on extinction modeling, populations of this size have the potential to remain demographically viable over the long-term in the absence of severe catastrophic events or reductions in carrying capacity through reduced carcass availability, habitat loss, or fragmentation.

The American burying beetle are believed to bury themselves under vegetation litter or into soil, during the daytime (USFWS 2020). At night, American burying beetles are active from late spring through early fall, occupy a variety of habitats and bury themselves in the soil to hibernate for the duration of the winter. Reproductive activity usually begins in May to June once ambient nocturnal air temperatures in the general area approach 59°F consistently and American burying beetles cease burying carcasses by mid-August. Immediately upon emergence from their winter hibernation, American burying beetles begin searching for a mate and proper sized carcass for reproduction. Burying beetles are capable of finding a carcass between 1-48 hours following death of prey and at a distance of at least 3.2 km but finding them after 24 hours is more typical. Because carrion is scarce and ephemeral in nature, American burying beetles must traverse large areas in search of it. By necessity, they are strong flyers capable of covering substantial distances overnight. In a Nebraska study, a marked American burying beetle was captured at a distance 6.1 km from its original capture. On average, recaptured marked beetles at Fort Chaffee in 2006 moved an average of 1.29 km per day (USFWS 2008).

Although several American burying beetle populations occur on public lands or private conservation organization properties, most of the protected lands supporting this species require ongoing management to ensure the species' continued presence. Elsewhere in the range (Nebraska, South Dakota, and Kansas), the species occurs almost exclusively on private land. The species thus receives varying levels of habitat protection across its current range. Given the ephemeral availability of carrion for reproduction, it is unlikely that populations isolated by habitat fragmentation will be self-sustaining over the long-term. Habitat fragmentation remains a risk across much of the species' current range, particularly because habitat conservation at the landscape level has not been initiated. In addition, little is known about population size and trends in much of the species' current range, making it difficult to design appropriate conservation strategies.

In addition to ongoing concerns about habitat fragmentation, reductions in carrion availability, and increasing competition for carcasses, newly identified threats of invasive plant (red cedar) and animal (red-imported fire ants) species are growing problems in the portion of the range where all except one of the natural populations occur. Further, effects of disease and climate change on the species have not been ruled out as concerns. These types of factors pose risks irrespective of land conservation measures. Threats to extant populations are a heightened concern because, although husbandry and captive rearing methods for the species are now reasonably well-established, efforts to reintroduce populations through the release of captive-reared or wild translocated beetles have met with mixed results.

Most of the existing American burying beetle range does not experience any widespread pesticide applications. Most of the known occupied habitat on the western portions of the range is grassland or woodland/grassland mix that has grazing or hay production as an agricultural use and pesticides are not routinely or widely used (such as aerial or broadcast spraying) in these types of agriculture. Pesticides are frequently used for row crops that may be within the range, but American burying beetles are rarely found in row crops. Pesticide applications for grasshoppers has been proposed in past years for grassland portions of the range in Nebraska and South Dakota but has rarely been implemented on a large scale. In Nebraska and South Dakota, a large portion of the known American burying beetle distribution overlaps with distributions of economically damaging grasshoppers that are managed using Dimilin® (diflubenzuron), carbaryl, chlorantraniliprole, and Malathion pesticides through the USDA APHIS grasshopper and Mormon cricket suppression program. The use of very low application rates, reduced agent area treatments, and large buffer distances (from 200 ft up to 1 mile depending on the pesticide and the application type) minimizes the amounts of these pesticides should they be used within the range of the American burying beetle from program applications (USFWS 2008, 2019, 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 24.2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 31). Up to 11.2% of the species' range overlaps with methomyl use sites while 13.1% of the range occurs off-field but may still be exposed to spray drift or runoff. Corn and soybean rotation use sites are the predominant methomyl use driving overlap with the species range, with up to 12.7% overlap. However, overlap with other use sites may still contribute to the overall exposure to the species.

Usage

While the action area overlaps with up to 24.2% of the species' range, past usage data indicate that only up to 3% of the species range has been treated with methomyl annually (Table 31). Based on past usage data, methomyl use on vegetables and ground fruit and alfalfa, along with corn and soybeans, may be the most significant uses within the species' range.

Table 31. Overlap and usage data for the American burying beetle. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	1.3	3.4	4.7	0.2	0.5	0.7
Citrus	NA	NA	NA	NA	NA	NA
Corn[31]	7.8	4.9	12.7	0.4	0.2	0.6
Cotton	<0.1	<0.1	0.1	0	0	0
Other Grains	1.4	3.6	5.1	<0.1	0.2	0.3

[31] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Orchards	0.2	0.2	0.4	0.2	0.2	0.4
Other Row Crops	0.1	0.3	0.4	<0.1	0.1	0.2
Soybeans	6.4	4.9	11.2	0.3	0.3	0.6
Vegetables and Ground Fruit	0.3	0.5	0.8	0.3	0.5	0.8
Wheat	NA	NA	NA	NA	NA	NA
Total	**11.2**	**13.1**	**24.2**	**1.1**	**1.9**	**3.0**

Additional Exposure Considerations

The American burying beetle is an opportunistic scavenger that is only active between February and October. They overwinter underground as adults at all other times. Reproduction occurs from late April through mid-August. Block Island populations are reproductively active in June and July, but Oklahoma beetles breed as early as April, or as late as August. Given that we anticipate methomyl applications likely coincide with these periods of activity, we expect individuals are likely to be exposed to methomyl throughout their life cycle.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 4.04% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

While there is a high extent of overlap between the species' range and methomyl use sites and areas likely exposed through off-site transport (24.2% overlap), past usage data indicates only a small portion of the species' range is likely to be treated with methomyl (up to 3% annually). Data from the USDA Census of Agriculture corroborates this low level of usage as only 4.04% of the species range has been treated with any insecticide in recent years. Given the conservative nature of the Census of Agriculture data, we have high confidence that individuals have a low likelihood of exposure to methomyl. As such, we anticipate only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will reduce the availability of vertebrate carcasses that the beetle uses for food and reproduction. As such, we do not expect any adverse indirect effects are likely to occur.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of Action Summary

While there is a high degree of overlap between the action area and the species' range, we anticipate only a small portion of the range is likely to be treated with methomyl as past usage data is low (up to 3% annually). Additional data from USDA's Census of Agriculture corroborates our expectation of low methomyl usage as very little insecticides (not just methomyl) has been reported in the counties where the species' range occurs (up to 4% of the species range). As such, we expect only a small number of individuals will experience exposure throughout the duration of the proposed action. Given that insects are highly sensitive to methomyl at estimated environmental concentrations and are likely to die up to 90 meters from treated fields, we determined the overall toxicity for the species is high. While toxicity is high, we expect the American burying beetle is at low risk of adverse effects from the proposed action as few individuals are likely to experience exposure, indicating that only a small number of individuals will die throughout the duration of the proposed action.

Conclusion

The American burying beetle is listed as threatened. Once widespread, the species has been extirpated from all but nine states in the nation and is likely extirpated from Canada. Only two highly disjunct populations remain, one on an island in New England and the other in eastern Oklahoma. Reintroduction efforts have established a population in Massachusetts and a nonessential experimental population in Missouri; recovery efforts in Ohio remain inconclusive. The species' life history depends on the availability of vertebrate carcasses, which it must search large areas to secure, in order to carry out reproduction. Several populations exist on public or private conservation organization properties, where ongoing management is required to maintain the species. Most populations occur almost exclusively on private lands. Considering information about the species status, specific reproductive requirements, and we have determined that the species has a high vulnerability.

Most of the species' range does not experience widespread pesticide applications. Pesticide use occurs in the species' range for use on row crops, but American burying beetles are rarely found in row crops, therefore we will expect little to no exposure from this scenario. Methomyl use sites overlap with 11.2% of the American burying beetle's range, however, past usage data suggests that only 3% of the species' range has been treated annually. While toxicity remains high, with an expectation that all individuals exposed to methomyl will die, we do not expect a significant number of individuals to be exposed due to low usage rates of methomyl. As such, we anticipate a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the American burying beetle.

References

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Reclassifying the American Burying Beetle From Endangered to Threatened on the Federal List of Endangered and Threatened Wildlife With a 4(d) Rule. Final Rule. Federal Register 85: 65241-65261.

U.S. Fish and Wildlife Service. 2019. Species Status Assessment Report for the American Burying Beetle, *Nicrophorus americanus.* 233 pp.

U.S. Fish and Wildlife Service. 2008. American Burying Beetle (*Nicrophorus americanus*) 5-Year Review: Summary and Evaluation. Concord, New Hampshire. 53 pp.

Integration and Synthesis Summary: Northeastern beach tiger beetle

Scientific Name:	Common Name:	Entity ID:
Habroscelimorpha dorsalis dorsalis	Northeastern beach tiger beetle	442

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is medium overlap and low usage within the species' range (Figure 19), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the northeastern beach tiger beetle. We discuss our rationale for the species in the sections below.

Species range

Last updated: 12/27/2021; Wherever found; *States within the range:* MA, MD, NJ, VA

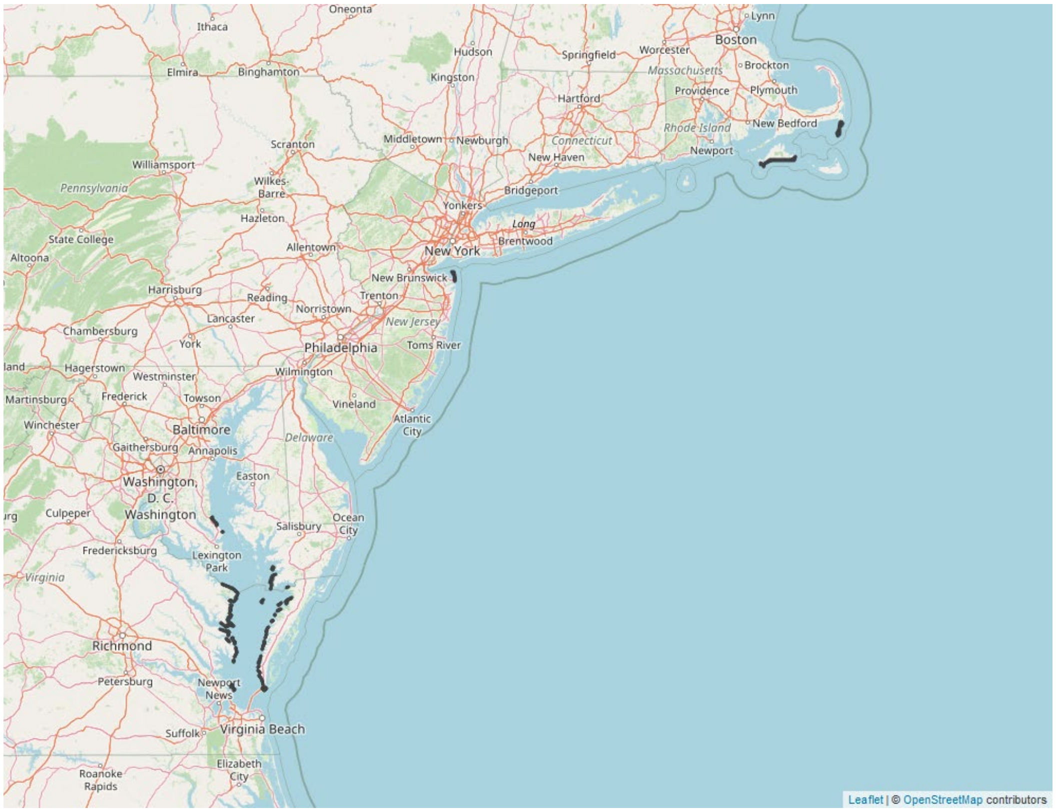

Figure 19. Range map of northeastern beach tiger beetle (black areas). Range map accessed at https://ecos.fws.gov/ecp/species/8105.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/28/2019

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The northeastern beach tiger beetle's historic range was from Massachusetts to Virginia. The species is now extirpated from Rhode Island, Connecticut, New York, and New Jersey and found only in the Chesapeake Bay area of Maryland and Virginia, and on two sites in Massachusetts. The beetle is restricted to sandy beaches in areas subject to stochastic storm events, high shoreline development pressure, and human use. Surveys have documented a decline in beetle numbers on occupied sites over most of the beetle's range. The number of occupied sites, in particular those with greater than 500 adults, have continued to decrease in Maryland and Virginia on the western shoreline of the Chesapeake Bay. The number of occupied sites has remained relatively stable on Virginia's eastern shoreline; however, most sites had declining numbers, and there were fewer sites with very large populations (>1,000 adults). With increasing fragmentation of contiguous areas of occupied habitat, smaller population segments will become increasingly separated by unsuitable habitat, leading to greater isolation, reduced gene flow, and eventual extirpation, as observed in Calvert County, Maryland with just one viable population remaining. Only one of the geographic recovery areas, Tangier Sound, Maryland, meets the recovery criteria. Some occupied sites are permanently protected, owned, and managed by state agencies, federal agencies, or nongovernmental organizations or are protected through conservation easements; however, it is likely difficult for these entities to address offsite impacts such as littoral sand drift and sea level rise.

The primary threat to the northeastern tiger beetle continues to be the loss of suitable beach habitat due to multiple factors, including increasing development and shoreline structures, hurricanes/large storms, and sea level rise. Some sites are impacted by high intensity usage and off-road vehicles on public beaches. There remains little suitable, functionally available habitat within the tiger beetle's Northeast range on the Atlantic Ocean coastline, and observations during surveys and preliminary analysis indicate a decreased amount of suitable habitat across both shorelines of the Chesapeake Bay. The continued increase in threats from human development, the specificity of its habitat requirements, and the length of time spent as larvae occupying the intertidal zone of a beach make the beetle highly susceptible to changes in beach habitat and vulnerable to extirpation. Originally the beetle was proposed for listing as endangered, but it was listed as a threatened species in the final rule. Since that time, more occupied sites have been identified, but we also documented a decline in numbers of beetles and occupied habitat range-wide. Overall, the northeastern beach tiger beetle is facing serious and growing threats to its continued existence throughout its range (USFWS 2009, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 8.3% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 32**)**. There is less than 0.1% overlap between methomyl use sites and the species' range, indicating that the majority of exposure is likely a result of spray drift. Corn/soybean rotations, other grains, and vegetables and ground fruit use sites are the most prevalent within the species' range, with 4.7%, 1.6%, and 1.1%

overlap, respectively. However, overlap with other use sites may still contribute to the overall exposure of the species.

Usage

Based on past usage data, we anticipate up to 1.5% of the species range will be treated with methomyl annually (Table 32).

Table 32. Overlap and annual usage data for the northeastern beach tiger beetle. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	0.4	0.4	0	0.1	0.1
Citrus	NA	NA	NA	NA	NA	NA
Corn[32]	0	4.7	4.7	0	0.2	0.2
Cotton	0	0.4	0.4	0	0	0
Other Grains	0	1.6	1.6	0	0.1	0.1
Other Orchards	<0.1	<0.1	<0.1	0	0	0
Other Row Crops	0	<0.1	<0.1	0	0	0
Soybeans	0	4.1	4.1	0	0.2	0.2
Vegetables and Ground Fruit	0	1.1	1.1	0	1.1	1.1
Wheat	NA	NA	NA	NA	NA	NA
Total	**<0.1**	**8.3**	**8.3**	**0**	**1.5**	**1.5**

[32] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

Additional exposure considerations
The northeastern beach tiger beetle occurs in open sand flats, dunes, water edges, beaches, woodland paths, and sparse grassy areas. Adults are primarily active from June to September, and over winter as larvae. The adults mate and lay eggs from late June through August. The eggs hatch in 10-14 days, depending on soil moisture.
Adult and larval beetles are typically found on highly dynamic beaches with back beach vegetation, and they prefer long, wide beaches that have low human and vehicular activity, fine sand particle size, and a high degree of exposure.
Larvae are sedentary ambush predators that live in well-formed burrows from which they extend to capture passing prey. Adults are active predators that forage on small invertebrates or scavenge on dead fish, crabs, and amphipods.
The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage (including other pesticides than methomyl). Results from 2017 indicate that very low levels of insecticides, in general, were used within the counties where the species' range occurs, with only 2.58% of the species range treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

There is a medium extent of overlap between the action area and the species' range (8.3% total overlap). However, past usage data indicates that a smaller portion of the species' range is likely to be treated (up to 1.5% annually). This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows very little insecticide usage has occurred within the species' range. While the timing of methomyl applications likely coincide with periods of high larval and adult activity, the low level of past usage data suggests very little of the species' range is likely to be treated throughout the duration of the proposed action. As such, we expect only a small number of individuals are likely to be exposed to methomyl.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We expect that exposure to methomyl will result in adverse effects to some of the prey items for this beetle which include other insects, amphipods, and crabs.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die, as will prey items this beetle consumes.

Overall Toxicity: High

Effects of Action Summary

Overlap for the northeastern beach tiger beetle is medium (8.3%) and we expect usage in the range is low (1.5%). Additional usage data from the USDA Census of Agriculture provide further evidence that only a small portion of the species' range is likely to be treated with methomyl. Therefore, we determined that the overall likely exposure for the northeastern beach tiger beetle to be low. As such, we expect only a small number of individuals may experience exposure throughout the duration of the proposed action.

The northeastern beach tiger beetle has a high toxicity ranking. Insects are highly sensitive to methomyl at estimated environmental concentrations are likely to die with exposure. Additionally, we anticipate that there will be significant reductions in the availability of insect prey species for larvae and adults to feed on as these species are likewise sensitive to methomyl exposure, indicating there is a high level of indirect effect to the species.

While we anticipate a high level of mortality of exposed individuals in addition to reductions in prey species abundance, we anticipate very few individuals are likely to be exposed or experience significant loss of prey species as the exposure potential is very low (as informed by past methomyl usage data and corroborated by the Census of Agriculture data). As such, we expect the overall risk of adverse effects to the species is low.

Conclusion

The northeastern beach tiger beetle is listed as threatened. It has been extirpated from much of its former range and is currently found in the Chesapeake Bay area of Maryland and Virginia, and on two sites in Massachusetts. Surveys have documented a decline in beetle numbers on occupied sites over most of the beetle's range. The number of occupied sites, in particular those with greater than 500 adults, have continued to decrease in Maryland and Virginia on the western shoreline of the Chesapeake Bay. The number of occupied sites has remained relatively stable on Virginia's eastern shoreline; however, most sites had declining numbers, and there were fewer sites with very large populations (>1,000 adults). Some occupied sites are permanently protected, owned, and managed by state agencies, federal agencies, or nongovernmental organizations or are protected through conservation easements. The primary threat to the northeastern tiger beetle continues to be the loss of suitable beach habitat due to multiple factors, including increasing development and shoreline structures, hurricanes/large storms, and sea level rise. Additionally, some sites are impacted by high intensity usage and off-road vehicles on public beaches. Thus, we have determined that the species has a high vulnerability.

While 8.3% of the range overlaps with the action area and has the potential for methomyl use, past pesticide usage data indicates only 1.5% of the species' range has been treated with methomyl in recent years, indicating a low likelihood of individuals experiencing methomyl exposure. This low level of past usage is corroborated by data from the USDA's Census of Agriculture, which shows very little insecticide usage has occurred within the species' range. Although prey items for northeastern beach tiger beetles include arthropods, which are susceptible to the effects of methomyl, we do not anticipate significant impacts to prey availability due to the low extent of methomyl exposure within the range.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the northeastern beach tiger beetle.

References

U.S. Fish and Wildlife Service. 2019. Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) 5-Year Review: Summary and Evaluation. Gloucester, Virginia. 27 pp.

U.S. Fish and Wildlife Service. 2009. Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) 5-Year Review: Summary and Evaluation. Gloucester, Virginia. 21 pp.

Integration and Synthesis Summary: Puritan tiger beetle

Scientific Name:	Common Name:	Entity ID:
Ellipsoptera puritana	Puritan tiger beetle	443

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is high overlap and low usage within the species' range (Figure 20), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Puritan tiger beetle. We discuss our rationale for the species in the sections below.

Species range

Last updated: 8/27/2020; Wherever found; *States within the range:* CT, MA, MD

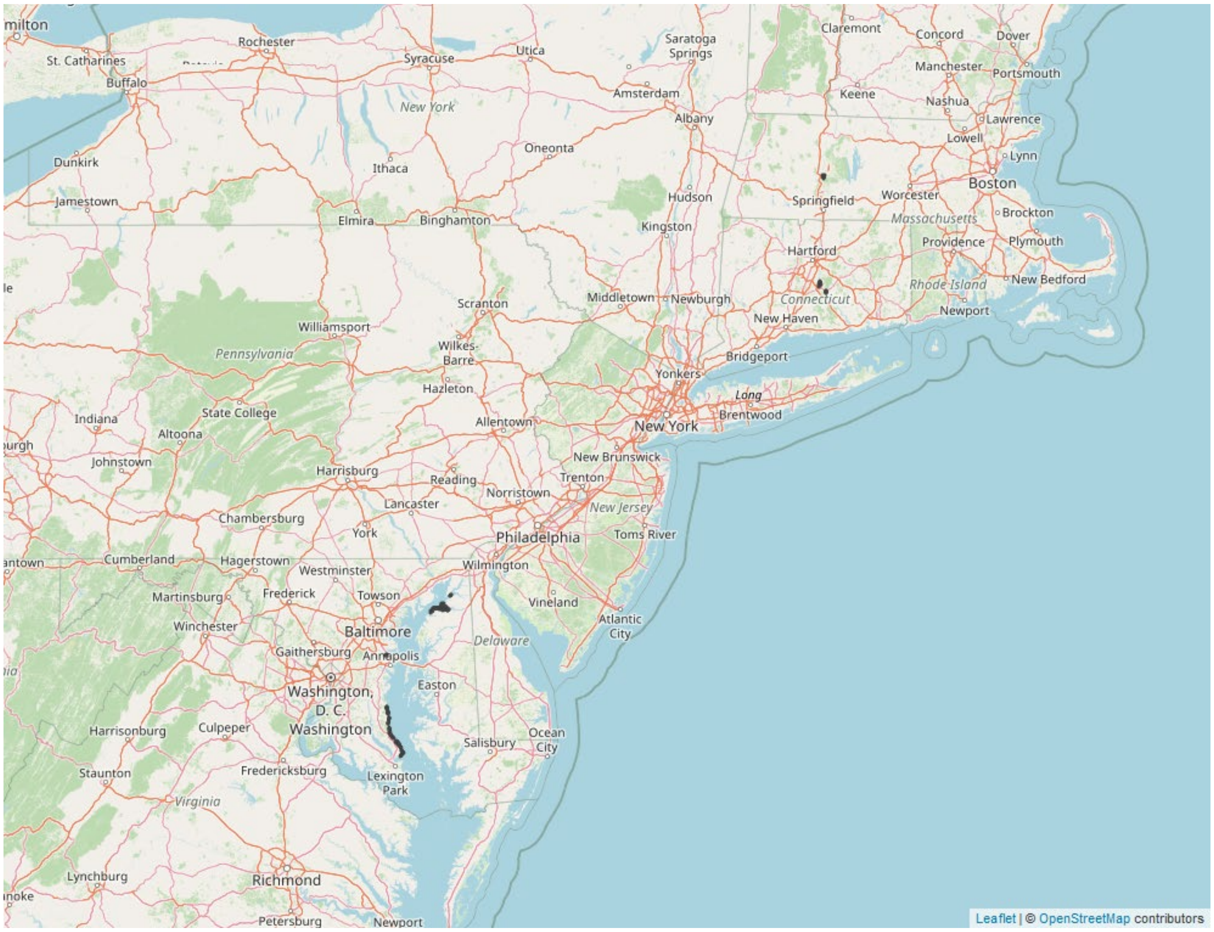

Figure 20. Range map of Puritan tiger beetle (black areas). Range map accessed at https://ecos.fws.gov/ecp/species/6073.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 7/24/2019

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Puritan tiger beetle is found in shoreline habitat along the Connecticut River in New England and the Chesapeake Bay in Maryland. The species has disappeared from a large part of its range in New England, and the Chesapeake Bay populations appear to be highly susceptible to habitat loss and degradation. Due to its declining range and vulnerability to natural and human-related threats, this species was listed as threatened in August 1990. Information evaluated for the 2007 5-Year Review provided a clear indication that the Puritan tiger beetle was not recovering. It had not met any of the four recovery criteria and, in fact, was further from these goals today than at the time the recovery plan was written: there were fewer large populations, none of the required new metapopulations in New England were established, there was no site-specific management at most tiger beetle sites, and there were few protected populations or corridors.

Residential development and recreational use activities continue to threaten the species' habitat range-wide, as do storm and flooding events that could increase in frequency and/or intensity due to changing climate conditions. New information for the 2007 5-Year Review indicated that there has been a declining trend in population numbers and a substantial decline in suitable habitat for the Chesapeake Bay populations of the Puritan tiger beetle. This is significant because, range-wide, the majority of Puritan tiger beetles and Puritan tiger beetle habitat occurs along the Chesapeake Bay. The decline in suitable habitat results partly from construction of shore erosion control projects (the number one threat for the species according to the recovery plan) and partly from a newly recognized threat: significant vegetative encroachment on the cliffs along the Chesapeake Bay that support the species. In addition, the population viability analysis for the Chesapeake Bay Puritan tiger beetle populations provides evidence that both Chesapeake Bay metapopulations are vulnerable to extinction; this is particularly true for the Sassafras River metapopulation. In New England, the Massachusetts population remains extremely small and vulnerable, while the Connecticut population has shown a small increase. However, there is a marked trend toward increasing degradation of habitat by intensive recreational usage at sites supporting both populations. In summary, information from the 2007 5-Year Review indicates that the species has declined substantially since listing and recovery plan approval, that the species is highly vulnerable to extinction, and that threats to the species have markedly increased.

The 2019 5-Year Review provides an update on the status of the three current metapopulations for this species, one in the Northeast and two in the Chesapeake Bay – one in Calvert County on the western shore of the Bay, and the other along the Sassafras River of the eastern shore of the Bay. The Connecticut River populations include one fairly strong metapopulation in Connecticut and one site in Massachusetts that declines to perilously low numbers and could become extirpated without periodic augmentation. Although there has been great progress in our ability to raise Puritan tiger beetle larvae in the lab and transfer them to the wild to augment existing populations or establish new populations, managing existing habitat has not been demonstrated to have long-term success. In New England, the Connecticut metapopulation appears to be stable since the last 5-Year Review, and although populations have been fluctuating, the overall trend does not demonstrate a decline. In the Chesapeake Bay, the redundancy in the metapopulations has been retained as the subpopulations identified in 2007 are still present and a few new small areas containing beetles have been discovered. The Calvert County metapopulation is not increasing but is not in a sharp decline either.

The 2019 5-Year Review indicates there are two strong metapopulations in the Chesapeake Bay, with the highest numbers ever counted in the Sassafras River metapopulation in 2018. In addition, two new areas of beetles were discovered in Maryland in 2014 and 2015. Also in Maryland, three large subpopulations are currently protected from development by State ownership, and a fourth and fifth subpopulation are now protected by conservation easements, thus achieving protection of five of the six large populations as required for Recovery Criterion 1. It is noted that while significant recovery progress has been made, significant threats remain, and habitat loss is continuing.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 24.7% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 33). Less than 0.1% of the species' range overlaps with methomyl use sites while up to 25% of the range occurs off-field but may still be exposed to spray drift or runoff. Alfalfa, corn/soybean rotation, other grains, and vegetables and ground fruit use types are most predominant within the species' range, with 4.0%, 10.7%, 5.9%, and 3.1% overlap, respectively. However, overlap with other use types may also contribute to the overall exposure of the species.

Usage

While the action area overlaps with a large portion of the species' range, past usage data indicate that only up to 5.1% of the species range will likely be treated with methomyl annually. Usage data indicates that methomyl applications to vegetables and ground fruit has the highest past usage, with 3.1% of the species' range treated on these crops alone. Usage on other use sites contributes to the total annual past usage in the species range, as shown in Table 33 below.

Table 33. Overlap and annual usage data for the Puritan tiger beetle. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	4.0	4.0	0	0.6	0.6
Citrus	NA	NA	NA	NA	NA	NA

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Corn[33]	0	10.7	10.7	0	0.5	0.5
Cotton	0	0	0	0	0	0
Other Grains	0	5.9	5.9	0	0.3	0.3
Other Orchards	<0.1	0.3	0.3	<0.1	0.3	0.3
Other Row Crops	0	0.7	0.7	0	0.3	0.3
Soybeans	0	8.1	8.1	0	0.4	0.4
Vegetables and Ground Fruit	0	3.1	3.1	0	3.1	3.1
Wheat	NA	NA	NA	NA	NA	NA
Total	**<0.1**	**24.7**	**24.7**	**<0.1**	**5.1**	**5.1**

Additional exposure considerations

The Puritan tiger beetle typically lives in deep burrows, which they dig in sandy deposits on non-vegetated potions of bluffs or the upper portions of sandy beaches. Occasionally, burrows can be near the water's edge. Adults and larvae position themselves in the rack along the shoreline and probably also to some extent on the bluff face on sandy beaches. The Puritan tiger beetle makes use of sandy areas where beetles live, breed, and forage. If pesticide applications are made, it will be in these areas where these beetles will be impacted the most (no name, pers. comm. USFWS species co-occurrence Ask to Field 2016).

Puritan tiger beetles typically undergo a two-year larval period before emergence. Larvae hatch in late July or August as first instars. Larvae generally over-winter as second instars and become active again (as evidenced by open burrows) the following spring, when they molt to the third instar. Larvae tend to be most active (as evidenced by open burrows) in the fall, with lesser

[33]We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

numbers appearing in the spring and summer. Pupation occurs in late spring, and in Maryland, adults emerge during mid- to late-June (Hill and Knisley 1991). The timing of adult emergence is 2-3 weeks later in the Connecticut River populations (P. Nothnagle, pers. obs.). The adult populations peak in late June to early July and begin to decline in late July. Population size then decreases rapidly until the middle of August, when only a few adults remain.

Young beetles develop in tiny burrows in sandy soils of the cliff face and adults inhabit the beach below the cliffs. The larvae firmly position themselves at the mouths of their burrows by means of abdominal hooks and wait for small invertebrates to pass by. Adults feed actively on smaller invertebrates which probably comprise the bulk of their diet. As such, we anticipate exposure is more likely to occur in adult beetles rather than larvae.

Additional data from the USDA show very little methomyl is likely to have been used within the species' range in the past, suggesting that only a small portion of the species' range is likely to be treated with methomyl in the future. The USDA's Census of Agriculture provides information on reported insecticide usage, in general, at the county level. Data from the USDA's 2017 Census of Agriculture shows very low levels of insecticides in general were used within the counties where the species' range occurs, with only 2.18% of the species range treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. Furthermore, given that this data is associated with the specific counties that the puritan tiger beetle's range occurs, we have high confidence that there has only been a small portion of the species' range treated recently.

Exposure Summary

While there is a large extent of overlap between the action area and the species' range (24.7% overlap), multiple lines of evidence indicate that only a small portion of the range is likely to be treated. Past usage data provided by the EPA suggests up to 5.1% of the species' range will likely be treated annually, while past usage data as reported by the USDA's Census of Agriculture shows only 2.18% of the range has been treated with any insecticide annually in the past. Given that the Census of Agriculture data is specific to the counties where the puritan tiger beetle's range occurs and includes the usage of other insecticides besides methomyl, we anticipate only a small portion of the range is likely to be treated annually. As such, we expect only a small number of individuals are likely to be exposed to methomyl as a result of the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We anticipate adverse effects to the insect prey base from methomyl exposure on or near use sites. Because insects taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of the insects in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be lower based on distance from use sites from spray drift effects. Adverse effects to the insect community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die, as will prey items this beetle consumes.

Overall Toxicity: High

Effects of the Action Summary

The Puritan tiger beetle has a low exposure ranking. While there is a large extent of overlap between the action area and the species' range (24.7%) and a moderate level of past methomyl usage (up to 5.1% range treated annually), additional data from the USDA Census of Agriculture show very little insecticides have been used within the species' range in the past (only up to 2.8% range treated with any insecticide). Given that the Census of Agriculture data is spatially specific to the Puritan tiger beetle's range and describes a low level of general insecticide use (not just methomyl), we expect only a small number of individuals are likely to experience methomyl exposure.

The Puritan tiger beetle has a high toxicity ranking. Available toxicity data indicates that insect species are highly sensitive to methomyl, suggesting that individuals are likely to die with exposure to methomyl. As such, we expect direct adverse effects to exposed individuals are likely. Additionally, we anticipate methomyl will result in a loss of prey availability as the insects that larvae and adult prey on are also similarly sensitive to methomyl, indicating a high level of indirect adverse effects to individuals in treated areas is likely.

While we anticipate a high level of mortality of exposed individuals in addition to reductions in prey species abundance, we anticipate very few individuals are likely to be exposed or experience loss of prey species as the exposure potential is very low (as informed by past methomyl usage data and corroborated by the Census of Agriculture data). As such, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Puritan tiger beetle is a threatened species that is found in shoreline habitat along the Connecticut River in New England and the Chesapeake Bay in Maryland. The species has disappeared from a large part of its range in New England, and the Chesapeake Bay populations appear to be highly susceptible to habitat loss and degradation. According to the 2019 5-Year Review, the Connecticut populations include one fairly strong metapopulation in Connecticut and one site in Maine that declines to perilously low numbers intermittently which could become extirpated without periodic augmentation. In New England, the Connecticut metapopulation appears to be stable, as the overall trend does not demonstrate a decline. In the Chesapeake Bay, the redundancy in the metapopulations has been retained as the subpopulations identified in 2007 are still present and a few new small areas containing beetles have been discovered. The Calvert County subpopulation appears to be stable. In Maryland, three large subpopulations are currently protected from development by State ownership, and a fourth and fifth subpopulation are now protected by conservation easements, thus achieving protection of five of the six large populations in this state. However, although significant recovery progress has been made, significant threats and habitat loss continue. Thus, we have determined that the species has a high vulnerability.

There is large overlap (24.7%) between the species range and the action area, with a fraction (<0.1%) of the species range overlapping with use sites, and 24.7% susceptible to off-site exposure trough spray drift and runoff. While usage data indicates that a moderate amount of the range (5.1%) will be treated with methomyl, past usage data as reported by the USDA's Census of Agriculture shows only 2.18% of the range has been treated with any insecticide annually in the past. Given that the Census of Agriculture data is specific to the counties where the Puritan's tiger beetle's range occurs in and includes the usage of other insecticides besides methomyl, we anticipate only a small portion of the range is likely to be treated annually. We anticipate only adult Puritan tiger beetles are likely to experience exposure, as larvae stay within underground burrows and the timing of most methomyl applications will coincide with periods of peak adult beetle activity. The species has a high toxicity ranking as available toxicity data indicates that insect species are highly sensitive to methomyl, suggesting that individuals are likely to die with exposure to methomyl. In addition, prey items for Puritan tiger beetles include arthropods, which are similarly susceptible to the effects of methomyl.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Puritan tiger beetle.

References

U.S. Fish and Wildlife Service. 2019. Puritan Tiger Beetle (*Cicindela puritana*) 5-Year Review: Summary and Evaluation. Annapolis, Maryland. 38 pp.

U.S. Fish and Wildlife Service. 2007. Puritan Tiger Beetle (*Cicindela puritana*) Draft 5-Year Review: Summary and Evaluation. Annapolis, Maryland. 21 pp.

U.S. Fish and Wildlife Service. 1993. Puritan Tiger Beetle (*Cicindela puritana* G. Horn) Recovery Plan. Hadley, Massachusetts. 45 pp.

Integration and Synthesis Summary: Behren’s silverspot butterfly

Scientific Name:	Common Name:	Entity ID:
Speyeria zerene behrensii	Behren's silverspot butterfly	444

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species’ vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a low overlap and usage within the species’ range (Figure 21), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Behren’s silverspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 4/27/2021; Wherever found; *States within the range:* CA

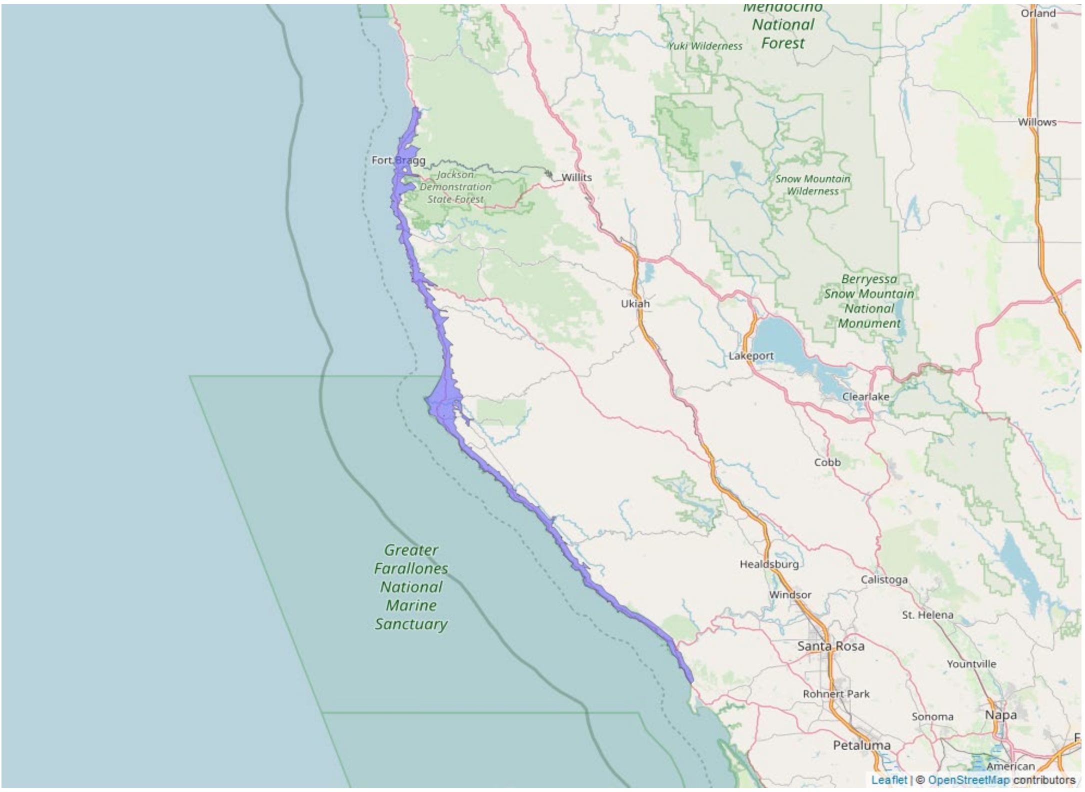

Figure 21. Range map of Behren's silverspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/900.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/12/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Behren's silverspot butterfly is a medium-sized butterfly with a wingspan of approximately 5.5 cm. This species was historically recorded from several coastal locations from central Sonoma County north to near the City of Mendocino, Mendocino County, California. In the decade before the 2020 5-Year Review, the species has been observed at only three areas: two highly localized sites in Sonoma County, and a cluster of observations, perhaps representing a metapopulation, in southern Mendocino County in the vicinity of Point Arena. The butterfly is associated with grasslands on coastal terraces and stabilized dunes, where its larval host plant, the early blue violet (*Viola adunca*) occurs. Disturbance is probably important in maintaining suitable habitat for the species; in the absence of disturbance, shrubs and coastal pines can colonize coastal prairies and degrade or eliminate habitat. Key resources for the species include sufficient violets to support larval development for a population, as well as nectar sources for the adult butterflies. In other Speyeria, the amount and quality of available nectar affect fecundity and has been implicated in the decline and loss of populations.

We have no new information to suggest that threats to the species have substantially changed since the time of listing. The primary threats continue to be potential destruction and modification of habitat. Regulatory mechanisms do not prevent development of coastal grassland areas. Conversion of potential habitat by development and succession due to altered disturbance regimes continue to result in the loss of habitat. Development likely increases the modification of habitat caused by vegetation succession, by reducing fire frequency through increased suppression, and perhaps by reducing grazing, which can help maintain coastal grasslands. The threat posed by destruction of habitat has diminished since the time of listing, where occupied sites have been conserved through land purchases, including two large purchases of occupied areas since the last review. We anticipate that future management of these areas will reduce and perhaps eventually reverse the negative effects from succession and other threats that could reduce the suitability of butterfly habitat. While no known occupied sites are being managed primarily for Behren's silverspot butterfly conservation, management actions at Stornetta Public Lands and Manchester State Park have helped to maintain habitat for the species and will likely occur on 126 ac (51 ha) near Point Arena, which was transferred in January 2012 to Bureau of Land Management (BLM). Some aspects of BLM's management of the Stornetta Public Lands, such as cattle grazing, may result in incidental take of butterflies, but may also benefit the species by limiting succession. Other BLM management actions have helped restore habitat, notably removal of conifers encroaching into butterfly habitat. Service-funded surveys conducted between 2004 and 2011 observed Behren's silverspot butterflies at historical sites in Sonoma County and, in one case, at a new location near Point Arena, Mendocino County. However, the extent and viability of those populations remain unknown. Extant populations remain at historical sites located at Salt Point, Stewarts Point, and Point Arena/Manchester, which were documented at the time of listing. Populations of the species are likely sensitive to the effects of climatic variation on important vegetation resources and on thermal regime and other climatic characteristics, which can affect survival and reproduction. While climate change has the potential to affect the species, the nature of any effects could not be predicted at the time of the 2012 review. A captive rearing program is considered in the 2020 5-Year Review.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 3.1% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 34). Up to 0.4% of the species' range overlaps with methomyl use sites while 2.7% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 34. Overlap data for the Behren's silverspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	0.2	0.3
Citrus	0	0	0
Corn	0	0	0
Cotton	0	0	0
Other Grains	0.3	2.5	2.8
Other Orchards[34]	<0.1	<0.1	<0.1
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	<0.1	<0.1
Wheat	NA	NA	NA
Total	**0.4**	**2.7**	**3.1**

[34] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 0.7% (Table 35). Over that same time period, up to 0.2% of the range was treated with any insecticide, and no areas within the species' range were treated. Based on this reporting data, we expect a low extent of usage within the species' range.

Table 35. Annual percent of the Behren's silverspot butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
0.7	0.2	0

Additional exposure considerations

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 1.3% of the species range reported to be treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low extent of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range overlaps with methomyl use sites or associated areas exposed through off-site transport. State mandated pesticide usage reporting data indicate that only a small portion of the species' range was treated with any pesticides from 2012-2021, and that no methomyl has been used within the species' range in that same period. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage within the species' range. We anticipate the extent of exposure to individuals is very low based on this usage data. While we cannot preclude an increase in the exposure of individuals in the future as there may be possible changes in pesticide use patterns, given the low level of overlap between the species' range and the action area, we anticipate any future exposure will be limited and will only result in the exposure of a very small number of individuals. As such, we determine the overall exposure ranking for the Behren's silverspot butterfly is low.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat (such as flowering plants that provide nectar for adults or food and shelter for larvae).

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Behren's silverspot butterfly has a low exposure ranking based on the low extent of overlap between the species' range and the action area and the low level of general pesticide usage within the species' range. State mandated pesticide usage reporting data indicates that no methomyl has been used within the species' range from 2012-2021, suggesting a very low likelihood of exposure. While we cannot rule out a possible increase in exposure occurring in the future, we anticipate only a very small number of individuals are likely to be exposed, at most. The species has a high toxicity ranking as available toxicity data shows insects are highly sensitive to methomyl, suggesting any individuals that are exposed are likely to die. However, coupled with the low exposure ranking, we anticipate only a very small number of individuals are likely to experience this level of adverse effect. As such, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Behren's silverspot butterfly has a high vulnerability based on its endangered status, limited distribution, and declining trend and we anticipate exposure of individuals of the species to methomyl will result in mortality. However, we anticipate a very low extent of usage will occur within the species range annually based on past usage data, including State mandated pesticide usage reporting data that indicates no methomyl has been used within the species' range from 2012-2021. We also anticipate similar levels of usage in the future given the species' coastal habitat generally removed from agricultural activities. The Behren's silverspot butterfly exists in grassland and coastal dunes in Mendocino County and Sonoma County, California, which also limits the likelihood of exposure as we do not anticipate methomyl use in these habitats. Thus, the likelihood of exposure to methomyl is considered low.

We anticipate that a very small number of individuals will be affected over the duration of the proposed action (exposure through agricultural uses and spray drift resulting in the loss of a very small number of individuals). While the species limited range and declining populations, its limited overlap with agricultural use sites, and conservation efforts that preserve and manage key occupied sites we do not expect species-level effects to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Behren's silverspot butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2020. Behren's silverspot butterfly (*Speyeria zerene behrensii*) 5-Year Review. Arcata, California. 3 pp.

U.S. Fish and Wildlife Service. 2012. Behren's silverspot butterfly (*Speyeria zerene behrensii*) 5-Year Review: Summary and Evaluation. Arcata, California. 26 pp.

Integration and Synthesis Summary: Hine's emerald dragonfly

Scientific Name:	Common Name:	Entity ID:
Somatochlora hineana	Hine's emerald dragonfly	445

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is high overlap of the action area with the species' range (Figure 22), and low past usage of methomyl within the species' range, indicating a medium extent of exposure. We expect individuals exposed to methomyl will die. Given that exposure is medium and toxicity is high, we determined that the risk of adverse effects to the species is high. As such, we expected a moderate number of individuals were likely to be exposed and die.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Hine's emerald dragonfly to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hine's emerald dragonfly. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/25/2023; Wherever found; *States within the range:* IL, MI, MO, WI

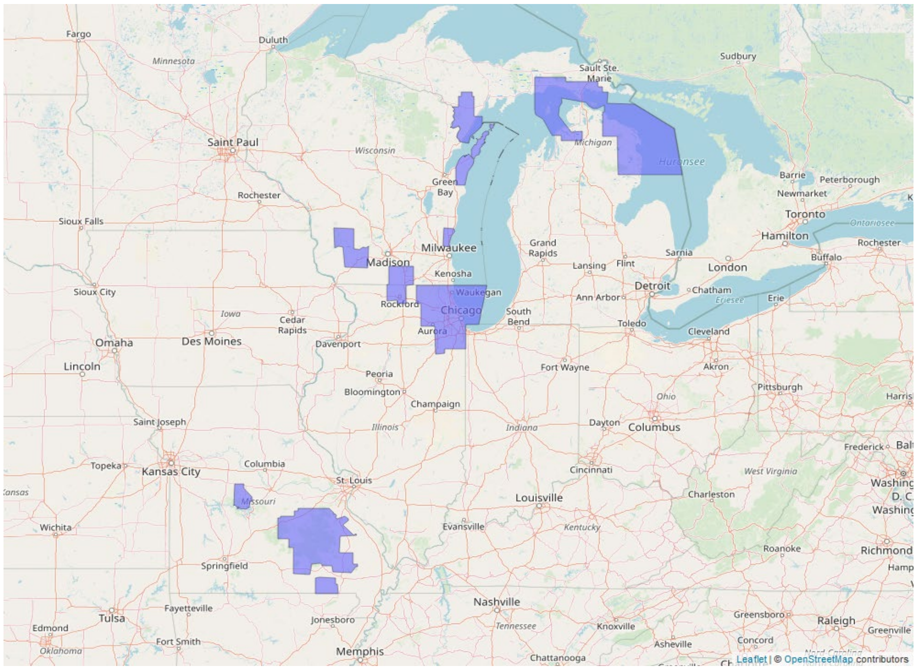

Figure 22. Range map of Hine's emerald dragonfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7877.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 4/30/2019

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (numerous)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Since the 2013 5-Year Review, seven new sites were confirmed, although population numbers do not appear to have changed in that time. Two of these recently confirmed sites have verified breeding habitat that have geological characteristics that are different than what is typical for

Hine's emerald dragonfly habitat, specifically the soil depth to bedrock. Previously, the species was believed to be restricted to wetland habitats characterized by thin soils over dolomite bedrock with marshes, seeps, and sedge meadows. Of the 16 subpopulations within the Northern Wisconsin Population and Northern Michigan Population, the habitat of five of those subpopulations are entirely managed and protected by federal or State agencies, while others have a mixture of ownership and are not completely protected and managed. Hine's emerald dragonfly breeding sites currently known or verified in the future within the Hiawatha National Forest will be protected under the federal Threatened and Endangered Species and Regional Forest Sensitive Species Plan. The majority of the habitat within the three Illinois subpopulations is protected and managed by county and state agencies and state laws. Private land exists within Illinois Subpopulation 1, but it is currently being managed to benefit Hine's emerald dragonfly. The habitat within the Ozaukee County, Wisconsin Population is protected and managed by the Wisconsin Department of Natural Resources and the University of Wisconsin. The entire Hine's emerald dragonfly habitat area that has been identified within the Southwest Wisconsin Population is managed and protected by the Wisconsin Department of Natural Resources. In Missouri, the majority of the habitat in two of the five subpopulations are completely protected and managed by either the U.S Forest Service or Missouri Department of Conservation. The Forest Plan for the Mark Twain National Forest identifies a number of actions supporting management of Hine's emerald dragonfly habitat. Management actions identified include control of non-native and/or undesirable (e.g., woody) plant species, restoration of local hydrology, and methods to minimize unauthorized vehicle and heavy equipment access near fens with known or suspected Hine's emerald dragonfly. There is an ongoing captive rearing project, though success of this project was not discussed in the 2019 5-Year Review.

Fragmentation and destruction of suitable habitat are believed to be the main reasons for this species' endangered status and continue to be the primary threats to its recovery. The known breeding sites in Illinois occur along the Des Plaines River floodplain, which has been fragmented by industrial and urban development. In Wisconsin, land development for agriculture, light industry, and tourism are principal threats. Off-road vehicle use and possibly logging, creation of water impoundments, real estate development, road development and maintenance, pipeline construction, and changes in hydrology are potential threats in Michigan. In addition, the species is vulnerable to loss of habitat caused by off-site hydrology alterations and ground watershed development affecting the groundwater-fed seeps and springs. Many of the threats to habitat vary across the range of the species but also vary in magnitude and ability to be mitigated. Direct loss of habitat is the most severe of all of the threats but occurs infrequently due to laws protecting wetlands and measures taken to preserve habitat. Other threats to hydrology or from fragmentation and contamination can also have a permanent impact on habitat and even entire populations of the species but our ability to manage or prevent these threats is limited. Invasive plant species are the most widespread of the threats; however, the magnitude of this threat and our ability to manage it depends on the invasive species and the degree that it has encroached upon Hine's emerald dragonfly habitat. Management of impacts from invasive plants and animals will be an ongoing effort (USFWS 2013, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 27.8% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 36). Up to 0.1% of the species' range overlaps with methomyl use sites while 27.7% of the range occurs off-field but may still be exposed to spray drift or runoff. Alfalfa and corn/soybean rotation use types are the most prevalent within the species' range, which both overlap with the species range by 10.5%. However, overlap with other use types may still contribute to the overall exposure to the species.

Usage

While up to 27.8% of the action area overlaps with the species' range, past usage data indicate that only up to 4.5% of the species range has been treated with methomyl annually (Table 36). Usage data indicate that alfalfa has the highest past usage, with 1.6% of the species' range treated on these crops alone, however, usage on other use types may still contribute to the overall exposure of the species.

Table 36. Overlap and usage data for the Hine's emerald dragonfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	10.5	10.5	0	1.6	1.6
Citrus	NA	NA	NA	NA	NA	NA
Corn[35]	0	10.5	10.5	0	0.5	0.5
Cotton	0	<0.1	<0.1	0	0	0
Other Grains	0	4.5	4.5	0	0.2	0.2
Other Orchards	0.1	0.5	0.6	0.1	0.5	0.6

[35] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Row Crops	0	0.2	0.2	0	0.1	0.1
Soybeans	0	9.8	9.8	0	0.5	0.5
Vegetables and Ground Fruit	0	1.5	1.5	0	1.5	1.5
Wheat	0	0	0	0	0	0
Total	**0.1**	**17.9**	**18.0**	**0.1**	**4.4**	**4.5**

Additional Exposure Considerations

The Hine's emerald dragonfly lifecycle encompasses both terrestrial and aquatic environments. Adults establish breeding sites and territories in summer starting June-August (depending on where in the range an individual is). Females oviposit in shallow water; usually in seepage marshes, seepage sedge meadows, sedge hummocks, muck along sluggish water, and in small muck-bottomed pools. Nymphs live in water for 2 to 4 years then crawl out and shed for a final time, emerging as a flying adult. Larvae begin to emerge as adults between May and June (depending on specific locations) and continue to emerge throughout the summer. Known flight season lasts up August to October (depending on specific locations). Fully adult Hine's emerald dragonflies can live at least 14 days and may live 4-6 weeks (USFWS 2001).

Given that methomyl applications within the species' range likely coincide with periods of peak activity, we anticipate all life stages are likely to experience exposure to methomyl, including both aquatic and terrestrial phases.

Exposure Summary

There is a high extent of overlap between the species' range and the action area, particularly with off-site areas. In contrast, past usage data suggests that only a much smaller portion of the species' range is likely to be treated with methomyl (up to 4.5% annually). While we consider this a low level of usage, we anticipate a moderate number of individuals will likely experience exposure given the high level of overlap, particularly since we expect the timing of typical methomyl applications likely coincide with periods of peak dragonfly activity. As such, the overall exposure ranking for the Hine's emerald dragonfly is medium.

Overall Exposure: Medium

Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites. This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. However, despite the incorporation of the rain restriction mitigation, toxicity remains high for this species.

Aquatic habitat buffers: The methomyl label also has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet, of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

Effects of the Action: Toxicity

Aquatic Phase and Terrestrial Phase Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed during the aquatic or terrestrial phase.

Aquatic Phase and Terrestrial Phase Indirect Effects

Both nymph and adult Hine's emerald dragonfly are general predators, feeding on insects they can capture (NatureServe 2015). We expect methomyl use will result in a decrease in the availability of insect prey species as insects have been demonstrated to be sensitive to methomyl exposure at estimated environmental concentrations. As such, we anticipate high levels of indirect effects are likely to occur during the aquatic or terrestrial phase.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations (both in terrestrial and aquatic habitats), we anticipate all individuals exposed to methomyl will die. Furthermore, we anticipate individuals will experience reductions in prey availability, resulting in high levels of indirect effects.

Overall Toxicity: High

Effects of the Action Summary

The Hine's emerald dragonfly has a medium exposure ranking. While past usage data suggests that only up to 4.5% of the species' range is likely to be treated with methomyl annually, the high extent of overlap between the species' range and the action area (18%) and the expectation that the timing of methomyl applications coincides with periods of peak dragonfly activity indicate that a moderate number of individuals will likely experience exposure to methomyl. The Hine's emerald dragonfly has a high toxicity ranking as available toxicity data indicates that insect species are highly sensitive to methomyl and that any exposed individuals are likely to die. Furthermore, both nymphs and adult dragonflies consume other arthropod prey, indicating that a loss in prey resources is likely as these prey animals are likely also sensitive to methomyl exposure. Thus, we anticipate that there is a high risk of adverse effects to the species during the aquatic or terrestrial phase.

Preliminary Conclusion (with General Conservation Measures)

The Hine's emerald dragonfly has a high vulnerability based on its status, distribution, and trends. The Hine's emerald dragonfly exists primarily in and near wetlands, but the status and protections for many of these habitats is questionable in light of the most recent Supreme Court ruling regarding WOTUS (*see* Sackett et ux. V. Environmental Protection Agency et al., Decided May 25, 2023). While many of the species' occupied sites are conserved and actively managed, fragmentation of habitat and ongoing loss of habitat remain as significant barriers to recovery. The risk to the species posed by labeled uses of methomyl across the range is also high as overlap with the species range on use sites is approximately 18%. The estimated usage within the species range is anticipated to be 4.5% based on past usage data. Therefore, the likelihood of exposure to methomyl is medium based on agricultural use site overlap and from usage estimates. The Hine's emerald dragonfly exists primarily in and near wetlands, but the status and protections for many of these habitats is questionable in light of the most recent Supreme Court ruling regarding WOTUS (*see* Sackett et ux. V. Environmental Protection Agency et al., Decided May 25, 2023).

We anticipated that a moderate number of individuals would be affected over the duration of the proposed action (exposure through agricultural uses and spray drift, and larval and adult stage dragonfly contact with contaminated arthropod prey resulting in the loss of a number of individuals).

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Hine's emerald dragonfly:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Hine's emerald dragonfly by >95% for terrestrial habitat and between 74 and 99% for aquatic habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Applicators need 9 points of mitigation as outlined in EPA's Draft Insecticide Strategy. This will reduce methomyl loads in the habitat of the Hine's emerald dragonfly by an order of magnitude (i.e., a 10-fold reduction).*

The PULA for the Hine's emerald dragonfly will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect these pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hine's emerald dragonfly in the wild.

References

U.S. Fish and Wildlife Service. 2019. Hine's Emerald Dragonfly (*Somatochlora hineana*) 5-Year Review. Barrington, Illinois. 10 pp.

U.S. Fish and Wildlife Service. 2013. Hine's Emerald Dragonfly, *Somatochlora hineana* (Odonata: Corduliidae) 5-Year Review: Summary and Evaluation. Barrington, Illinois. 52 pp.

U.S. Fish and Wildlife Service. 2001. Hine's Emerald Dragonfly (*Somatochlora hineana Williamson*) Recovery Plan. Fort Snelling, Minnesota. 133 pp.

Integration and Synthesis Summary: Blackburn's sphinx moth

Scientific Name:	Common Name:	Entity ID:
Manduca blackburni	Blackburn's sphinx moth	446

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is medium overlap of the action area with the species' range (Figure 23). Most exposed individuals are likely to die. Given toxicity is high, but exposure is low, we determined that the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Blackburn's sphinx moth. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/25/2022; Wherever found; *States within the range:* HI

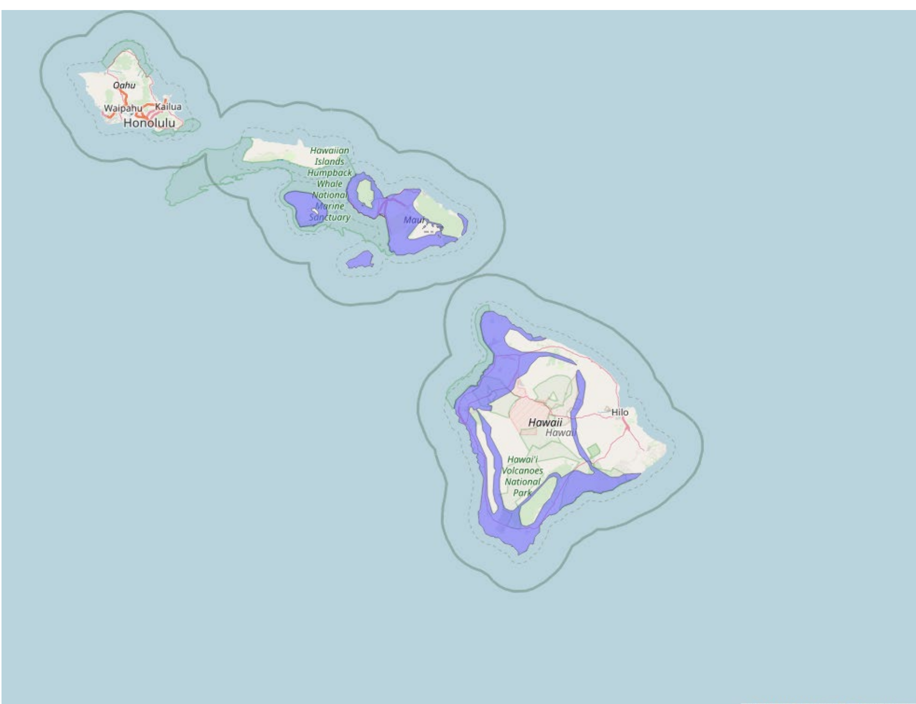

Figure 23. Range map of Blackburn's sphinx moth (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4528.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: Downlist to Threatened

Date of most recently completed 5-Year Review: 8/16/2019

Distribution: Species/Populations neither constrained nor widespread

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Blackburn’s sphinx moth is endemic to the Hawaiian Islands and is currently found on the islands of Hawai'i, Maui, and Kahoolawe (USFWS 2005, 2009). As of 2019, the species appears to be absent from Kaua‘i, O‘ahu, Lāna‘i and Moloka‘i (USFWS 2019). The Blackburn’s sphinx moth is believed to have declined over the past 100 years, probably as a result of habitat loss and mortality from non-native predators and parasitoids. Loss and degradation of habitat for the species continues due to overgrazing by introduced ungulates. Alien arthropods continue to impact the species through predation, competition, and parasitism. In addition, the accidental or intentional release of alien predators and competitors continues to threaten the species. Long-term changes in climatic conditions due to global warming are also expected to impact the distribution and abundance of available habitat for the species. However, the extent of these impacts on the Blackburn’s sphinx moth’s populations remains unknown. Although some habitats are under public ownership and zoned for conservation purposes, no known Blackburn’s sphinx moth-occupied habitat areas or populations are entirely protected from the threats of invasive, non-native weeds, wildfire, and/or predaceous or parasitic non-native insect species.

Impacts to the moth’s habitat from urban and agricultural development, invasion by non-native plant species, habitat fragmentation and degradation, increased wildfire frequency, ungulates, and direct impacts to the moth from non-native parasitoids and insect predators have significantly reduced the species’ range (USFWS 2009). The primary threats to the moth now include predation by ants and parasitic wasps that prey on the eggs and caterpillars, and the continued decline of its native larval host plants partly as a result of feral ungulates.

Blackburn’s sphinx moth larvae can develop on a range of native and non-native plants in the Solanaceae (nightshade) family. In addition to using known larval hosts like the native and endangered ‘aiea (*Nothocestrum* spp.) and the invasive tree tobacco (*Nicotiana glauca*), the species also can develop fully on the native ʻolohua (glossy nightshade; *Solanum americanum*) and pōpoloʻaikeakua (*Solanum sandwicense*) in a laboratory setting. These potential larval host plants could provide additional restoration options for land managers that will benefit this species (USFWS 2019). The 2005 Recovery plan noted that many alien weeds are known to be an important indirect threat to *Nothocestrum* sp. and that invasive weed control (e.g., removal by hand, local herbicide application, and biological control) should be a priority management activity for the Blackburn's sphinx moth management units (USFWS 2005). To avoid impacts to the Blackburn's sphinx moth, the recovery plan recommended that herbicide application be supervised by experienced managers.

Our current knowledge of the overall distribution of the moth is based largely on incidental sightings. On Maui, observations of the species have been made from the Kanaio area on leeward Haleakalā, ʻUlupalakua, Wailea/Mākena, Makawao, Launiupoko on west Maui, along Kuihelani Highway in the central valley, and along the north coast from Waiheʻe to Kanahā. While incidental observations have occurred on both ʻaiea and tree tobacco in a variety of habitat types and elevations, the restricted distribution of ʻaiea leads us to believe that the majority of the current range is based on tree tobacco occurrence. As tree tobacco grows in disturbed areas (e.g., along roadsides or recently cleared/graded ground/fallow fields), the species has incidentally been found along highway rights-of-way, parking lots, and other highly degraded areas, as well as in more intact native dry forests and shrublands where remnant ʻaiea persists. Tree tobacco has also appeared to have significantly expanded in the fallow sugar cane fields throughout the low-elevation "saddle" area of Maui since sugar production on Maui ended in 2016. Roadside surveys conducted by the Hawaiian Division of Forestry and Wildlife documented the distribution of tree tobacco along major highways in 2017. They found tree tobacco widely distributed in dry and mesic areas from Nʻu to Launiupoko in the south of the island, from Waiheʻe to Hoʻokipa in the north, and up to elevations of around 940 meters in Kula. This area will represent approximately 55,000 to 60,000 hectares (135,000 to 150,000 acres [ac]) of potential habitat, though tree tobacco density varies widely within the entire area. The moth has been recently documented from surveys on Kahoʻolawe, which were conducted in 2018 and 2019. Similar to previous documentation, moths were not uncommon on tree tobacco. On the island of Hawaiʻi, Blackburn's sphinx moths are known from the Puʻu Anahulu and Puʻu Waʻawaʻa areas, as well as along Saddle Road, all locations where comprehensive surveys have been conducted. Moth presence is not currently known from Lānaʻi, though there were reports of moths present in 2011. None have been reported since that time, though no comprehensive surveys have been conducted. No recent sightings have been made on Molokaʻi (last observed in 1940s), Oʻahu (1931), or Kauaʻi (1940). Tree tobacco has not been documented from Kauaʻi, though it is found on all other islands (USFWS 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Based on 90-meter spray drift estimates, we expect up to 6.1% of the species' range to overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 37). However, we do not expect methomyl to be applied aerially in Hawai'i.

Table 37. Overlap data for the Blackburn's sphinx moth.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	2.4	3.6	6.1

Usage

Past methomyl usage data in Hawai‘i is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawai‘i were treated with insecticides, with methomyl presumably being among these insecticides. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage.

Additional Exposure Considerations

The Blackburn's sphinx moth adult is large, nocturnal, strong-flighted, and wide-ranging. Adults fly over large areas at night feeding on nectar of native plants and non-native plants including agricultural and horticultural plants. Plants in the Solanaceae (nightshade) family seem to be particularly important to the species as eggs have been observed on commercial tobacco (*Nicotiana tabacu*), eggplant (*Solanum melongena*), tomato (*Lycopersicon esculentum*), in addition to non-crop plants such as native aiea (*Nothocestrum* spp.) and the non-native tree tobacco (*Nicotiana glauca*), which readily invades and occupies disturbed areas like agricultural fields.

As noted above, we do not expect methomyl to be applied aerially in Hawai'i. As such, we expect off-field overlap to be lower as spray drift from ground applications will not travel as far off the field. Based on ground applications only, we expect 3.5% of the species' range to overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area. Data indicate that 2.4% of the species' range occurs on methomyl use sites while 1.1% of the range occurs off-field but may still be exposed through spray drift and/or runoff. Applying the maximum usage data of 45%, as described above, to this 3.5% overlap, we determine that 1.6% of the range is likely to be treated with methomyl.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. Data indicate that within this area, a low extent of any insecticides are likely to be applied. As such, we anticipate a small number of individuals are likely to experience exposure and determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Blackburn's sphinx moth has a low extent of exposure (3.5% overlap) and we expect that a small percent of the range (up to 1.6%) is likely to be treated with methomyl. We anticipate individuals will enter methomyl use sites. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate a small number of individuals are likely to be exposed and die, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Blackburn's sphinx moth has a high vulnerability based on its status, distribution, and trends. However, the risk to the species posed by the labeled uses across the range is low, and there is a low amount of estimated usage within the range of the species based on prior usage data. While usage is not expected on all use sites at the maximum rates allowed by the labels where used each year, we anticipate that usage could occur on up to 1.6% of agricultural crops, as stated above.

Based on recent sightings and known behavior patterns, the Blackburn's sphinx moth is most likely to be directly exposed to methomyl on agricultural use sites. More specifically, methomyl is registered for use on vegetables and ground fruit, including some of the plants the moth has been documented to use as larval host plants. It has also been found on non-native tree tobacco in highly disturbed sites, which makes it vulnerable to loss or disturbance from removal of this species.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Blackburn's sphinx moth.

References

U.S. Fish and Wildlife Service. 2019. Blackburn's Sphinx Moth (*Manduca blackburni*) 5-Year Review Summary and Evaluation. Honolulu, Hawaiʻi. 20 pp.

U.S. Fish and Wildlife Service. 2009. Blackburn's Sphinx Moth (*Manduca blackburni*) 5-Year Review Summary and Evaluation. Honolulu, Hawaiʻi. 15 pp.

U.S. Fish and Wildlife Service. 2005. Recovery Plan for the Blackburn's Sphinx Moth (*Manduca blackburni*). Portland, Oregon. 125 pp.

Integration and Synthesis Summary: Fender’s blue butterfly

Scientific Name:	Common Name:	Entity ID:
Icaricia icarioides fenderi	Fender's blue butterfly	450

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species’ vulnerability is low. While the vulnerability of the Fender’s blue butterfly is considered to be low due in part to improvements in its status, its viability and recovery over the long-term will require addressing a number of ongoing threats, including exposure to insecticides and herbicides. In our evaluation of the effects of the proposed action to the species, we determined there is high overlap of the action area with the species’ range (Figure 24), and high past usage of methomyl within the species’ range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that both exposure and toxicity are high, we determined the risk of adverse effects to the species is high. As such, we expected a large number of individuals were likely to be exposed and die.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Fender's blue butterfly to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Fender's blue butterfly. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 10/12/2021; Wherever found; States within the range: OR

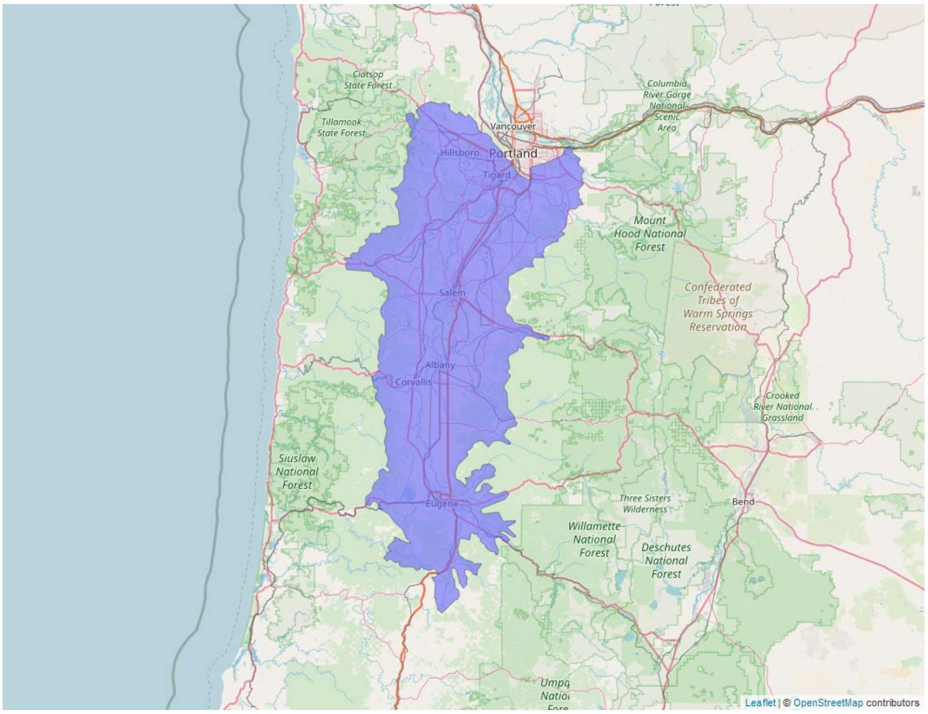

Figure 24. Range map of Fender's blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6659.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: Downlist to Threatened; Reclassified 1/12/23

Date of most recently completed 5-Year Review: 3/6/2019

Distribution: Species/populations neither constrained or widespread

Number of populations: Multiple populations (numerous)

Species trends: Increasing population(s)

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Fender's blue butterfly is found only in the prairie and oak savannah habitats of the Willamette Valley of Oregon. Surveys indicate that the current distribution is identical to its historical distribution, which is restricted to Benton, Lane, Linn, Polk, Yamhill, and Washington Counties in Oregon. Fender's blue butterflies rely primarily upon a relatively uncommon lupine plant, the Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), also endemic to the Willamette Valley and listed as a threatened species under the Act (65 FR 3875), as the host plant for the larval (caterpillar) life stage. The only other host plants known for Fender's blue butterflies are *Lupinus arbustus* (longspur lupine) and *Lupinus albicaulis* (sickle-keeled lupine) (USFWS 2020). The low availability of lupine host plants, and inadequate supply of appropriate lupine seed for restoration efforts, is a limiting factor for Fender's blue butterfly. The species was downlisted to threatened in 2023 due to status improvement (USFWS 2023).

After evaluating threats to the species and assessing the cumulative effect of the threats in 2020, the Service found that Fender's blue butterfly experienced a marked increase in resiliency, redundancy, and representation across its historical range, contributing to an overall increase in viability. The Fender's blue butterfly was listed as endangered in 2000 (65 FR 3875). Since then, our evaluation of the best scientific and commercial data available indicates that the abundance and distribution of Fender's blue butterfly improved as a result of metapopulation expansion, metapopulation discovery, and metapopulation creation, as well as a marked increase in habitat protection and management across the range of the species. We use the term metapopulation to describe groups of sites occupied by Fender's blue butterflies that are within 2 km of one another and not separated by barriers. We chose this distance because it is the estimated dispersal distance of Fender's blue butterfly. We assume that butterflies within a metapopulation are capable of at least occasional interchange of individuals. At the time the species was listed in 2000, we knew of approximately 3,391 individuals on 32 sites, equating to 12 metapopulations of Fender's blue butterfly. As of 2020, 137 total sites are known, containing more than 13,700 Fender's blue butterfly individuals that comprise 15 Fender's blue butterfly metapopulations and 6 independent groups distributed throughout the Willamette Valley. Of the currently known sites, 44 are on tracts of public land owned by the U.S. Army Corps of Engineers, Bureau of Land Management, Bureau of Reclamation, Oregon State University, or the Service, all of which are being managed for prairie habitat to varying degrees given funding and personnel. Fourteen sites are in public rights-of-way managed by the Oregon Department of Transportation or County Public Works and all are being managed for prairie. Thirty sites are on private land without any form of protection or active management for Fender's blue butterfly or its habitat. Another 43 sites are on private land with some level of protection via a conservation easement (20 sites) or under a cooperative agreement (23 sites) and are being managed for prairie habitat (USFWS 2020). A number of countywide Habitat Conservation Plans and voluntary Safe Harbor Agreements with private landowners are in place for this species (USFWS 2023).

Overall, the strong majority of metapopulations (11 out of 15) are ranked in either high or moderate condition, indicating an appreciable degree of resiliency in metapopulations across the range of the species. Fender's blue butterfly exhibits metapopulation redundancy within and across each of the three recovery zones spanning the geographic range of the species. The presence of multiple highly and moderately resilient metapopulations distributed across the geographic range of the Fender's blue butterfly increases the likelihood that the species will be able to adapt to environmental changes as well as to withstand catastrophic events. We consider the Fender's blue butterfly to have representation across the known range of the species. Having multiple populations distributed across the range of the species, in a variety of habitat types and elevations, increases the adaptive capacity of Fender's blue butterfly and the ability of species to respond to environmental change (USFWS 2020).

The Fender's blue butterfly was reclassified from endangered to threatened with a section 4(d) rule in 2023. There has been a marked reduction in threats to the species posed by land conversion for agriculture and urbanization, heavy grazing, and invasion of prairies by non-native, invasive plants and by woody species, helped in large part by effective habitat restoration and management efforts in the Willamette Valley. Furthermore, threats identified at the time of listing, such as overcollection and predation, have not materialized as originally anticipated. Fender's blue butterfly metapopulations primarily rank in high to moderate condition throughout all three recovery zones established for the species within its historical range, exhibiting an appreciable degree of resiliency, redundancy, and representation such that the species is no longer currently in danger of extinction (USFWS 2023).

Threats within the foreseeable future are primarily due to loss and degradation of habitat, including impacts from habitat conversion, woody succession, and invasive plant species; the potential exposure of Fender's blue butterfly to herbicides or insecticides; and changes in vegetation composition due to climate change. Although the condition of Fender's blue butterfly has improved and threats to the species have been reduced relative to the time of listing, the species remains vulnerable due to the small size of many of its metapopulations, limited connectivity between metapopulations because of fragmentation and the reduced extent of native prairie habitats, and the relative rarity of its lupine host plants on the landscape. The viability of Fender's blue butterfly over the long term will therefore require addressing influences on viability including ongoing habitat conversion, loss of habitat disturbance resulting in habitat succession, invasion by non-native plants, and exposure to insecticides and herbicides, as well as continued conservation and management efforts (USFWS 2023).

The potential for exposure to pesticides (herbicides, insecticides) is an ongoing threat to the species throughout its range, due to the close proximity of Fender's blue butterfly occurrence sites to agricultural lands as well as areas subject to spraying to control gypsy moths or mosquitoes (USFWS 2020). Agricultural land is widely distributed throughout the Willamette Valley, more lands are being converted to agriculture, and pesticide use is generally occurring more now than at any other time in history. Because pesticides are used on most agricultural crops to increase crop yield and prevent disease spread, pesticide use in the Willamette Valley is likely to affect multiple metapopulations.

Protective regulations in the final 4(d) rule for the species are designed to help to regulate a range of human activities that have the potential to affect Fender's blue butterfly, including agricultural or urban development; certain agricultural practices (e.g., pesticide use); heavy levels of grazing; mowing; some practices associated with forestry (e.g., road construction); roadside maintenance activities; control of non-native, invasive plant species; and direct capture, injury, or killing of Fender's blue butterfly (USFWS 2023).

Overall Vulnerability: Low

Effects of the Action: Exposure

Overlap

Data indicates 63.1% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 38). Up to 15.7% of the species' range overlaps with methomyl use sites while 47.4% of the range that occurs off-field is likely to be exposed due to spray drift or runoff. Other orchards and vegetables and ground fruit are the use sites most prevalent within the species' range, with 20.2% and 19.8% overlap, respectively. However, overlap with other use sites may still contribute to the overall exposure of the species.

Usage

Past usage data indicates that up to 44.5% of the species range has been treated with methomyl annually (Table 38).

Table 38. Overlap and usage data for the Fender's blue butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0.4	2.4	2.8	<0.1	0.3	0.4
Citrus	NA	NA	NA	NA	NA	NA
Corn[36]	1.7	4.4	6.1	<0.1	0.2	0.3
Cotton	0	0	0	0	0	0
Other Grains	1.5	7.0	8.5	<0.1	0.3	0.4
Other Orchards	4.4	15.8	20.2	4.4	15.8	20.2
Other Row Crops	1.0	4.7	5.6	0.4	2.1	2.5

[36] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	6.8	13.0	19.8	6.8	13.0	19.8
Wheat	0	0	0	0	0	0.9
Total	**15.7**	**47.4**	**63.1**	**11.8**	**31.8**	**44.5**

Additional Exposure Consideration

Adult Fender's blue butterflies live only 7-14 days. Given its short adult lifespan, the Fender's blue butterfly has limited dispersal ability. Both male and female Fender's blue butterflies are estimated to disperse approximately 0.75 km if they remain in their natal lupine patch and approximately 2 km if they disperse between lupine patches (USFWS 2020).
The flight period for the Fender's blue butterfly is from April 15 to June 30 (USFWS 2023). During this period, adult females lay their eggs on larval host plants, including Kincaid's lupine (*Lupinus sulphureus spp. Kincaidii*), longspur lupine (*Lupinus arbustus*), or sickle-keeled lupine (*Lupinus albicaulis*). Newly hatched larvae feed exclusively on the host lupine plant for a short time and then enter an extended diapause (a period of suspended development) when the host lupine plant senesces in July, where they remain in the leaf litter at the base of the host plant through the fall and winter and become active again in March-April of the following year (though some may extend diapause for more than one season depending on the individual and environmental conditions). Once diapause is broken, the larvae feed and grow through three to four additional instars, enter their pupa stage to undergo metamorphosis, and emerge after about two weeks as adult butterflies between mid-April and the end of June (USFWS 2020).
We expect most methomyl applications within the species range will coincide with periods of peak larval and adult activity, indicating that exposure is likely to occur during critical periods of the species' life cycle.

Exposure Summary

There is a high extent of overlap between the action area and the species' range. While usage data indicates that a smaller proportion the range is likely to be treated with methomyl (up to 44.5% annually), we still consider this a high extent of exposure. As such, we anticipate a large number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Fender's blue butterfly has a high exposure ranking as there is a large extent of overlap between the species' range and the action area and we anticipate a large portion of the species' range is likely to be treated annually. Furthermore, we anticipate the timing of most methomyl applications will coincide with periods of peak adult and larval activity, indicating that exposure may be more likely to occur. The species also has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. Coupled with the high exposure ranking, we anticipate the overall risk of adverse effects to the species is high and anticipate a large number of individuals are likely to be adversely affected.

Preliminary Conclusion

Originally listed as endangered in 2000, the Fender's blue butterfly was reclassified as threatened in 2023 due to its improved status. It is currently distributed throughout its historic range, with 15 metapopulations across six counties in the Willamette Valley of Oregon (USFWS 2020). The majority of the 137 sites where the Fender's blue butterfly is known to occur are on public or private land with some form of protection and management of prairie and oak savannah habitats that support the species, and the distribution and separation of metapopulations provides for resiliency and redundancy. However, the long-term viability and recovery of the butterfly will require a number of actions, including ongoing and increased protection and management of suitable habitats and addressing on-going threats to the species, which include exposure to herbicides and insecticides (USFWS 2023).

The risk of methomyl to the species is anticipated to be high due to high overlaps of the species range with use sites, high anticipated usage, and high toxicity leading to mortality of exposed individuals. Additionally, the limited dispersal ability and short flight period of the Fender's blue butterfly reduce the likelihood that they will be able to recolonize extirpated sites, especially those sites greater than 2 km from existing populations. Individuals that can recolonize sites where the butterfly has been extirpated due to methomyl exposure will likely be at risk of the same fate (i.e., mortality from exposure). Further, suitable habitats with lupine plants that serve as hosts for the Fender's blue butterfly are a limiting factor for the species. Dispersing butterflies will only be able to reproduce if they reach sites with host lupine plants during their short flight periods and within their limited flight distances, limiting the likelihood that their use of other sites will compensate for the loss of butterflies exposed to methomyl. For these reasons, we anticipate the loss of a large number of individuals across the extensive overlapping portion of the species range with use sites where usage is anticipated is likely to reduce the reproduction, numbers, and distribution of the species.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Fender's blue butterfly:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Fender's blue butterfly by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Do not apply methomyl from two hours after sunrise until two hours before sunset on cucurbits and mint. Do not apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on chickpeas, dry beans, fresh beans, peas, and snap beans and all methomyl registered crops in the 'other orchards' UDL. We expect these mitigations to reduce on-field exposure.*

The PULA for the Fender's blue butterfly will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Fender's blue butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2023. Endangered and Threatened Wildlife and Plants; Reclassifying Fender's Blue Butterfly From Endangered to Threatened With a Section 4(d) Rule. Final Rule. January 12, 2023. Federal Register 88(8): 2006-2028.

U.S. Fish and Wildlife Service. 2020. Fender's Blue Butterfly (*Icaricia icarioides fenderi*) Species Status Assessment Report. Portland, Oregon. 121 pp + appendices.

Integration and Synthesis Summary: Saint Francis' satyr butterfly

Scientific Name:	Common Name:	Entity ID:
Neonympha mitchellii francisci	Saint Francis' satyr butterfly	455

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is estimated to be moderate, we anticipate low past usage of methomyl on use sites within the species' range (Figure 25). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Saint Francis' satyr butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 5/6/2021; Wherever found; *States within the range:* NC

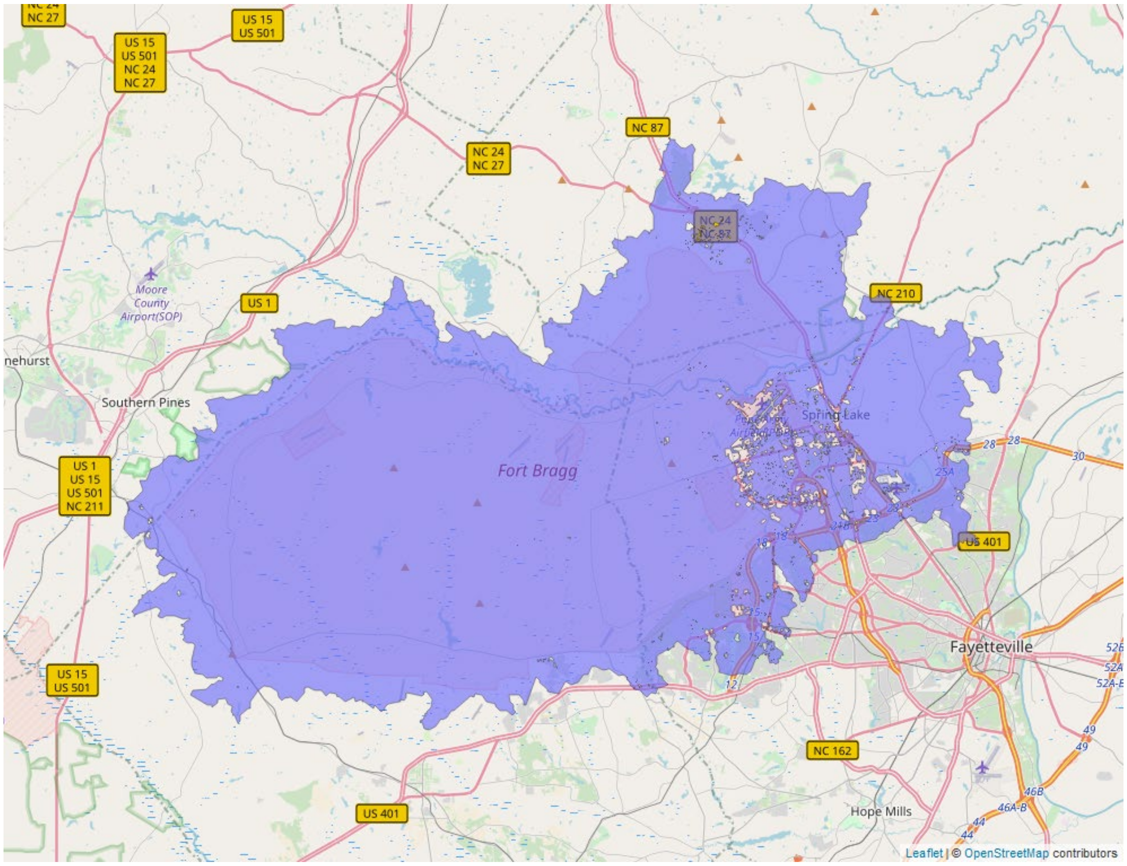

Figure 25. Range map of Saint Francis' satyr butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5419.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 5/22/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The historic range for Saint Francis' Satyr butterfly consists solely of the area currently known to be occupied by the species within Ft. Bragg. Despite extensive survey efforts, the butterfly has never been detected outside of Ft. Bragg. The current distribution is much reduced from the proposed historic range. At Ft. Bragg, there have been observations of both extinctions and new subpopulations. Outside artillery impact areas, the type of location discovered in 1983 now supports only occasional, apparently transient individuals. Of the two sites known in 1994, one currently supports a large subpopulation, and the other is inundated by beaver and unoccupied by butterflies. Since 2000, four additional subpopulations have been discovered, of which one is large, one is declining, and two have occasional transient individuals. Within artillery impact areas, the distribution of sites has changed as described above, and there are now thought to be seven large subpopulations. Thus, there are now known to be nine large and one declining subpopulations at Ft. Bragg.

As discussed in the 2020 5-Year Review, efforts are underway to augment existing populations at Ft. Bragg with releases of captive-reared adults. A limited number of adults were released in July and August 2009 at an unoccupied site in the northwest sector of Ft. Bragg in a pilot attempt to establish a new breeding population. In 2011, an experimental habitat restoration project created four additional sites to establish new subpopulations. Adults have been successfully released to these sites.

The distribution of Saint Francis' satyr at the local subpopulation level is most closely tied to grassy wetlands with numerous sedges that are created and maintained through a regular disturbance regime. The most influential disturbances for these sites are beaver impoundments, which create inundated regions highly favorable to sedge growth. Beavers, eliminated from North Carolina in the late 1800s, are now common on the landscape. Since beavers are also abundant outside of Ft. Bragg, there is potential for species' habitat creation or maintenance. Although there is a general policy of leaving beavers on Ft. Bragg, they are removed when they flood roads and become pests. Until the early 2000s, this was true even near Saint Francis' Satyr habitat. Now, Ft. Bragg is working to maintain beavers in watersheds where Saint Francis' Satyr is found and throughout the training lands. Disturbance from periodic fires also contributes to shaping SFS habitat. Fire resets succession, where grassy wetlands naturally succeed to shrub lands and then hardwood forest, although at the local level it can reduce Saint Francis' Satyr populations.

The primary threats to the Saint Francis' satyr at the time it was listed as endangered were overcollection and habitat loss. These threats remain relevant. In addition, small population size, limited dispersal ability and highly restricted distribution range make the butterfly highly vulnerable. Environmental stochasticity has always influenced population structure, although current habitat conditions persist under limited disturbance regimes, which greatly affect population fluctuations. With the elimination of natural controls to create wetlands and then prevent succession, suitable habitat has become much less prevalent and can be easily eliminated by small-scale, short-term environmental events. The few remaining subpopulations that constitute the metapopulation are under high pressure to act as source populations for new colonization.

In summary, past activities, including destruction and degradation of its wetland habitat in addition to alteration of natural disturbance regimes on which the species is dependent have impacted and continue to impact the species. Significant conservation efforts continue within its small range and include captive propagation and population supplementation and habitat restoration efforts, we anticipate similar activities and processes to occur in the future. Some activities, such as those associated with habitat restoration and the species existence on federal lands provide protection for the species. The species status is endangered, its life history and habitat requirements are still not well understood, and it persists within a very small range keeping it vulnerable to stochastic events (e.g., drought, wildfire) and management of the remaining habitat is limited by funding and access. Thus, the vulnerability of the species is high (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 14.2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 39). Up to 2.4% of the species' range overlaps with methomyl use sites while 12.2% of the range occurs off-field but may still be exposed to spray drift or runoff. Corn/soybean rotation and other grains use sites are the most prevalent within the species' range, with 8.6% and 2.6% overlap, respectively. However, overlap with other use types may still contribute to the overall exposure of the species.

Usage

Based on past usage data, we anticipate up to 1.3% of the species range will be treated with methomyl annually.

Table 39. Overlap and annual usage data for the Saint Francis satyr butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	<0.1	<0.1	<0.1	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn	0.7	4.9	5.6	<0.1	0.3	0.3
Cotton	0.3	1.8	2	<0.1	<0.1	0.1

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Grains	0.2	2.4	2.6	<0.1	<0.1	0.1
Other Orchards	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Row Crops	<0.1	0.4	0.4	<0.1	0.2	0.2
Soybeans[37]	1.5	7	8.6	<0.1	0.3	0.4
Vegetables and Ground Fruit	<0.1	0.3	0.3	<0.1	0.3	0.3
Wheat	NA	NA	NA	NA	NA	NA
Total	**2.4**	**12.2**	**14.2**	**0.1**	**2.4**	**1.3**

Additional exposure considerations

The Saint Francis' satyr butterfly is an early summer brooder and probably completes its development in less than 80 days, with pupation taking about 2 weeks of this time. The second brood probably overwinters in the fourth late larval instar as in the nominate subspecies (USFWS 2016 status of the species). First broods emerge about May 5th and are usually gone by June 6th; the second flight period runs from about July 26 to August 21st. Because the height of feeding and reproductive activities for this butterfly most likely occurs from May through August, it may be more vulnerable to the effects of methomyl during the larval and adult stages if applications are made at this time.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 0.85% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As

[37] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

There is a high extent of overlap between the species' range and the action area. Past usage data indicates that only a small portion of the species' range is likely to be treated with methomyl (up to 1.3% annually). This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage within the species' range. Given that the Census of Agriculture data is specific to the counties that the species' range occurs in and includes the usage of other insecticides besides methomyl, we expect it to represent an upper bound of methomyl usage within the range. Thus, we anticipate only a small portion of the range is likely to be treated annually. As such, we expect only a small number of individuals are likely to be exposed to methomyl as a result of the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Saint Francis' satyr butterfly has a low exposure ranking. While there is a high extent of overlap between the species' range and the action area (14.2% total overlap), we expect only a small portion of the species' range will be treated annually (up to 1.3% annually). Additional data from the USDA Census of Agriculture corroborates this low level of past usage as only a small portion of the species' range (0.85%) has been treated with any insecticide in the past. Thus, we anticipate only a small portion of the range is likely to be treated with methomyl, indicating only a small number of individuals are likely to be exposed.

The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. This high toxicity ranking, coupled with the low exposure ranking, indicates that a small number of individuals are likely to experience adverse effects. As such, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Saint Francis' satyr butterfly has a high vulnerability based on its status, distribution, and trends and we anticipate that any exposed individuals are likely to die. However, while there is a high extent of overlap between the species' range and the action area (14.2% total overlap), we expect only a small portion of the species' range will be treated (up to 1.3% annually). This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage within the species' range. In addition, the overlap information for this species is interpreted cautiously as the only known population of this species occurs on the Fort Liberty (previously Fort Bragg) Army installation in North Carolina and access to the occupied sites is highly restricted and not expected to contain agricultural use sites. Thus, we do not expect usage on or near any known extant sites.

Even though the vulnerability and toxicity are high for this species, the likelihood of exposure to methomyl is low. We anticipate that a very small number of individuals will be affected over the duration of the proposed action and do not expect species-level effects to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Saint Francis' satyr butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2020. Saint Francis' Satyr (*Neonympha mitchellii francisci*) 5-Year Review: Summary and Evaluation. Raleigh, North Carolina. 34 pp.

Integration and Synthesis Summary: Mount Hermon June beetle

Scientific Name:	Common Name:	Entity ID:
Polyphylla barbata	Mount Hermon June beetle	456

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range, and low past usage of methomyl within the species' range (Figure 26). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mount Hermon June beetle. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 6/6/2022; Wherever found; *States within the range:* CA

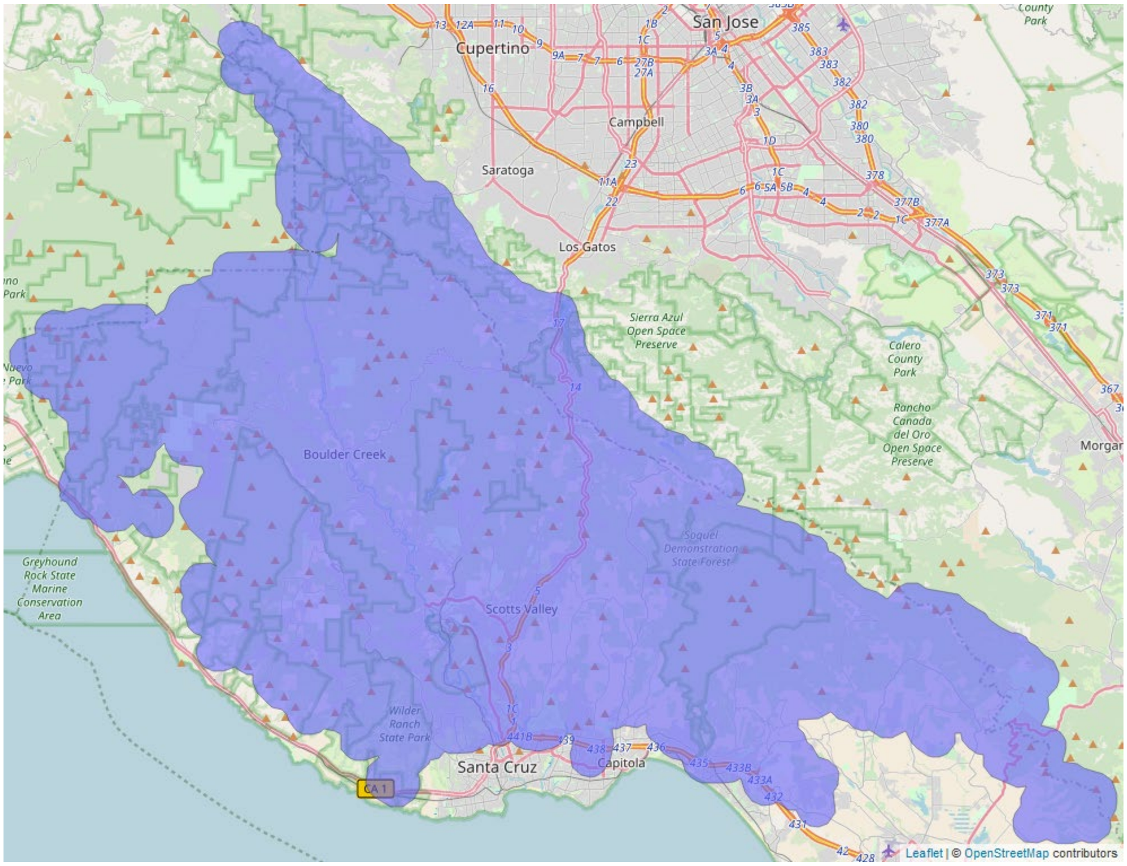

Figure 26. Range map of Mount Hermon June beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3982.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 4/26/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Mount Hermon June beetle is only known from the Zayante sandhills, including adjacent transitional soils, in Santa Cruz County, California. Adults and larvae have been found in oak woodlands, mixed hardwood forests, and other areas in or adjacent to Zayante soils, including degraded and developed areas (USFWS 2021). No populations occur on federal lands (USFWS 1984). This species spends the majority of its life cycle underground with seasonal activity (flight season when males and females emerge for mating purposes) documented to occur between May and mid-September (USFWS 2021). Activity is strictly crepuscular, with males emerging at dusk and flying low over the ground or brush. Females are flightless and emerge from burrows in the soil only to mate, after which they immediately return underground. Most of the life cycle is spent in larval stages where the subterranean larvae feed on plants.

Populations appear to fluctuate over time in response to factors such as, but not limited to, temperature, precipitation, moon phase, extent of light-shed during trapping, and potentially whether the presence of a female is near a trap emitting pheromones that may attract a disproportionate number of adults (USFWS 2021). Larvae of this species are believed to be generalists, foraging on multiple species, mostly on root shoots, subterranean stem material and fungal mycorrhizae (USFWS 2009). Because of limited data and the many drivers of beetle numbers, the population trend is characterized as uncertain rather than stable (USFWS 2021).

The primary threat at the time of listing was habitat destruction due to sand mining (USFWS 1998). Much of the historical habitat for the species was destroyed by mining and remaining habitat has been degraded and heavily fragmented. Based on current research, it appears that efforts to restore degraded habitat have not been successful. Mining activity has been reduced since the species was listed, and many of the quarries are either closed or nearing closure. However, approximately 80% of the original 405 ha (1,000 ac) of sand parkland has already been destroyed, much of which was directly due to mining. As a result, even minor losses of the remaining habitat are now important to the future status of the species. Early mines did not require habitat conservation measures, and three of the six mines operated in sandhills habitat were closed and left as is with no habitat restoration or revegetation attempted. Where restoration of sandhills habitat has been attempted, it has met with limited success (USFWS 2009). Residual effects from mining, including habitat fragmentation, also pose a serious challenge to future conservation efforts.

Alteration of habitat due to suppression of natural fire cycles is now the predominant threat preventing the recovery of the species. Fire suppression continues throughout the Santa Cruz sandhills, and conversion of habitat is widespread. Introduction of fast-growing and hardy non-native species has exacerbated this problem. In our 2009 5-Year Review, we refer to an expert who believes that populations of this species are in a state of decline and that the reduction in available habitat due to successional processes is now largely to blame. While the foremost threat to sandhills habitat identified at the time of listing, sand mining, has been much reduced, habitat is still being lost via this mechanism and other threats have become more severe. Habitat conversion in the sandhills due to the suppression of natural disturbance factors, such as fire, is a continuing threat to sandhills habitat. Conversion of the patch mosaic created by episodic fires to a uniform habitat “frozen” in a late successional stage will eliminate necessary habitat for many species, including this species and other listed species endemic to the Zayante sandhills (USFWS 2009).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 0.9% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 40). Approximately 0.1% of the species' range overlaps with methomyl use sites and 0.8% of the range that occurs off-field is likely to be exposed to spray drift or runoff.

Table 40. Overlap data for the Mount Hermon June beetle. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	0.1	0.1
Citrus	<0.1	<0.1	<0.1
Corn[38]	<0.1	<0.1	<0.1
Cotton	<0.1	<0.1	<0.1
Other Grains	<0.1	0.3	0.3
Other Orchards[39]	<0.1	0.1	0.2
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	0.2	0.2
Wheat	0	0	0
Total	**0.1**	**0.8**	**0.9**

[38] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[39] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Usage

Mandatory reporting data from the state of California (Table 41) indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 3.3%. Up to 3.0% of the species' range has been treated with any insecticide annually, and up to 0.2% of the species' range has been treated with methomyl annually. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 41. Annual percent of the Mount Hermon June beetle's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
3.3	3.0	0.2

Additional exposure considerations
Mount Hermon June beetles spend the majority of their lives as larvae, which live underground and feed on plant roots. As such, we anticipate larval exposure to methomyl through as soil contact is not considered a major route of exposure for methomyl (see the General Effects to Invertebrates for additional details). Adults emerge for one to two months in the summer to reproduce. Males are strong fliers and will travel in search of females, who remain just below the surface in burrows. Methomyl applications may coincide with these periods of adult activity, indicating that exposure may occur, particularly for adult males traveling in search of mates. The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low of insecticides in general were used within the counties where the species' range occurs, with only 1.2% of the species' range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Given that larvae and adult female beetles primary live under ground, we anticipate only adult males that emerge in search of mates are likely to experience methomyl exposure. A small portion of the species' range will be exposed to methomyl given the low overlap between the action area and the species' range. Mandatory pesticide usage reporting data from the state of California confirms very little of the species' range has been treated with methomyl in recent years. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage in general within the species' range, further indicating a low likelihood of individuals experiencing methomyl exposure. As such, while adult males may be active during periods where methomyl is likely to be used, we anticipate only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as the plants it relies on for food or habitat (such as plant roots that larvae feed on) are not expected to experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-202119, with 3.0% insecticide usage and 0.2% methomyl usage reported in the same period. The Mount Hermon June beetle has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur. As such, we anticipate the risk of adverse effects to the species is low and that only a small number of individuals are likely to experience any adverse effects from the proposed action.

Conclusion

The Mount Hermon June beetle is listed as endangered and is a narrow endemic species that exists in Santa Cruz County, California. They spend the majority of their life cycle as subterranean larvae when they are generalist herbivores. The primary threat to the species has been habitat loss and degradation, historically from mining activities. More recently, the species is threatened by fire suppression, which prevents species' recovery.

Methomyl use sites overlap with a very small portion (0.9%) of the Mount Hermon June beetle's range, indicating a low potential for exposure. In addition, mandatory pesticide usage reporting data from the state of California confirms low insecticide usage overall (3.0% of the species' range annually), further indicating a low likelihood of individuals experiencing methomyl exposure. As such, we anticipate, at most, a small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mount Hermon June beetle in the wild.

References

U.S. Fish and Wildlife Service. 2021. Zayante band-winged grasshopper (*Trimerotropis infantilis*) and Mount Hermon June beetle (*Polyphylla barbata*) 5-Year Review: Summary and Evaluation. Ventura, California. 19 pp.

U.S. Fish and Wildlife Service. 2009. Zayante band-winged grasshopper (*Trimerotropis infantilis*) and Mount Hermon June beetle (*Polyphylla barbata*) 5-Year Review: Summary and Evaluation. Ventura, California. 33 pp.

U.S. Fish and Wildlife Service. 1998. Recovery Plan For Insect and Plant Taxa from the Santa Cruz Mountains in California. Portland, Oregon. 83 pp.

Integration and Synthesis Summary: Ohlone tiger beetle

Scientific Name:	Common Name:	Entity ID:
Cicindela ohlone	Ohlone tiger beetle	457

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure due to low overlap and low past usage of methomyl on use sites within the species' range (Figure 27). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Ohlone tiger beetle. We discuss our rationale for the species in the sections below.

Species range

Last updated: 9/22/2021; Wherever found; *States within the range:* CA

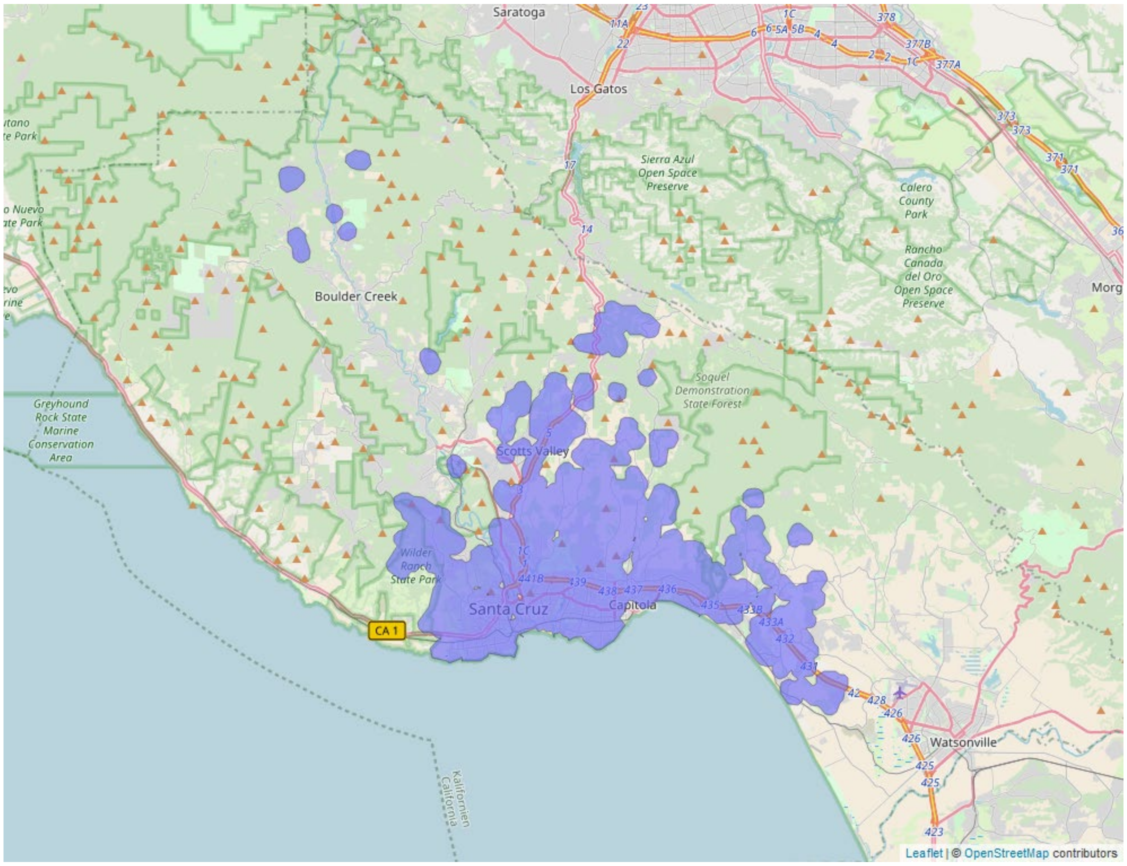

Figure 27. Range map of Ohlone tiger beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8271.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 11/6/2019

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Ohlone tiger beetle is endemic to Santa Cruz County, California, where it is known only from coastal terraces supporting patches of native grassland habitat. Ohlone tiger beetle habitat is associated with either Watsonville loam or Bonnydoon soil types, both of which are characterized by shallow, pale, poorly drained clay, or sandy clay soil that bakes to a hard crust by summer, after winter and spring rains cease. Adult beetles are typically found along trails or barren areas among low, sparse vegetation within the grassland habitat. Ohlone tiger beetles require these open areas for construction of larval burrows, thermoregulation, and foraging. The density of burrows decreases with increasing vegetation cover (USFWS 2009, 2019).

At the time of listing in 2001, 16 occurrences of the Ohlone tiger beetle were known from five geographic areas. At the time of our 2009 5-Year Review, nine previously known occurrences were not detected and were thought to be extirpated, a decline of 56%, and the seven remaining occurrences were distributed in only three geographic areas. Our 2019 5-Year Review now reports 8 of the occurrences have been confirmed or assumed to be present, while the 8 remaining sites are thought to be extirpated or potentially extirpated (Note: surveys are not routinely conducted at all previously known locations). The 2019 5-Year Review notes that although a large portion of prior occurrences are considered to be potentially extirpated, the potential for recolonization is high, as most of these locations have not been lost to development, rather, only need consistent management in the form of grazing, mowing, or other habitat manipulation techniques.

Threats to the Ohlone tiger beetle include habitat fragmentation and destruction due to urban development, habitat degradation due to invasion of non-native plants, potential threats due to collection, pesticides, and recreational use of habitat, and vulnerability to random local extirpations continue to imperil the continued existence of this species. In particular, encroachment by non-native plants has become a much more serious threat since the species was listed. Much of the habitat of this species is suitable for development and is unprotected from these threats (USFWS 2009, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 3.6% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 42). Up to 0.4% of the species' range overlaps with methomyl use sites, specifically in the category of other orchards. Up to 3.2% of the range occurs in off-field areas that may be exposed to spray drift. Vegetables and ground fruit is the predominant use site with an overlapping spray drift zone, making up almost half of the total overlap. However, overlap with spray drift from other use sites is also likely to contribute to the overall exposure of the species.

Table 42. Overlap data for the Ohlone tiger beetle. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0	0.3	0.3
Citrus	0	0	0
Corn[40]	0	0.2	0.2
Cotton	0	0	0
Other Grains	0	0.7	0.7
Other Orchards[41]	0.4	0.5	1
Other Row Crops	0	<0.1	<0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	0	1.5	1.5
Wheat	NA	NA	NA
Total	**0.4**	**3.2**	**3.6**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 4.6% (Table 43). Up to 4.2% of the range has been treated annually with any insecticide while 0.6% of the range has been treated annually with methomyl in that same time period. Based on this reporting data, we anticipate low levels of methomyl usage in the species' range.

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40 We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

41 We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Table 43. Annual percent of the Ohlone tiger beetle range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
4.6	4.2	0.6

Additional exposure considerations

The Ohlone tiger beetle habitat consists of small patches of grassland and coastal terrace prairies. Both adult and larval Ohlone tiger beetles are found where grasses are low and sparse enough to leave bare ground. Trails and trampled areas appear to be especially attractive to the Ohlone tiger beetle. These soil conditions appear to be critical for oviposition, burrow creation, and the burrow environmental conditions necessary for larval Ohlone tiger beetles. Larval development occurs in an underground burrow and can last 1 to 4 years, during which time we do not expect the larva will be exposed to pesticides. Adult Ohlone tiger beetles are active and reproduce from late January to early April. The Ohlone tiger beetle preys on small arthropods such as spiders and ants. Both adults and larvae are carnivorous and will prey upon other insects.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 2.31% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range overlaps with the action area (3.6% total overlap). Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with only a small portion of the species' range having been treated with methomyl (up to 0.6% annually). This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage in general within the species range. While past usage data indicate a low level of overlap and usage that will result in individuals being exposed to methomyl, changes in pesticide usage patterns in the future may result in increased risk of exposure. However, we expect that a small number of individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas and low anticipated usage within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

Because insects taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of the insects in these areas, but not eliminate the prey base in these portions of the range. Adverse effects to the insect community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Risk Summary

The Ohlone tiger beetle has a low exposure ranking. There is a low extent of overlap between the species' range and the action area (3.6% total overlap) and state-mandated pesticide usage reporting data indicates that only a small portion of the species' range has been treated with methomyl between 2012-2021 (up to 0.6% treated annually). Furthermore, larvae spend their time burrowed underground and are likely protected from methomyl exposure through their development. The Ohlone tiger beetle has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. We anticipate the species will experience indirect effects through the loss of arthropod prey as well. However, given that the species has a low exposure ranking, we anticipate only a small number of individuals are likely to be exposed and experience these effects. Thus, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Ohlone tiger beetle is an endangered species endemic to just one county in California, Santa Cruz County, where it is confirmed or assumed to be present at only 8 sites, down from 16 at the time of listing. It is found on coastal terraces supporting patches of native grassland habitat. Threats to the species include habitat fragmentation and destruction due to urban development, habitat degradation due to invasion of non-native plants, potential threats due to collection, pesticides, and recreational use of habitat, and vulnerability to random local extirpations.

Methomyl use sites and spray drift areas overlap with 3.6% of the Ohlone tiger beetle's range. Past usage data indicates that up to 4.2 % of the range has been treated with any insecticide annually, with 0.6% of the range treated with methomyl. This indicates a low level of methomyl exposure. As such, we anticipate a small number of individuals are likely to experience exposure in a small portion of the species range from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Ohlone tiger beetle in the wild.

References

U.S. Fish and Wildlife Service. 2019. 5-Year Review Ohlone Tiger Beetle (*Cicindela ohlone*). Ventura, California. 5 pp.

U.S. Fish and Wildlife Service. 2009. Ohlone Tiger Beetle (*Cicindela ohlone*) 5-Year Review: Summary and Evaluation. Ventura, California. 27 pp.

Integration and Synthesis Summary: Zayante band-winged grasshopper

Scientific Name:	Common Name:	Entity ID:
Trimerotropis infantilis	Zayante band-winged grasshopper	458

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a low overlap and usage within the species' range (Figure 28), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Zayante band-winged grasshopper. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 1/31/2022; Wherever found; *States within the range:* CA

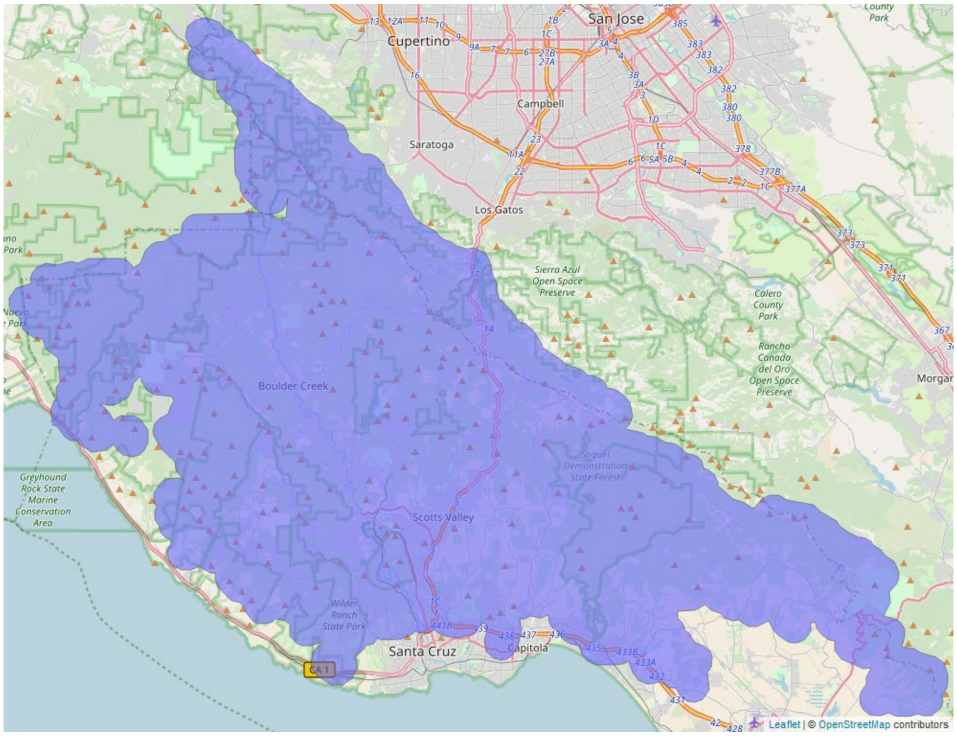

Figure 28. Range map of Zayante band-winged grasshopper (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1036.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 4/26/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Zayante band-winged grasshoppers are found in the Zayante sandhills in Santa Cruz, California. They feed on plants including the silver bush lupine (*Lupinus albifrons*), which is >60% of their diet. Female oviposit eggs directly into loose, sandy soil and they overwinter there. Nymphs begin to appear in May and the first adults appear in June. Adults may live for over a month and are often found on sandy soils or lupine plants. Their flight season is from June to November. Populations are found between the communities of Mt. Hermon to the south, Bonny Doon to the west, Scotts Valley to the east, and Quail Hollow County Park to the north (USFWS 2021). A lack of consistent monitoring efforts makes interpretation of population trends speculative, but they are believed to be declining based on results of survey data. At least three populations are believed to be extirpated. The closest reliable measure that can be used to infer population trends for this species is related to available habitat. Sand parkland habitat has been reduced by approximately 80% over a 60-year period (USFWS 2009).

The primary threat to the species at the time of listing was habitat destruction due to sand mining (USFWS 1998). Much of the historical habitat for the species was destroyed by mining and the remaining habitat has been degraded and heavily fragmented. Mining activity has been reduced since the species was listed, and many of the quarries are either closed or nearing closure. However, approximately 80% of the original 405 ha (1,000 ac) of sand parkland has already been destroyed, much of which was directly due to mining. As a result, even minor losses of the remaining habitat are now important to the future status of the species. Early mines did not require habitat conservation measures, and three of the six mines operated in sandhills habitat were closed and left as is with no habitat restoration or revegetation attempted. Where restoration of sandhills habitat has been attempted, it has met with limited success (USFWS 2009). Residual effects from mining, including habitat fragmentation, also pose a serious challenge to future conservation efforts.

Alteration of habitat due to suppression of natural fire cycles is now the predominant threat preventing the recovery of the species. Fire suppression continues throughout the Santa Cruz sandhills, and conversion of habitat is widespread. Introduction of fast-growing and hardy non-native species has exacerbated this problem. We refer to a species expert in our 2009 5-year review who believes that the Zayante band-winged grasshopper is declining and that the reduction in available habitat due to successional processes is now largely to blame. Rates of annual encroachment were estimated to be around 0.8% annually and will reduce remaining "islands" of open habitat quickly. As these successional processes continue, increased habitat fragmentation, reduction in fragment sizes, and declines in numbers of individuals and populations will increase the risk of stochastic extinction events, further reducing chances for recovery of this species (USFWS 2009, 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.9% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 44). Up to 0.1% of the species' range overlaps with methomyl use sites while 0.8% of the range occurs off-field but may still be exposed to spray drift or runoff.

Table 44. Overlap data for the Zayante band-winged grasshopper. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	<0.1	0.1	0.1
Citrus	<0.1	<0.1	<0.1
Corn[42]	<0.1	<0.1	<0.1
Cotton	<0.1	<0.1	<0.1
Other Grains	<0.1	0.3	0.3
Other Orchards[43]	<0.1	0.1	0.2
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	0.2	0.2
Wheat	NA	NA	NA
Total	**0.1**	**0.8**	**0.9**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 3.3% (Table 45). Up to 3.0% of the range has been treated annually with any insecticide while 0.2% of the range has been treated annually with methomyl in that same time period. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

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42 We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

43 We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Table 45. Annual percent of the Zayante band-winged grasshopper's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
3.3	3.0	0.2

Additional exposure considerations

The flight season of the Zayante band-winged grasshopper extends from late May through August with peak activity during July and August. Eggs over-winter in the soil and nymphs begin to appear in May, with first adults appearing in June. Applications of methomyl are likely to occur during this period of peak activity, indicating that methomyl usage is likely to result in exposure to individuals.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 1.2% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff (0.9% total overlap). Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with only up to 0.2% of the range treated annually with methomyl. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage in general within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as the plants it relies on for food or habitat (such as the silver lupine, *Lupinus albifrons*) are not expected to experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Zayante band-winged grasshopper has a low exposure ranking. There is a low extent of overlap between the species' range and the action area (0.9% total overlap) and state mandated pesticide usage reporting data indicates that only a small portion of the species range is likely to be treated (up to 0.2% treated annually with methomyl and 3.0% treated annually with any insecticide). The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. However, when coupled with the low exposure ranking, we anticipate only a very small number of individuals, at most, are likely to die. As such, we anticipate the risk of adverse effects to the species is low.

Conclusion

The Zayante band-winged grasshopper is listed as endangered and is a narrow endemic species that exists in Santa Cruz County, California. Eggs overwinter in loose, sandy soils before nymphs appear in May and adults appear in June. They are herbivores and rely on sliver bush lupine primarily. The primary threat to the species has been habitat loss and degradation, historically from mining activities. More recently, the species is threatened by fire suppression, which prevents species' recovery. Considering information about the species status, we have determined that the species has a high vulnerability.

Methomyl use sites overlap with a very small portion (0.9%) of the Zayante band-winged grasshopper's range, indicating a low potential for exposure. In addition, mandatory pesticide usage reporting data from the state of California confirms low insecticide usage overall (3.0% annually), further indicating a low likelihood of individuals experiencing methomyl exposure. As such, we anticipate, at most, a small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Zayante band-winged grasshopper in the wild.

References

U.S. Fish and Wildlife Service. 2021. Zayante band-winged grasshopper (*Trimerotropis infantilis*) and Mount Hermon June beetle (*Polyphylla barbata*) 5-Year Review: Summary and Evaluation. Ventura, California. 19 pp.

U.S. Fish and Wildlife Service. 2009. Zayante band-winged grasshopper (*Trimerotropis infantilis*) and Mount Hermon June beetle (*Polyphylla barbata*) 5-Year Review: Summary and Evaluation. Ventura, California. 33 pp.

U.S. Fish and Wildlife Service. 1998. Recovery Plan for Insect and Plant Taxa from the Santa Cruz Mountains in California. Portland, Oregon. 98 pp.

Integration and Synthesis Summary: Carson wandering skipper

Scientific Name:	Common Name:	Entity ID:
Pseudocopaeodes eunus obscurus	Carson wandering skipper	462

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is estimated to be moderate, we anticipate low past usage of methomyl on use sites within the species' range (Figure 29). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Carson wandering skipper. We discuss our rationale for the species in the sections below.

Species range

Last updated: 7/16/2021; Wherever found; *States within the range:* CA, NV

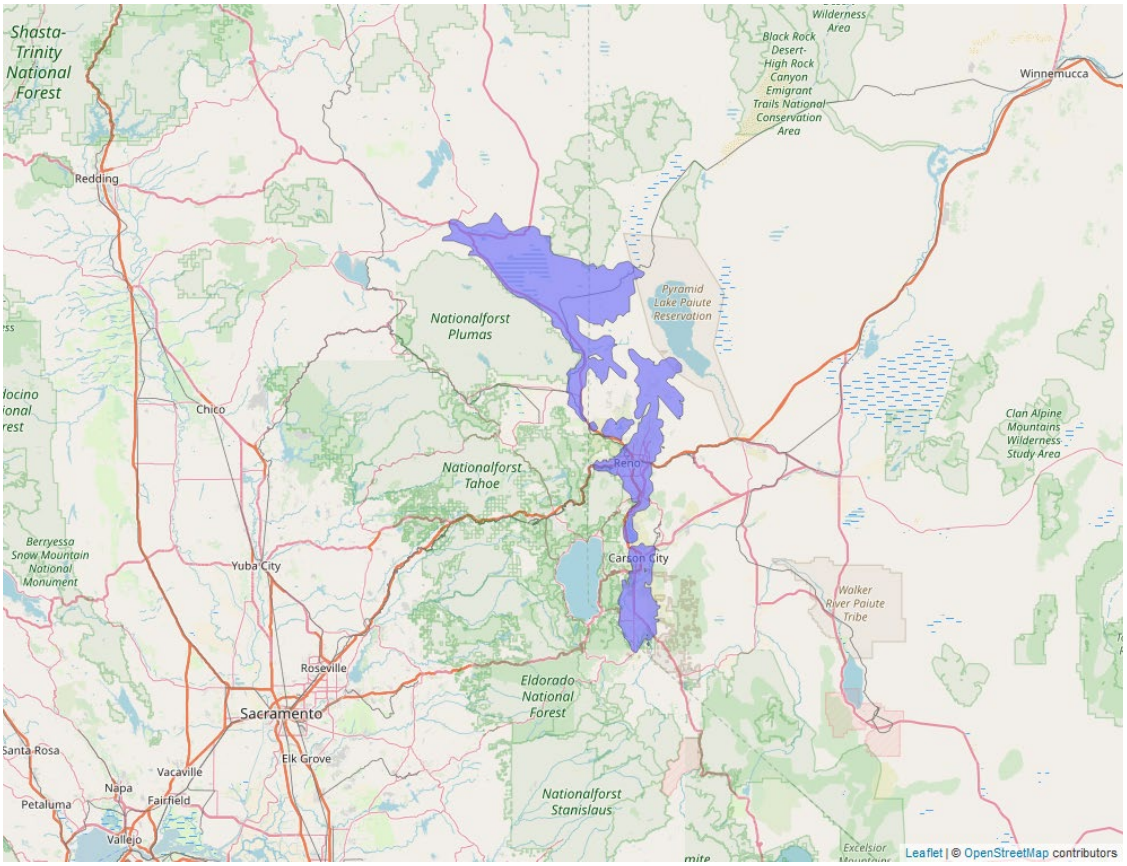

Figure 29. Range map of Carson wandering skipper (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/674.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/17/2022

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

At the time of listing in 2001, only two Carson wandering skipper populations were known, one in Washoe County, Nevada, and one in Lassen County, California. In 2004, a population was located in Douglas County, Nevada. An additional population discovered in Washoe County in 2005 (Spanish Springs Valley Site #2B) was subsequently determined as likely to be extirpated due to habitat loss and modifications that have occurred in the surrounding area from residential and commercial development. Many additional occupied sites have been found around Honey Lake associated with the Lassen County population. At this time, there are three extant populations (Warm Springs Valley # 1 located on Bureau of Land Management and private lands, Carson River, and Lassen County) and two extirpated populations (Carson City and Spanish Springs Valley).

In 2014, a Conservation Strategy for Honey Lake was completed as a requirement of section 7 consultation for property conveyance of Honey Lake from the U.S. Department of the Army to California State Lands Commission. Though the intent was to provide management objectives, conservation strategies, and monitoring to protect the Carson wandering skipper and its habitat at Honey Lake, we have no information demonstrating implementation of this strategy.

While known Carson wandering skipper populations and distribution have increased since listing, all populations remain at risk. In addition, the loss of the Spanish Springs population further reduces the opportunity for connectivity between remaining populations. While surveys of extant populations continue, we do not have an assessment of trend to understand what the variability in numbers over time means. Current threats to these populations are primarily due to development, non-native plant invasion, livestock grazing, recreational activities (e.g., off-road vehicles use), and small and restricted population vulnerabilities (USFWS 2021, 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 15.3% of the species range will overlap with methomyl use sites or is likely to be exposed by off-site transport within the action area (Table 46). Up to 4.7% of the species' range overlaps with methomyl use sites while 10.6% of the range occurs off-field but may still be exposed to spray drift or runoff. Alfalfa, vegetables and ground fruit, and other grains are the use sites that are the most prevalent within the species' range, with 10%, 0.9%, and 3.9% overlap, respectively. However, overlap with other use sites can still contribute to the overall exposure of the species.

Usage

Anticipated usage indicates 2.7% of the range is treated specifically with methomyl.

Table 46. Overlap and usage data for the Carson wandering skipper. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	3.7	6.4	10	0.5	1	1.5
Citrus	0	0	0	0	0	0
Corn[44]	<0.1	0.3	0.4	0	0	0
Cotton	<0.1	<0.1	<0.1	0	0	0
Other Grains	0.7	3.2	3.9	<0.1	0.2	0.2
Other Orchards [45]	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Other Row Crops	<0.1	<0.1	<0.1	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0.2	0.7	0.9	0.2	0.7	0.9
Wheat	NA	NA	NA	NA	NA	NA
Total	**4.7**	**10.6**	**15.3**	**0.8**	**1.9**	**2.7**

Additional exposure considerations

Little is known about the Carson wandering skipper biology. Carson wandering skipper larvae feed solely on succulent, green leaves of saltgrass from March through June to complete its life

[44] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[45] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

cycle. After several instar stages, the pupae emerge as adults in May or June. The life span of an adult is 1 to 2 weeks, but they may live longer where abundant nectar sources exist. Carson wandering skippers produce only one brood per year during the June to mid-July flight season (USFWS 2007). Because the height of feeding and reproductive activities for this butterfly occurs from March through June or July, it may be more vulnerable to the effects of methomyl during the larval and adult stages if applications are made at this time.

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 1.4% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

There is a high extent of overlap between the action area and the species' range (15.3%). While the Carson wandering skipper may be more susceptible to pesticide exposure during most of its life cycle, pesticide usage reporting data indicates that up to 2.7% of areas within the species' range have been treated with methomyl in recent years. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage, in general, within the species' range. Given that the Census of Agriculture data is specific to the counties where the species' range occurs in and includes the usage of other insecticides besides methomyl, we expect this to be an upper limit of methomyl usage and anticipate only a small portion of the range is likely to be treated annually. As such, we expect only a small number of individuals are likely to be exposed to methomyl as a result of the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any plant species that the species is reliant on for food (nectaring plants for adults or host plants for larvae) or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Carson wandering skipper has a low exposure ranking. While there is a high extent of overlap between the species' range and the action area (15.3% total overlap), we expect a low level of usage within the species' range (up to 2.7% annually treated). This low level of past usage is corroborated by the USDA's Census of Agriculture data, which shows low levels of insecticide usage, in general, within the species' range (1.4% range treated with any insecticide). As such, we anticipate only a small portion of the species' range is likely to be treated over the duration of the proposed action, and only a small number of individuals are likely to be exposed.

The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. Coupled with the low exposure ranking, we anticipate that a small number of individuals are likely to die. As such, we determine that the risk of adverse effects to the species is low.

Conclusion

The Carson wandering skipper is an endangered species that exists in three distinct population clusters in Nevada and California. Two other Nevada populations have been extirpated since 2005, reducing the overall number of individuals of the species and the connectivity amongst remaining populations. The major threat to the species is habitat loss, and while a conservation strategy exists for one of the extant populations, we have no information about the implementation of this plan. The vulnerability for this species remains high.

We expect a large area (15.3%) of the Carson wandering skipper's range to overlap with the action area. Up to 4.7% of the species range overlaps with methomyl use sites, while 10.6% of the range is exposed to spray drift or runoff. Several use sites—alfalfa, vegetables, ground fruit and other grains—are prevalent in the species' range but overlap with other use sites can contribute to the overall exposure of the species. Anticipated usage data indicates that up to 2.7% of the range is treated specifically with methomyl. We anticipate that exposure to methomyl will occur through spray drift throughout a large portion of the species range, including during the main feeding and reproductive periods in the species' life cycle. However, data from the 2017 Census of Agriculture indicate that only 1.4% of the species range was treated with any insecticides. Given that methomyl is only one of a number of insecticides used to treat the area, there is likely even a lower level of methomyl used in the past. Toxicity is high and is likely to result in mortality for all individuals exposed; however, based on the low extent of exposure, we expect a small number of individuals to be exposed.

Considering the high vulnerability of the species, low level of exposure, and the small number of individuals expected to come into contact with the chemical, we do not expect species-level effects are likely to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Carson wandering skipper in the wild.

References

U.S. Fish and Wildlife Service. 2022. Carson Wandering Skipper (*Pseudocopaeodes eunus obscurus*) 5-Year Review. Reno, Nevada. 14 pp.

U.S. Fish and Wildlife Service. 2012. Carson Wandering Skipper (*Pseudocopaeodes eunus obscurus*) 5-Year Review: Summary and Evaluation. Reno, Nevada. 44 pp.

U.S. Fish and Wildlife Service. 2007. Recovery Plan for the Carson Wandering Skipper (*Pseudocopaeodes eunus obscurus*). Sacramento, California. 105 pp.

Integration and Synthesis Summary: Hawaiian picture-wing fly

Scientific Name:	Common Name:	Entity ID:
Drosophila heteroneura	Hawaiian picture-wing fly	1249

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 30). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian picture-wing fly (*D. heteroneura*). We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 3/6/2017; Wherever found; *States within the range:* HI

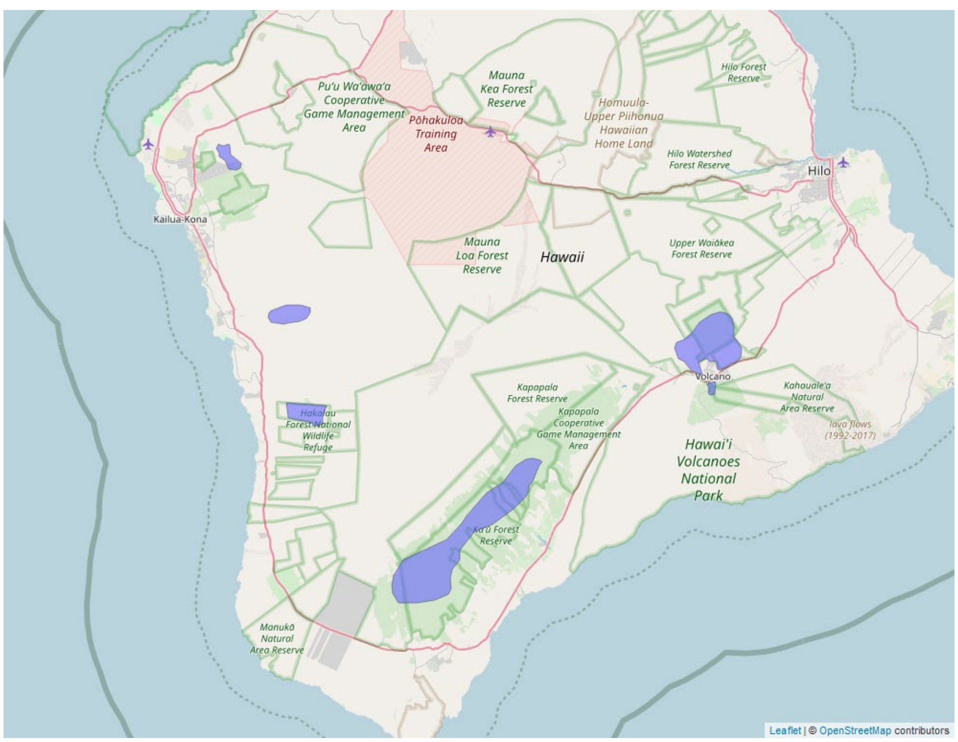

Figure 30. Range map of Hawaiian picture-wing fly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7895.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/29/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

This species of picture-wing fly is endemic to the island of Hawaiʻi and has experienced a dramatic population decline over the last 30-40 years. Historically, *Drosophila heteroneura* was recorded from 24 localities on four of the island's five volcanoes (Hualalai, Mauna Kea, Mauna Loa, and Kilauea) in five different mesic to wet montane environments (USFWS 2012). The species was thought to be extinct in the late 1980s, but an extremely small population was rediscovered in 1993 on private land at Hualalai Volcano (USFWS 2006). This species was not observed again until 1998 when eight individuals were observed. In 1999, a *D. heteroneura* population was recorded at the National Wildlife Refuge South Kona Hakalau Forest unit where over 134 individuals were observed between 1999-2001. Based on the most recent surveys conducted in 2009, 2010, and 2011, the species is currently known from only one location on the island of Hawaiʻi, though most of the historic areas have not been surveyed in the last 20 years. The known population occurs in mesic montane habitat in the Kukuiopaʻe area of the South Kona Forest Reserve. The number of individuals in this population is unknown (USFWS 2020).

Adult picture-wing flies are generalist microbivores (microbe eating) and feed upon decomposing plant material. Females oviposit (lay their eggs) primarily in decaying stems and bark of *Clermontia* spp. and *Delissea* spp. (ʻōhā), though it has been reported from decaying bark of *Cheirodendron* spp. Breeding generally occurs year-round, but egg laying and larval development increase following the rainy season as the availability of decaying matter, which picture-wing fly larvae feed on, increases in response to heavy rains. The larvae complete development in the decaying tissue before dropping to the soil to pupate. Pupae develop into adults in approximately one month, and adults sexually mature about one month later. Adults live for 1 to 2 months.

On January 5, 2009, the Final Rule establishing Critical Habitat for *D. heteroneura*, went into effect. Five Critical Habitat management units totaling 4,582 acres (855 ha) have been designated for *D. heteroneura* on federal, state, and privately managed lands on the island of Hawaiʻi. Conservation and management strategies for these state-owned forest reserves, Service-owned national wildlife refuge, and National Park Service-owned national park units include reducing the risk of wildfire, ungulate control through fencing and hunting, and protection of *D. heteroneura* larval host plants (USFWS 2012).

The primary threats to the species, its plant hosts, and its habitat include: habitat degradation and destruction, non-native ungulates and plants, drought, fire, predation, parasitism, competition for breeding resources, inadequate regulatory mechanisms to address non-native species, natural disasters, limited numbers of populations and individuals, potential environmental changes, and the interaction of these threats. A loss or decrease in host plant resources and degradation of habitat that meets the fly’s humidity needs and supports the decay cycle of the plant host threaten the existence of *D. heteroneura.* Climate change will significantly impact the life cycle characteristics of *D. heteroneura* and the range of its host plants. The fly’s host plant species are also threatened by herbivory and trampling by non-native vertebrates (goats, pigs, etc.) (USFWS 2020). The fly’s host plant species are also threatened by herbivory and trampling by non-native vertebrates (goats, pigs, etc.).

Large populations of *Clermontia* spp., a host plant of *D. heteroneura*, have reestablished on the northeastern slopes of Mauna Loa near Puʻu Makaʻala and Kulani in the wet montane ʻohiʻa forest since ungulate fencing was installed. The host plants occur as understory vegetation beneath the canopy of ʻohiʻa and koa trees. Historically, *D. heteroneura* is known from the northeastern slopes of Mauna Loa, though no recent surveys for the species have been conducted in this area. The presence of large populations of host plants provides an important resource for reestablishment of *D. heteroneura* (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 1% of the species’ range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 47). Up to 0.3% of the species’ range occurs on methomyl use sites while 0.7% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 47. Overlap data for the Hawaiian picture-wing fly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	0.3	0.7	1.0

Usage

Past methomyl usage data in Hawaiʻi is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawaiʻi were treated with insecticides, with methomyl presumably being among these insecticides.
Additional Exposure Considerations
The fly-bait methomyl use is limited to applications around livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters. The fly baits can be used as a perimeter scatter bait, placed in bait stations (hung at least 4 feet high), or mixed with water to form a paste which can be brushed onto walls, windowsills, and support beams of outdoor livestock houses. While the fly-bait does contain a fly specific pheromone, muscamone, the footprint for this use is limited in scope and not likely a significant exposure pathway of methomyl (see BE Appendix 4-5). Because *D. heteroneura* is found in mesic to wet montane environments in the Kukuiopaʻe area of the South Kona Forest Reserve, we do not anticipate it will be found in the vicinity of where the methomyl fly-bait will be applied.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. We don't expect the fly-bait applications for methomyl will be used within the vicinity of the preferred habitat for *D. heteroneura* (i.e., mesic to wet montane environments) within the forest reserve area where it is currently known. Thus, exposure from this methomyl use type is not anticipated. As such, we anticipate only a small number of individuals are likely to experience exposure and thus determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as native host plants) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Hawaiian picture-wing fly has a low extent of exposure (1% overlap), we determine the species has a low exposure ranking (which will include the fly-bait application as well). The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed and that these individuals are likely to experience severe adverse effects, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Hawaiian picture-wing fly (*D. heteroneura*) is listed as endangered. It is endemic to Hawai'i from mesic to wet montane environments. The most recent surveys were completed in 2011 and the species was known in one location, though much of the species' historical range has not been surveyed. The species is threatened by habitat and host plant degradation, primarily by non-native species.

Potential methomyl use sites overlap with 1% of the species' range, indicating a low potential for exposure. Even though prior usage data indicated that 8-45% of agricultural crops on Hawai‘i were treated with insecticides, potentially including methomyl, we expect a low likelihood of individuals experiencing methomyl exposure from agricultural areas or fly-bait applications such as livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters based on the overlap information. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian picture-wing fly (*D. heteroneura*) in the wild.

References

U.S. Fish and Wildlife Service. 2020. Picture-wing fly (*Drosophila heteronuera*) 5-Year Review. Honolulu, Hawaiʻi. 11 pp.

U.S. Fish and Wildlife Service. 2012. Picture-wing fly (*Drosophila heteronuera*) 5-Year Review. Honolulu, Hawaiʻi. 17 pp.

U.S. Fish and Wildlife Service. 2006. Recovery Outline for 12 Hawaiian Picture-wing Flies. Honolulu, Hawaiʻi. 32 pp.

Integration and Synthesis Summary: Hawaiian picture-wing fly

Scientific Name:	Common Name:	Entity ID:
Drosophila mulli	Hawaiian picture-wing fly	1251

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 31). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian picture-wing fly (*D. mulli*). We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 1/25/2022; Wherever found; *States within the range:* HI

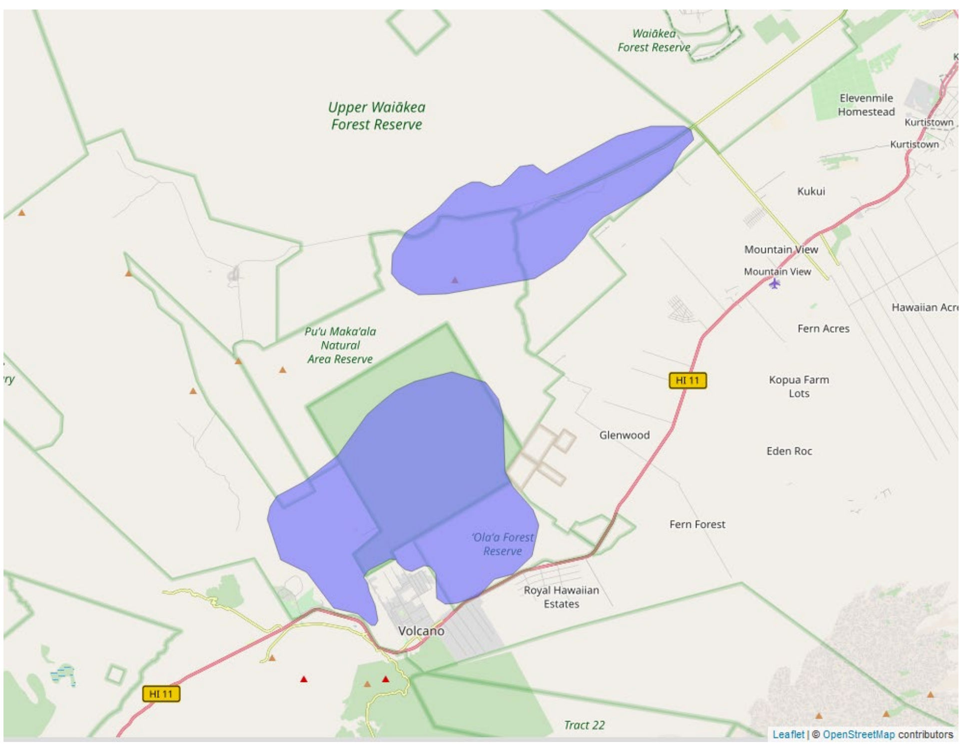

Figure 31. Range map of Hawaiian picture-wing fly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5064.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: Uplist to Endangered

Date of most recently completed 5-Year Review: 11/5/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Unknown

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Drosophila mulli (Mull's picture wing fly) is endemic to montane wet ohia forests northeast of Kilauea volcano and has been documented at only two locations. They use the fan palm, *Pritchardia beccariana* (loulu) as a breeding host and adult flies are typically seen on the underside of the fronds and are believed to be generalist microbivores (i.e., microbe eating). In general, picture-wing flies use decaying bark, stems, leaves, or fermenting bark or sap fluxes as a larval substrate and they may travel some distances to reach host plants (100 m), especially within contiguous forest. Individuals feeding on isolated host plants probably do not frequently move between plant populations (USFWS 2021). The general life cycle of Hawaiian Drosophila is typical of most flies: after mating, females lay eggs from which larvae (immature stage) hatch; as larvae grow, they molt (shed their skin) through three successive stages (instars); when fully grown, the larvae change into pupae (a transitional form) in which they metamorphose and emerge as adults (USFWS 2012). Last observed in 2014, one population occurs within the Upper Waiakea; the other population, observed in 2000 and 2001, occurs about 9.3 mi (15 km) south within the adjacent ʻŌlaʻa habitat. The number of *D. mulli* individuals in each population is unknown. They are associated with loulu (*Pritchardia*) plants. *D. mulli* is not known from Hawaiʻi Volcanoes National Park, but it may be present there because of the Park's contiguous forests that support loulu and provide for similar conditions at the same elevations used by *D. mulli* in the ʻŌlaʻa Forest Reserve. Limited survey results do not preclude the existence of other undocumented populations. Detection of *D. mulli* is difficult because of the height of its loulu host, which requires the use of binoculars or climbing the tree to observe the species on the undersides of the loulu fronds. In the last decade, surveys for this species have been very limited.

Both known populations on Kilauea are at risk of extirpation, which could lead to extinction of the species, provided there are no unidentified populations (USFWS 2021).

Primary threats include habitat and host plant degradation and destruction, non-native ungulates and plants, predation and parasitism by non-native species, drought, fire, inadequate regulatory mechanisms to address non-native species, natural disasters, limited numbers of individuals and populations, climate change, and the interaction of these threats. The western yellowjacket (*Vespula pensylvanica*) is an aggressive, generalist predator that threatens *D. mulli.* Most threats to the picture-wing fly and its host plant are not being managed. Although this does not preclude the species' existence at unsurveyed populations of loulu in montane wet forests, *D. mulli* and its host remain at risk throughout their range from unmanaged threats (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 2.3% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 48). Up to 0.6% of the species' range occurs on methomyl use sites while 1.7% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 48. Overlap data for the Hawaiian picture-wing fly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	0.6	1.7	2.3

Usage

Past methomyl usage data in Hawaiʻi is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawaiʻi were treated with insecticides, with methomyl presumably being among these insecticides.

Additional Exposure Considerations
The fly-bait methomyl use is limited to applications around livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters. The fly baits can be used as a perimeter scatter bait, placed in bait stations (hung at least 4 feet high), or mixed with water to form a paste which can be brushed onto walls, windowsills, and support beams of outdoor livestock houses. While the fly-bait does contain a fly specific pheromone, muscamone, the foot print for this use is limited in scope and not likely a significant exposure pathway of methomyl (see BE Appendix 4-5). Because *D. mulli* is found in montane wet ohia forests northeast of Kilauea volcano in the ʻŌlaʻa Forest Reserve, we do not anticipate it will be found in the vicinity of where the methomyl fly-bait will be applied.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. We don't expect the fly-bait applications for methomyl will be used within the vicinity of the preferred habitat for *D. mulli* (i.e., montane wet ohia forests) within the ʻŌlaʻa Forest Reserve area where it is currently known. Thus, exposure from this methomyl use type is not anticipated. As such, we anticipate only a small number of individuals are likely to experience exposure and thus we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as native host plants) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl within the action area will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Hawaiian picture wing fly has a low extent of exposure (2.3% overlap), we determine the species has a low exposure ranking (which will include the fly-bait application as well). The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed and that these individuals are likely to experience severe adverse effects, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Hawaiian picture-wing fly (*D. mulli*) is listed as threatened and we recommended uplisting the species in 2021. It is endemic to montane wet ohia forests on Hawaiʻi. They breed on the underside of fan palm fronds, eat microbes, and may be exposed to methomyl when traveling between host plants (328 ft or 100 m), but they likely do not move between host plant populations due to dispersal limitations. There are two extant populations with unknown abundance, but there may be additional populations that have not been found due to low survey effort. The species is threatened by habitat and host plant degradation, primarily by non-native species.

Potential methomyl use sites overlap with 2.3% of the species' range, indicating a low potential for exposure. Even though prior usage data indicated that 8-45% of agricultural crops on Hawai‘i were treated with insecticides, potentially including methomyl, we expect a low likelihood of individuals experiencing methomyl exposure from agricultural areas or fly-bait applications such as livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters based on the overlap information. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian picture-wing fly (*D. mulli*) in the wild.

References

U.S. Fish and Wildlife Service. 2021. Picture-wing fly (*Drosophila mulli*) 5-Year Review. Honolulu, Hawai‘i. 21 pp.

U.S. Fish and Wildlife Service. 2012. Picture-wing fly (*Drosophila mulli*) 5-Year Review. Honolulu, Hawai‘i. 16 pp.

Integration and Synthesis Summary: Meltwater lednian stonefly

Scientific Name:	Common Name:	Entity ID:
Lednia tumana	Meltwater lednian stonefly	1849

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range (Figure 32), and very low past usage of methomyl within the species' range. Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the meltwater lednian stonefly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 2/23/2022; Wherever found; *States within the range:* MT

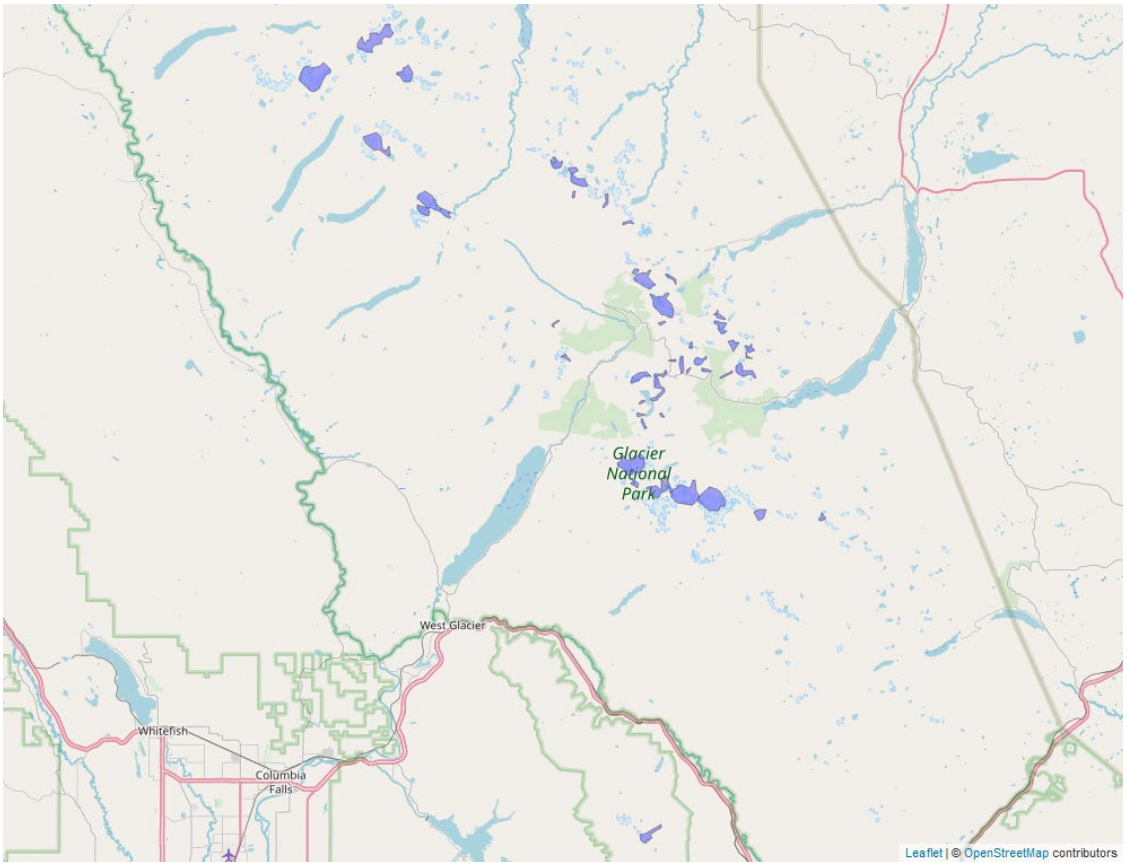

Figure 32. Range map of meltwater lednian stonefly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8276.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (numerous)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The meltwater lednian stonefly was originally described by Ricker in 1952 from the Many Glaciers area of Glacier National Park, Montana. The meltwater lednian stoneflies are known to occur in 113 streams: 109 in Glacier National Park, 2 south of Glacier National Park on National Forest Land, 1 south of Glacier National Park on tribal lands, and 1 north of Glacier National Park in Waterton Lakes National Park in Canada. As such, 94% of habitat for this species is managed by the National Park Service.

Meltwater lednian stonefly occupy relatively short reaches of streams (approximately 600 m per stream) below meltwater sources. The species occupies only these small amounts of area per stream because of its low thermal tolerance and the rapid warming of meltwater streams downstream of the meltwater sources, from full sun exposure in alpine environments.

Meltwater lednian stoneflies can attain moderate to high densities (350–5,800 per square m). Given this range of densities and a coarse assessment of available habitat, the abundance of meltwater lednian stonefly is estimated to be in the millions of individuals, however, no population trend information is available. The meltwater lednian stonefly occupies a relatively narrow range of alpine habitats that are expected to become fragmented and degraded by climate change. Densities and estimated abundance of the meltwater lednian stonefly are currently relatively high. In addition, some meltwater lednian stonefly populations continue to persist in meltwater habitats supplied by seasonal snowpack. Habitats for the meltwater lednian stonefly originate from meltwater sources that will be impacted by climate change, including glaciers, rock glaciers and small ice fields, perennial and seasonal snowpack, alpine springs, and glacial lake outlets. The alteration or loss of these meltwater sources and perennial habitat has direct consequences on meltwater lednian stonefly populations. Desiccation (drying) of these habitats, even periodically, could eliminate entire populations of the meltwater lednian stonefly because nymphs need perennial flowing water to breathe and mature before reproducing. Given that the species is believed to be a poor disperser (similar to other Plecopterans), recolonization of previously occupied habitats is not expected following dewatering and extirpation events. Lack of recolonization by the species is expected to lead to further isolation between extant occupied streams. Due to the anticipated near-term reduction of meltwater from seasonal snowpack and future reduction of flow from other meltwater sources in the foreseeable future, drought is expected to affect meltwater lednian stonefly populations occupying habitat supplied by those meltwater sources. As a result of this anticipated loss of habitat and populations, only a few refugia populations are expected to persist in the longer term. Recolonization of habitats where known populations are extirpated is not anticipated, given the poor dispersal abilities of the species (USFWS 2016, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.4% of the species' range will overlap with methomyl use site or is likely to be exposed through off-site transport within the action area (Table 49). Less than 0.1% of the species' range overlaps with methomyl use sites while 0.4% of the range occurs off-field but may still be exposed to spray drift or runoff.

Usage

Based on past usage data, we do not expect methomyl will be used within the species' range in the future as a result of the proposed action.

Table 49. Overlap data for the metlwater lednian stonefly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	<0.1	0.3	0.3	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn[46]	<0.1	<0.1	<0.1	0	0	0
Cotton	0	0	0	0	0	0
Other Grains	<0.1	<0.1	<0.1	0	0	0
Other Orchards	<0.1	<0.1	<0.1	0	0	0
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	<0.1	<0.1	<0.1	0	0	0
Wheat	NA	NA	NA	NA	NA	NA
Total	**<0.1**	**0.4**	**0.4**	**0**	**0**	**0**

[46] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Additional Exposure Considerations

Stoneflies begin their life cycle as aquatic invertebrates and eventually emerge to live as terrestrial invertebrates. Meltwater lednian stoneflies are thought to emerge from their aquatic environments in August and September to mature to adulthood and breed. Larvae are typically herbivores or detritivores while adult stoneflies have no mouth parts and do not feed. The species primarily occurs in high alpine streams within Glacier National Park (USFWS 2016, 2019).

Exposure Summary

We expect a small portion of the species' range will be exposed to methomyl based on the low overlap between the action area and the species' range. Past usage data indicates that no methomyl has been used within the species' range in recent years. Given that known occurrences of this species primarily occur in high alpine streams within Glacier National Park, we have high confidence that the likelihood of exposure is low. While we cannot completely rule out exposure as pesticide usage patterns may change, we anticipate any exposure that occurs will be rare and infrequent, primarily limited to instances where an adult wanders away from park boundaries. As such, we anticipate very few individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites. This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. However, despite the incorporation of the rain restriction mitigation, toxicity remains high for this species.

Aquatic habitat buffers: The methomyl label also has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet, of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds" for which vernal pools would be included.

Effects of the Action: Toxicity

Aquatic Phase and Terrestrial Phase Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed during the aquatic or terrestrial phase.

Aquatic Phase and Terrestrial Phase Indirect Effects

Nemourid stonefly larvae are typically herbivores or detritivores, and their feeding mode is generally that of a shredder or collector-gatherer. Therefore, we do not expect that exposure to methomyl will result in adverse effects to detritus or biofilms (bacteria, fungi, and algae) that the larvae feed on.

Adult stoneflies have no mouth parts and therefore do not feed (USFWS 2016, 2019).

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the action area (including use sites and spray drift areas) overlaps with only a small portion of the species' range and that we expect no usage in the species' range, we determined that the overall exposure for the meltwater lednian stonefly is low. As such, we do not expect exposure is likely to occur. As known occurrences of this species primarily occur within Glacier National Park, we have high confidence that individuals are not likely to be exposed to methomyl. However, we cannot completely rule out exposure to individuals as pesticide usage trends may change in the future. Given that insects are highly sensitive to methomyl at estimated environmental concentrations and are likely to die up to 90 meters from treated fields, we determined the overall toxicity for the species is high. While toxicity is high, we expect the meltwater lednian stonefly is at low risk of adverse effects from the proposed action as no individuals are likely to experience exposure, indicating that no individuals are likely to die during the aquatic or terrestrial phase, throughout the duration of the proposed action.

Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects from the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the meltwater lednian stonefly. Despite the species' high vulnerability, the low overlap between the action area and its habitat, along with minimal past usage of methomyl within its range, results in a low extent of exposure to the proposed action. Consequently, the anticipated risk of adverse effects to the species is low, with only a very small number of individuals expected to die from exposure to methomyl.

The meltwater lednian stonefly is currently listed as threatened, with multiple populations distributed across alpine streams primarily within Glacier National Park. These habitats are vital for the species' survival, yet they are under threat from habitat loss and climate change. However, the limited overlap between methomyl use sites and its habitat suggests a low likelihood of exposure to the proposed action.

In summary, while the meltwater lednian stonefly faces significant threats from environmental changes, the proposed action involving methomyl is not expected to substantially impact the species' survival and recovery. The low extent of exposure and the species' occurrence primarily within Glacier National Park contribute to the conclusion that the proposed action is not likely to result in adverse effects at the population level. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the meltwater lednian stonefly in the wild.

References

U.S. Fish and Wildlife Service. 2019. Recovery Outline Meltwater lednian stonefly (*Lednia tumana*) and Western glacier stonefly (*Zapada glacier*). Helena, Montana. 14 pp.

U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Western Glacier Stonefly as an Endangered or Threatened Species; Proposed Threatened Species Status for Meltwater Lednian Stonefly and Western Glacier Stonefly. Federal Register 81(192):68379-6839.

Integration and Synthesis Summary: Pacific Hawaiian damselfly

Scientific Name:	Common Name:	Entity ID:
Megalagrion pacificum	Pacific Hawaiian damselfly	1953

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 33). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Pacific Hawaiian damselfly. We discuss our rationale for this conclusion in the sections below.

Species range

Last updated: 2/7/2011; Wherever found; *States within the range:* HI

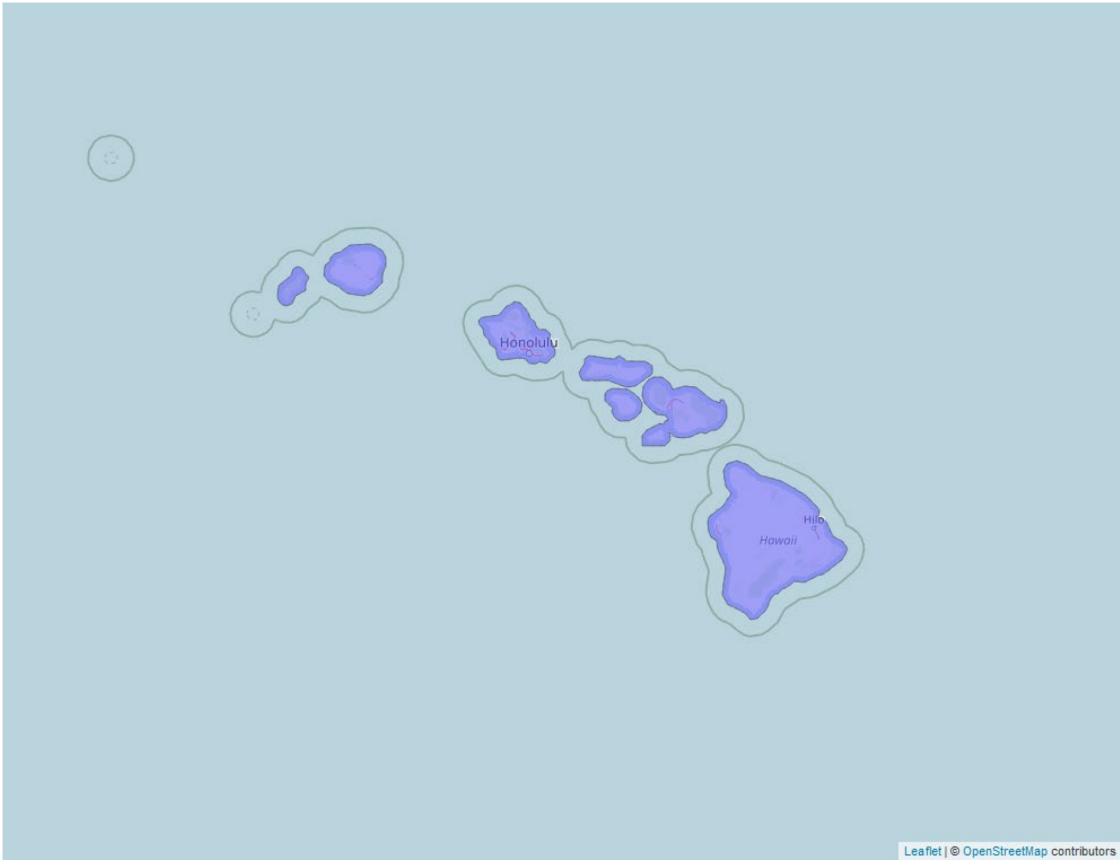

Figure 33. Range map of Pacific Hawaiian damselfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6119.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 7/20/2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Pacific Hawaiian damselfly is typically observed at elevations between 0-381 m and has been spotted up to 1,220 m. Pacific Hawaiian damselflies are often found in abandoned kalo fields, along perennial streams in pools adjacent to the main channel, and in open marshy areas on the flat valley floor (USFWS 2022). The Pacific Hawaiian damselfly is no longer found in lentic habitats in Hawaiʻi due to predation by non-native fish. They are restricted almost exclusively to seepage fed pools along overflow channels in the terminal reaches of perennial streams, usually in areas surrounded by thick vegetation. Adults do not stray far from the vicinity of breeding pools and are rarely seen along mainstream channels. Pacific damselflies do not disperse over long distances compared to other Hawaiian damselflies. Adult and immature (naiad) stages of this damselfly are predaceous. The naiad stage is aquatic and feeds on small aquatic invertebrates (USFWS 2018). They are found on Molokaʻi in at least nine streams and on Maui in twenty streams, all of which have not been invaded by non-native fish. The one population on Hawaiʻi has not been surveyed since 1998 but is believed to be extant. All thirty populations are believed to be small (< 100 individuals), though no quantitative estimates are available. The species is believed to be extirpated from Oʻahu, Kauaʻi, and Lānaʻi (USFWS 2023).

Threats to the species include predation by non-native fish, backswimmers, bullfrogs, and ant species; lack of population representation, resiliency, and redundancy due to its extreme reduction in range and dispersed populations (USFWS 2018); ongoing destruction and degradation of wetland and lowland stream habitat by non-native animals, particularly feral pigs; habitat poisoning through pesticide use; and *Hydra vulgrais*, a newly identified predatory freshwater invertebrate (USFWS 2023). The factors that contribute to habitat detriments are stream diversion and channelization, agricultural and urban development, improper water well placement, dewatering of aquifers, invasive plants, hurricanes, landslides, and drought (USFWS 2018). Habitat poisoning is a potential threat to the Pacific Hawaiian damselfly. Exposure to pesticide contamination can cause acute and chronic poisoning and lead to the mortality of non-target aquatic organisms. Pesticides applied to the aquatic environment during collection of Tahitian prawns (*Macrobrachium lar*) can poison and cause mortality to all aquatic life. In one stream where pesticide was used for Tahitian prawn collection, anecdotal evidence indicates that the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*) has not been documented since pesticide application. Hawaiian damselfly larvae and eggs can be exposed to pesticide contaminated water through direct contact (USFWS 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 4.1% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 50). Up to 1.9% of the range occurs on methomyl use sites and 2.2% of the range overlaps with potential runoff and/or spray drift areas.

Table 50. Overlap data for the Pacific Hawaiian damselfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	1.9	2.2	4.1

Usage

Past methomyl usage data in Hawaiʻi is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawaiʻi were treated with insecticides, with methomyl presumably being among these insecticides.

Additional Exposure Considerations

Adults do not stray far from the vicinity of the breeding pools and are rarely seen along mainstream channels. Pacific Hawaiian damselflies do not disperse over long distances compared to other Hawaiian damselflies (USFWS 2018). As stated above, adult, and immature (naiad) stages of this damselfly are predaceous. The naiad stage is aquatic and feeds on small aquatic invertebrates.

Exposure Summary

There is a low extent of overlap between the action area and the species' range, and thus we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We anticipate indirect effects to this species as it relies on other aquatic invertebrates as food during the adult and naiad stages. However, because prey taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of prey in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. Adverse effects to the prey community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Pacific Hawaiian damselfly has a low extent of exposure (4.1% overlap), we determine the species has a low exposure ranking. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Pacific Hawaiian damselfly is listed as endangered. It is known from thirty populations on Molokaʻi (n=9), Maui (n=20), and Hawaiʻi (n=1) in streams, adjacent pools, and open marshy areas. Adults eat insects and do not travel far. They are rarely seen along the main channels near their home streams. All populations are believed to be small (<100 individuals). They are believed to be extirpated from Oʻahu, Kauaʻi, and Lānaʻi. Threats to the species include habitat loss from ungulate pressure, non-native predatory fish, and *Hydra vulgaris*, and pesticide poisoning.

Potential methomyl use sites overlap with 4.1% of the species' range, indicating a low potential for exposure. Even though prior reporting data indicated that 8-45% of agricultural crops on Hawaiʻi were treated with insecticides, potentially including methomyl, we expect a low likelihood of individuals experiencing methomyl exposure based on the overlap information. The species relies on aquatic invertebrate prey, species of which could experience a range of sensitivities to methomyl exposure. We expect a short-term reduction in prey in areas where methomyl is used, but not a complete prey elimination. As such, we anticipate, at most, a small number of individuals are likely to experience effects from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Pacific Hawaiian damselfly in the wild.

References

U.S. Fish and Wildlife Service. 2023. Short Form Summary Pacific Hawaiian damselfly (*Megalagrion pacificum*) Honolulu, Hawaiʻi. 12 pp.

U.S. Fish and Wildlife Service. 2022. Species Report for the Pacific Hawaiian damselfly (*Megalagrion pacificum*) Version 1.0. Honolulu, Hawaiʻi. 36 pp.

U.S. Fish and Wildlife Service. 2018. Pacific Hawaiian damselfly (*Megalagrion pacificum*). 5-Year Review Summary and Evaluation. Honolulu, Hawaiʻi. 19 pp.

Integration and Synthesis Summary: Hermes copper butterfly

Scientific Name:	Common Name:	Entity ID:
Lycaena hermes	Hermes copper butterfly	1984

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range, and very low past usage of methomyl within the species' range (Figure 34). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hermes copper butterfly. We discuss our rationale for this conclusion in the sections below.

Species range

Last updated: 12/17/2021; Wherever found; *States within the range:* CA

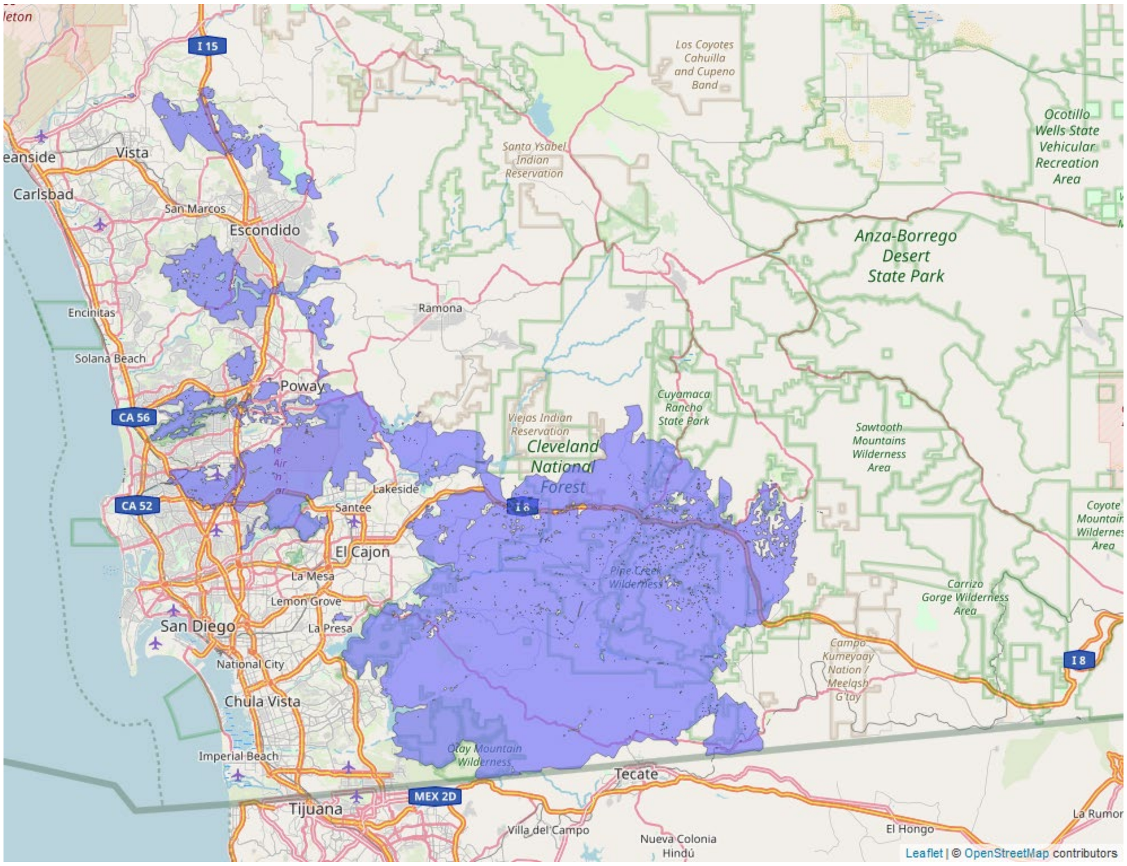

Figure 34. Range map of Hermes copper butterfly (blue polygons). Range map accessed https://ecos.fws.gov/ecp/species/4379.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: NA; listed on 01/20/2022

Date of most recently completed 5-Year Review: NA

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Hermes copper butterfly is a small butterfly currently found in San Diego County, California, United States, and northwestern Baja California, Mexico. Adults are active May through July, when females deposit single eggs exclusively on *Rhamnus crocea* shrubs (spiny redberry; USFWS 2020) in coastal sage scrub and chaparral vegetation. Adult occupancy and feeding are also associated with presence of the shrub *Eriogonum fasciculatum* (California buckwheat). Out of 95 historically recorded occurrences, there are currently 45 considered or presumed extant. In the United States, there is currently only one known extant occurrence with marine climate influence, four with montane climate influence, and the remainder are at intermediate elevations and in more arid climates.

While Hermes copper butterfly permanent population and habitat loss due to development is still a significant stressor, and population numbers have been depressed by recent drought (one monitored core population was not detected in 2017 or 2018; USFWS 2020), the primary cause of population loss between 2005-2020 was wildfire. We identified threats to Hermes copper butterfly attributable primarily to megafires (large wildfires), small and isolated populations, and to a lesser extent, habitat loss due to increased wildfire frequency and fragmentation resulting from the combined impacts of existing development, possible future (limited) development, and existing dispersal barriers. These threats increase the risk of extirpation of Hermes copper butterfly populations range-wide. Hermes copper butterflies occupy scattered areas of sage scrub and chaparral habitat in an arid region susceptible to wildfires of increasing frequency and size. The likelihood that the species will be burned by catastrophic wildfires, combined with the isolation and small size of extant populations, makes Hermes copper butterfly particularly vulnerable to population extirpation range-wide. Wildfires are considered a factor in 34 estimated historical occurrence extirpations, only one of which occurred before 2003, and only four of which appear to have been naturally re-established. Hermes copper butterflies rarely survive wildfire because all immature life stages inhabit host plant foliage, and spiny redberry typically burns to the ground and resprouts from stumps. The primary means to reduce and mitigate the stressor of wildfire is thought to be assisted recolonization. Eggs and adults were translocated in 2015 to a burned area where the species had been extirpated and at least one adult was observed there in 2016, but there were no documented breeding or adult detections in 2017 or 2018. Thus, the outcome of the translocation experiment remains uncertain (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect <0.1% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 51). Less than 0.1% of the species' range overlaps with methomyl use sites and <0.1% of the range that occurs off-field is likely to be exposed to spray drift or runoff.

Table 51. Overlap data for the Hermes copper butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0	<0.1	<0.1
Citrus[47]	<0.1	<0.1	<0.1
Corn	0	0	0
Cotton	0	0	0
Other Grains	0	<0.1	<0.1
Other Orchards	0	0	0
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	0	<0.1	<0.1
Wheat	NA	NA	NA
Total	**<0.1**	**<0.1**	**<0.1**

Usage

Mandatory reporting data from the state of California (Table 52) indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide any pesticide usage was 1.5%. Up to 0.7% of the range has been treated annually with any insecticide and 0.1% of the range has been treated annually with methomyl. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

[47] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Table 52. Annual percent of the Hermes copper butterfly's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
1.5	0.7	0.1

Additional exposure considerations

Little is known about the larval stage of the Hermes copper butterfly, as this life stage is little-studied and extremely difficult to find in the field (USFWS 2020). Hermes copper larvae feed exclusively on spiny redberry (*Rhamnus crocea*), and adults nectar exclusively on California buckwheat (*Eriogonum fasciculatum*). The Hermes copper requires woody canopy openings in coastal sage scrub and southern mixed chaparral with a northern exposure in stands of spiny redberry and adjacent stands of California buckwheat. These elements appear to be components of suitable habitat for Hermes copper butterfly. The breeding season for the Hermes copper is in early summer. Most occupied areas of the Hermes copper habitat are surrounded by suburban development. They are likely to travel through, forage, and breed in agricultural areas, managed forests, developed areas with easements and utilities present as well as rangeland (Alison Anderson, pers. comm. USFWS species co-occurrence Ask to Field 2016).
The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 0.2% of the species' range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

A small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. While the Hermes copper butterfly may be more susceptible to pesticide exposure during the adult flight period in their life cycle due to traveling through, foraging, or breeding in agricultural areas, mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years (2012-2021), with up to 0.1% treated with methomyl in the same period. This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticides, in general, have been used within the species' range. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may still result in exposure of individuals. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Direct Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including the spiny redberry or California buckwheat that the Hermes cooper butterfly is reliant on for food (host plants for larvae or nectaring plants for adults) or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl in the action area will die.

Overall Toxicity: High

Effects of the Action Summary

The Hermes copper butterfly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides have been used within the species' range from 2012-2021, with up to 0.7% of the range treated with any insecticide and up to 0.1% treated with methomyl in the same period. The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. However, the low exposure ranking suggests that only a very small number of individuals are likely to die. As such, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Hermes copper butterfly is listed as threatened. Fewer than half of the species' historical occurrences are presumed extant across San Diego, California and northwestern Baja California, Mexico (45 of 95 historical occurrences). The species is highly affected by wildfires, which is considered the primary cause of population loss over the last 15 years. Other stochastic events, like drought, also contribute significantly to the downward trend for this species and continued fragmentation of habitat and loss of habitat remain as significant barriers to recovery. Considering information about the species status, we have determined that the species has a high vulnerability.

However, threats to the species do not include agricultural use of methomyl. Methomyl use sites overlap with a very small portion (<0.1%) of the Hermes copper butterfly's range, indicating a low potential for exposure. In addition, mandatory pesticide usage reporting data from the state of California confirms low insecticide usage overall (0.4% of the range treated), further indicating a low likelihood of individuals experiencing methomyl exposure. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hermes copper butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2020. Species Status Assessment for the Hermes copper butterfly (*Lycaena* [*Hermelycaena*] *hermes*) Version 1.1. Carlsbad, California. 90 pp.

Integration and Synthesis Summary: Dakota skipper

Scientific Name:	Common Name:	Entity ID:
Hesperia dacotae	Dakota skipper	3412

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is high overlap of the action area with the species' range (Figure 35), and high past usage of methomyl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that both exposure and toxicity are high, we determined the risk of adverse effects to the species is high. As such, we expected a large number of individuals were likely to be exposed and die.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Dakota skipper to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Dakota skipper. We discuss our rationale for this conclusion for the species in the sections below.

Species range

4/6/2023; Wherever found; *States within the range:* MN, ND, SD

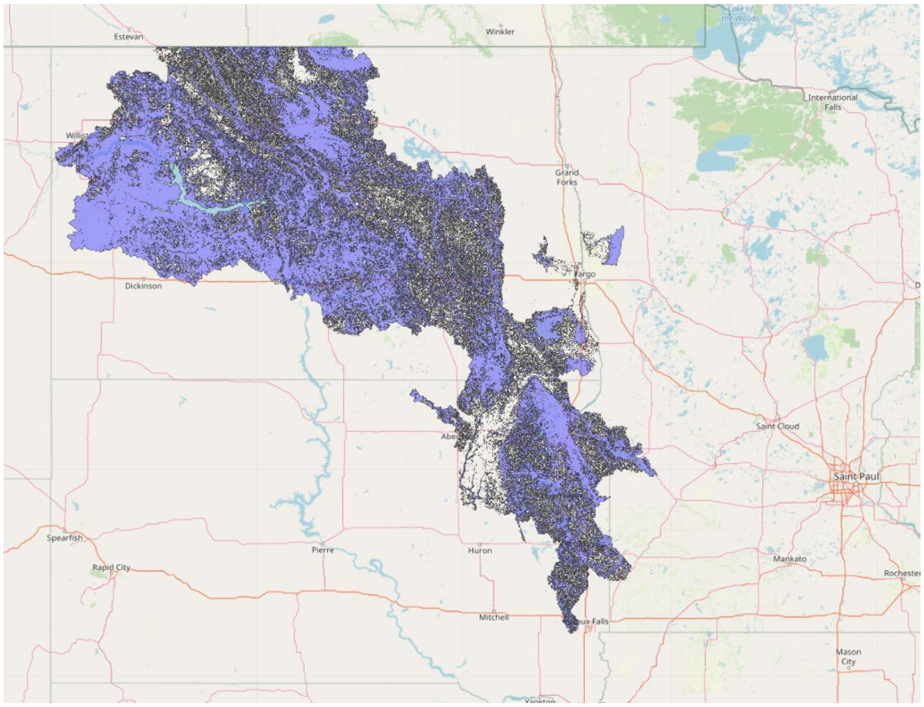

Figure 35. Range map of Dakota skipper (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1028.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/17/2019

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Dakota skipper inhabits remnants of tallgrass prairie and mixed-grass prairie in the north-central United States and into southern Saskatchewan and Manitoba Provinces of Canada

(USFWS 2021). Within the native prairie patches where it persists, the species relies on high-quality habitat conditions – diverse native grassland plant communities – and on natural or human disturbances that maintain the integrity of these plant communities while minimizing mortality to vulnerable life stages. The Dakota skipper's range once comprised native prairie in five States and Canada, extending from Illinois to Saskatchewan; it now occurs only in native prairie remnants in portions of three States and two Canadian provinces.

The Dakota skippers are univoltine (having a single flight per year), with an adult period that may occur from the middle of June through the end of July. Actual flight periods may vary somewhat across the range of the species and can also vary locally from year-to-year depending on temperature patterns. The Dakota skipper flight period in a locality lasts two to four weeks, and mating occurs throughout this period. Access to nectar during the flight period is a critical need for adult Dakota skippers. Females may realize lower fertility in areas with low nectar availability or may simply abandon such areas (USFWS 2018).

As of 2018, we estimate there are 76 metapopulations consisting of 150 distinct subpopulations that persist (67 Present and 83 Unknown status subpopulations) across 3 states and 2 Canadian provinces. Using the methodology in the Species Status Assessment and accounting for new populations, approximately 56 subpopulations have become extirpated since the time of listing, with the majority of subpopulations lost occurring in Minnesota. Many of the sites that became extirpated, however, were small and isolated populations where a low likelihood of persistence was anticipated based on poor habitat quality. While the number of known Dakota skipper subpopulations is in decline, new subpopulations have been discovered in areas not previously surveyed at the far western edge of its range. A total of 36 new subpopulations have been found, 34 in North Dakota and 2 in South Dakota, and the full extent of similar habitat in these areas have not been fully surveyed. The Minnesota Zoo has been involved with maintaining stable insurance populations of Dakota skippers, which has led to the reintroduction at one extirpated site in Minnesota (USFWS 2019). Additional reintroductions are planned, as well as a thorough survey effort at the original reintroduction site to verify survivorship and determine how well the population has become established.

Populations may also be influenced significantly at local, landscape, regional, and continental scales by other factors that include activities such as grazing, haying, burning, pesticide use, and lack of management (USFWS 2018). The primary factors supporting the determination of threatened species status for the Dakota skipper are habitat loss and degradation of native prairies, including conversion of native prairie for agriculture or other development; ecological succession and encroachment of invasive species and woody vegetation; certain fire, haying, and grazing management that reduces the availability of certain native-prairie grasses and flowering herbaceous plants to the Dakota skipper; some fire management; flooding; existing regulatory mechanisms that are inadequate to mitigate threats to the species; loss of genetic diversity; small size and isolation of remnant patches of native prairie; indiscriminate use of herbicides that reduces or eliminates nectar sources; climate conditions such as drought; and other unknown factors (USFWS 2014).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Up to 100% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area. The species' range does not include any methomyl use sites, indicating that exposure is only likely to occur off-field in adjacent areas through spray drift or runoff. Corn/soybean rotation and other grains are the use types most prevalent within the species' range, with 39.1-48.1 and 27.9% overlap, respectively. However, overlap with other use sites may still contribute to the overall exposure of the species.

Usage

While there is up to 100% overlap between the species' range and the action area, past usage data indicate that up to 23% of the species' range has been treated with methomyl annually (Table 53). Usage data shows that methomyl usage on vegetables and ground fruit is likely driving exposure with up to 12.5% of the species' range being treated for these crops alone. However, usage on other use sites may still contribute to the overall exposure of the species.

Table 53. Overlap and annual usage data for the Dakota skipper. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	4	13.8	17.8	0.6	2.1	2.7
Citrus	NA	NA	NA	NA	NA	NA
Corn	18.7	20.5	39.2	0.9	1.0	1.9
Cotton	0	0	0	0	0	0
Other Grains	10.7	17.2	27.9	0.6	0.9	1.5
Other Orchards	<0.1	<0.1	<0.1	0	0	0
Other Row Crops	2.1	6.7	8.8	0.9	3.0	3.9

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Soybeans[48]	28.2	19.9	48.1	1.4	1.0	2.4
Vegetables and Ground Fruit	3.4	9.1	12.5	3.4	9.1	12.5
Wheat	NA	NA	NA	NA	NA	NA
Total	**48.4**	**67.3**	**100**[49]	**6.9**	**16.1**	**23**

Additional Exposure Considerations

Adult Dakota skippers are typically active from mid-June through July for two to four weeks. Adults lay eggs on broadleaf plants and grasses and the eggs hatch between seven and 20 days. Larvae form shelters at or below the ground surface, where they will overwinter. Larvae resume feeding in the spring, pupate, and emerge in early summer. We expect that methomyl applications are likely to coincide with these periods of peak adult and larval activity, indicating that exposure is likely throughout its life cycle.

Exposure Summary

There is a high extent of overlap between the action area and the species' range (100% total overlap). While usage data indicates that a smaller proportion of the range is likely to be treated with methomyl (up to 23% treated annually), this still results in a high extent of exposure as we expect high usage within the species' range. Additionally, we expect the timing of methomyl applications will coincide with periods of peak larval and adult activity, indicating that exposure is more likely to occur. As such, we anticipate a large number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: High

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48 We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

49 Total overlap is capped at 100%.

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food (such as native plants that provide nectar for adults and food and shelter for larvae).

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl in the action area will die.

Overall Toxicity: High

Effects of the Action Summary

The Dakota skipper has a high exposure ranking. There is a high extent of overlap (100% total overlap), a high level of usage (up to 23% of the range treated annually), and the timing of methomyl applications likely coincide with periods of peak larval and adult activity, indicating that a potentially large number of individuals will experience exposure. The species also has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. Coupled with the high exposure ranking, we anticipate that a large number of individuals are likely to die. As such, we determine the overall risk of adverse effects to the species is high.

Preliminary Conclusion

The Dakota skipper is a threatened species that inhabits tallgrass and mixed-grass prairies in portions of three north-central U.S. states and southern Manitoba and Saskatchewan in Canada. The species depends on natural or human-made disturbances to maintain high-quality prairie habitat. Fifty-six subpopulations have been extirpated since the time of listing, mostly due to small population size and poor habitat quality, though 36 new subpopulations have been discovered. Recovery and reintroduction efforts are planned and in progress in Minnesota. Based on the threats and current population status, we have determined that the vulnerability ranking for this species is high.

The Dakota skipper's range does not overlap with any methomyl use sites, but we expect that exposure will occur through off-site spray drift or runoff. Past usage data indicates that methomyl has been used to treat up to 16.1% of the species range annually, with vegetables and ground fruit the primary use sites overlapping with the species range (9.1%). Additionally, application of methomyl is expected to occur at the same time as peak adult and larval activity, suggesting exposure throughout the species' life cycle. Given the high sensitivity of insects to methomyl, all individuals exposed are expected to die. We expected a large number of individuals would be exposed and die over the duration of the proposed action.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Dakota skipper:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Dakota skipper by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Do not apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on dry beans and chickpeas and all methomyl registered crops in the 'other orchards' UDL. We expect these mitigations to reduce on-field exposure.*

The PULA for the Dakota skipper will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Dakota skipper in the wild.

References

U.S. Fish and Wildlife Service. 2021. Recovery Plan for the Dakota Skipper (*Hesperia dacotae*). September 2021. Bloomington, Minnesota. 13 pages.

U.S. Fish and Wildlife Service. 2019. Dakota skipper (*Hesperia dacotae*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 9 pp.

U.S. Fish and Wildlife Service. 2018. Species status assessment report for the Dakota skipper (*Hesperia dacotae*). 97 pp.

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling. Federal Register 79 FR 63672.

Integration and Synthesis Summary: Hawaiian picture-wing fly

Scientific Name:	Common Name:	Entity ID:
Drosophila digressa	Hawaiian picture-wing fly	4000

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 36). We expect exposed individuals to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian picture-wing fly (*D. digressa*). We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 1/25/2022; Wherever found; *States within the range:* HI

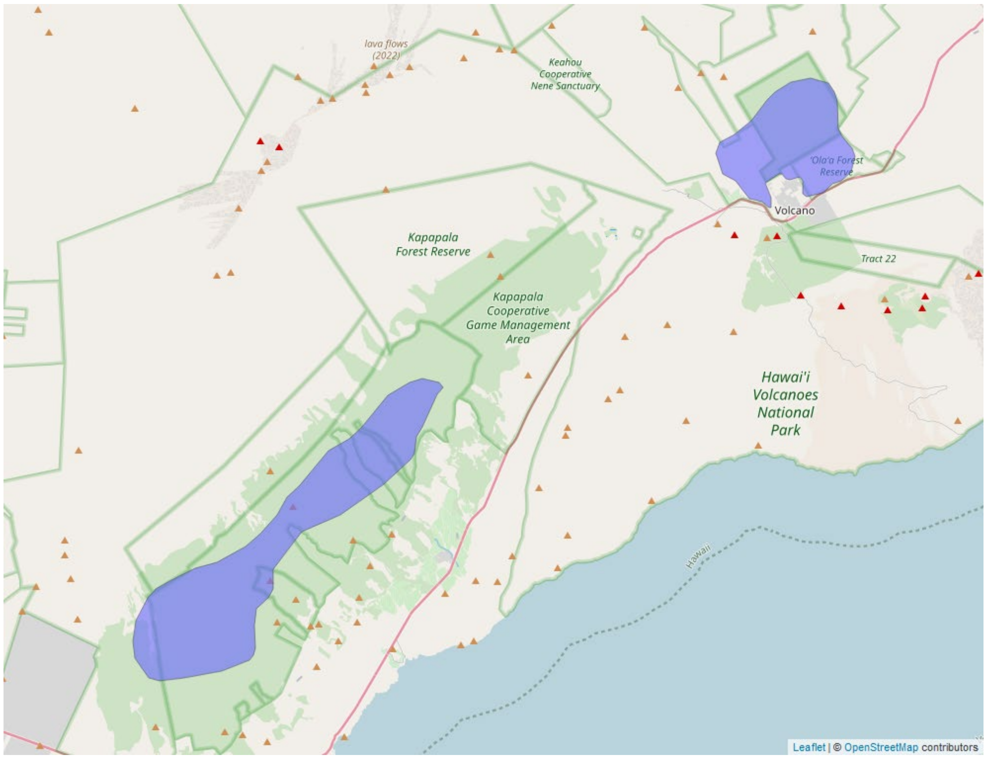

Figure 36. Range map of Hawaiian picture-wing fly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1543.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/19/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

This picture-wing fly is endemic to mesic and montane wet forests on Hawaiʻi and is currently known from only two locations, at which the number of individuals is unknown. Breeding generally occurs year-round, but egg laying and larval development increase following the rainy season as the availability of decaying matter, which picture-wing flies feed on, increases in response to heavy rains. In contrast to most continental Drosophilidae, many endemic Hawaiian species are highly host-plant-specific and *Drosophila digressa* rely on the decaying stems of *Charpentiera* spp. and *Pisonia* spp. for oviposition (to deposit or lay eggs) and larval substrate. The larvae complete development in the decaying tissue before dropping to the soil to pupate. The adult flies are generalist microbivores (microbe eating) and feed upon a variety of decomposing plant material. *Charpenteria* spp. typically occur as understory vegetation beneath the canopy of ʻōhiʻa and koa trees. *D. digressa* occurs in elevations from approximately 610 to 1,370 m in lowland mesic, montane mesic, and montane wet ecosystems. Historically, *D. digressa* was known from six sites: Moanuiahea pit crater on Hualalai, Papa in South Kona, Manukā Natural Area Reserve, Kipuka 9 along Saddle Road, Bird Park in Hawaii Volcanoes National Park, and ʻŌlaʻa Forest Reserve (USFWS 2013). The current population size, demographics, and distribution of *D. digressa* is unknown; however, the species is believed to be extant in low numbers in the ʻŌlaʻa Forest within the ʻŌlaʻa Small Tract, and possibly extant at the Olopua Kīpuka fenced exclosure at Manukā Natural Area Reserve in small pockets that provide adequate host substrate and humidity. A population of *D. digressa* was recently observed at a *Rockia sandwicensis* treefall, indicating a breeding population and thereby expanding its potential habitat. It is possible that small populations of the picture-wing fly exist in areas on private land owned by Kamehameha Schools that may have existing populations of *Charpentiera* spp., but no surveys have been conducted in those areas. The species is not currently in captivity (USFWS 2020).

Due to its endemic nature and restricted range, it is very vulnerable to stochastic events (natural and anthropomorphic). Threats include present and ongoing destruction and modification of its habitat from non-native feral ungulates, non-native plants, fire, and drought. It also faces serious threats from predation by non-native wasps and ants. Climate change may affect the species and its habitat, particularly through rising temperatures. There is limited information on the exact nature of impacts that this species may experience. Existing regulatory mechanisms are inadequate to reduce current and ongoing threats. There are also serious and ongoing threats to the picture-wing fly due to factors associated with small numbers of populations and individuals and from competition for host plants with non-native flies and declining numbers of host plants. These threats are exacerbated by the species' inherent vulnerability to extinction from stochastic events at any time because of its endemism, small numbers of individuals and populations, and restricted habitats. (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 1.2% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 54). Up to 0.3% of the species' range occurs on methomyl use sites while 0.7% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 54 Overlap data for the Hawaiian picture wing fly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	0.3	0.8	1.2

Usage

Past methomyl usage data in Hawai'i is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawai'i were treated with insecticides, with methomyl presumably being among these insecticides.

Additional Exposure Considerations
The fly-bait methomyl use is limited to applications around livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters. The fly baits can be used as a perimeter scatter bait, placed in bait stations (hung at least 4 feet high), or mixed with water to form a paste which can be brushed onto walls, windowsills, and support beams of outdoor livestock houses. While the fly-bait does contain a fly specific pheromone, muscamone, the footprint for this use is limited in scope and not likely a significant exposure pathway of methomyl (see BE Appendix 4-5). Because *D. digressa* is found in mesic and montane wet forests in the ʻŌlaʻa Forest within the ʻŌlaʻa Small Tract, and possibly extant at the Olopua Kīpuka fenced exclosure at Manukā Natural Area Reserve, we do not anticipate it will be found in the vicinity of where the methomyl fly-bait will be applied.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. We don't expect the fly-bait applications for methomyl will be used within the vicinity of the preferred habitat for *D. digressa* (i.e., mesic and montane wet forests) within the ʻʻŌlaʻa Forest within the ʻŌlaʻa Small Tract, and possibly at the Olopua Kīpuka fenced exclosure at Manukā Natural Area Reserve where it is currently known. Thus, exposure from this methomyl use type is not anticipated. Given the extent of overlap is low, we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl in the action area will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Hawaiian picture-wing fly has a low extent of exposure (1.2% overlap), we determine the species has a low exposure ranking (which will include the fly-bait application as well). The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Hawaiian picture-wing fly (*D. digressa*) is listed as endangered. It is endemic to Hawaiʻi from mesic to wet montane environments. We believe there are two extant populations, each with low numbers: one in Ōlaʻa Forest within the ʻŌlaʻa Small Tract and one in the Olopua Kīpuka fenced exclosure at Manukā Natural Area Reserve in small pockets that provide adequate host substrate and humidity. The species is threatened by habitat and host plant degradation, primarily by non-native species.

Potential methomyl use sites overlap with 1.2% of the species' range, indicating a low potential for exposure. Even though prior reporting data indicated that 8-45% of agricultural crops on Hawai'i were treated with insecticides, potentially including methomyl, we expect a low likelihood of individuals experiencing methomyl exposure from agricultural areas or fly-bait applications such as livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters based on the overlap information. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hawaiian picture-wing fly (*D. digressa*) in the wild.

References

U.S. Fish and Wildlife Service. 2021. Species Report for the Hawaiian Picture-wing fly (*Drosophila digressa*) Version 1.0. Honolulu, Hawaiʻi. 43 pp.

U.S. Fish and Wildlife Service. 2020. *Drosophila digressa* (picture-wing fly). 5-Year Review. Honolulu, Hawaiʻi. 27 pp.

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for 15 Species on Hawaiʻi Island; October 29, 2013. Final Rule. Federal Register 78(209): 64638-64690.

Integration and Synthesis Summary: Mariana eight-spot butterfly

Scientific Name:	Common Name:	Entity ID:
Hypolimnas octocula marianensis	Mariana eight-spot butterfly	4308

Species Overview

In our review of the current status of the species, as well as the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range and past usage of methomyl within the species' range (Figure 37). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mariana eight-spot butterfly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 8/10/2021; Wherever found; *States within the range:* GU, MP

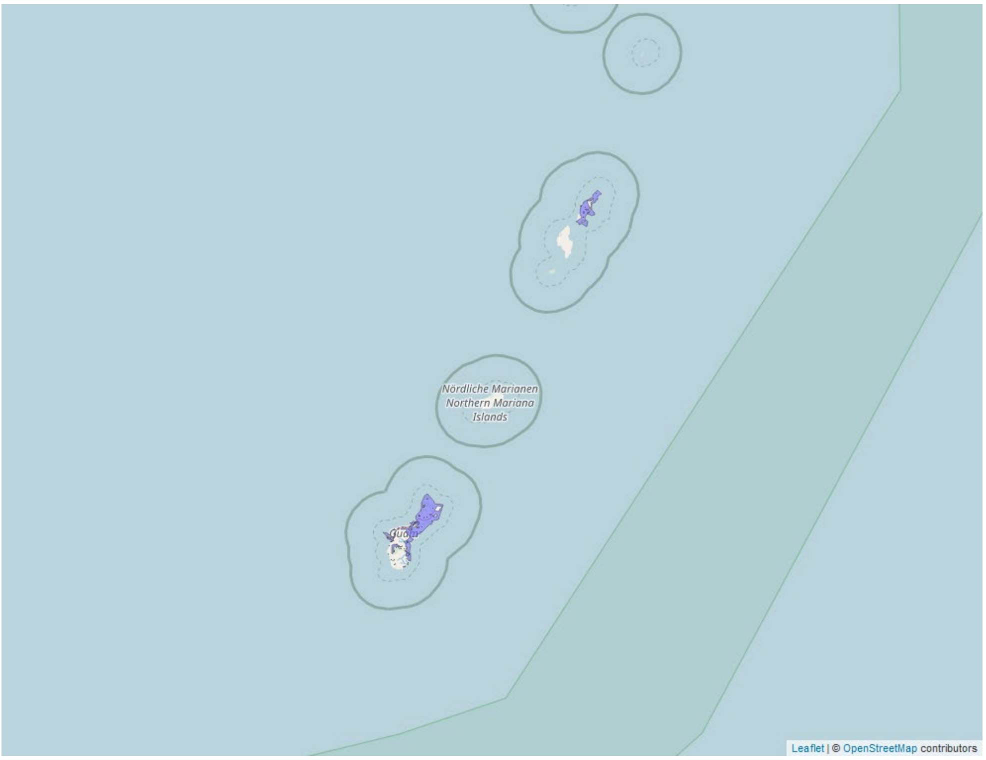

Figure 37. Range map of Mariana eight-spot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6540.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/18/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Six populations

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Mariana eight-spot butterfly, in the Nymphalidae family, is known solely from the forest ecosystems on the islands of Guam and Saipan. The species historical range also included the Northern Mariana Islands. The larvae of this butterfly feed on two native plants, *Procris pedunculata* and *Elatostema calcareum* (tapun ayuyu). Both forest herbs are found only on karst substrate within the forest ecosystem, draped over boulders and small cliffs. When adult butterflies were observed, they were always in proximity to the host plants. The two host plants have been recorded on the islands of Guam, Rota, Saipan, and Tinian. However, despite recent surveys (2011–2013) on Rota, Tinian, and Saipan, the Mariana eight-spot butterfly is currently known only from the island of Guam. Mariana eight-spot butterfly has been detected at nine sites on Guam in the karst limestone forest ecosystem and may be extirpated from Saipan (USFWS 2015). Currently, there are six known populations (USFWS 2021).

Mariana eight-spot butterflies were most abundant between December and February. These months include the end of the wet season and the beginning of the dry season on Guam and correspond to expected growth of the host plant species. Conversely, population levels were very low in July and August, the beginning of the wet season.

The Mariana eight-spot butterfly is vulnerable to the impacts of continued habitat loss and destruction from agriculture, urban development, non-native animals and plants, and typhoons. We anticipate the effects of climate change will further exacerbate many of these threats in the future. Herbivory of its host plants by non-native animals, combined with direct predation by ants and parasitic wasps, contribute to the decline of the Mariana eight-spot butterfly (USFWS 2015).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 3.3% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 55). Up to 0.7% of the species' range occurs on methomyl use sites while 2.6% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 55. Overlap data for the Mariana eight-spot butterfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	0.7	2.6	3.3

Usage

Past methomyl usage data in the Pacific islands are unavailable, however, prior reporting data in other island territories and Hawai'i has indicated that insecticide usage is likely to occur, with methomyl presumably being among these insecticides. While we are not able to use this generic data to adjust overlap estimates, we can broadly use this data as confirmation that insecticide usage likely occurs within on these islands.

Additional Exposure Considerations

Mariana eight-spot butterfly larvae are known to feed on two native forest herbs, *Procris pedunculata* and *Elatostema calcareum,* which are found only on karst substrate within the forest ecosystem. Adult females lay their eggs on the larval host plants. Adults' nectar feed on flowers including Hibiscus ornamental plants, in proximity to host plants. Therefore, Mariana eight-spot butterflies are anticipated to be exposed to methomyl in drift sites in proximity to host plant habitat and are less likely to be in agricultural fields.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. Given the extent of overlap is low, we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl in the action area will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Mariana eight-spot butterfly has a low extent of exposure (3.3% overlap), we determine the species has a low exposure ranking. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed and that these individuals are likely to experience severe adverse effects, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Mariana eight-spot butterfly is listed as endangered and faces significant threats including habitat loss and destruction from various factors such as agriculture, urban development, and invasive species. However, the extent of overlap between methomyl use sites and the species' range is low (3.3%), indicating a low extent of exposure. We do not expect the species to occur on-field where exposure and toxic effects from methomyl would be highest.

In summary, we anticipate minimal exposure to methomyl through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mariana eight-spot butterfly.

References

U.S Fish and Wildlife Service. 2021. Mariana eight-spot butterfly (*Hypolimnas octocula marianensis*). 5-Year Review. Honolulu, Hawaiʻi. 24 pp.

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Endangered Status for 16 Species and Threatened Status for 7 Species in Micronesia. 80 FR 59423 59497. Final Rule. October 1, 2015.

Integration and Synthesis Summary: Crimson Hawaiian damselfly

Scientific Name:	Common Name:	Entity ID:
Megalagrion leptodemas	Crimson Hawaiian damselfly	4326

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is low overlap of the action area with the species' range (Figure 38). Most exposed individuals are likely to die. Given that exposure is low and toxicity is high, we determined that the risk of adverse effects to the species is low. As such, we expect only a small number of individuals are likely to be exposed and die. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the crimson Hawaiian damselfly. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/25/2022; Wherever found; *States within the range:* HI

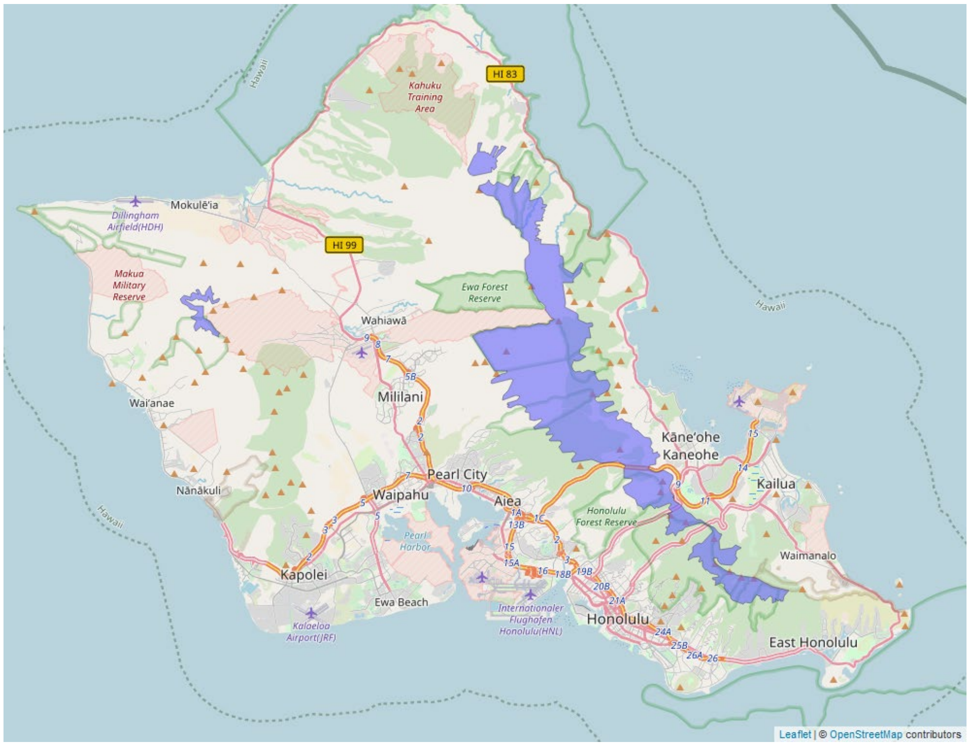

Figure 38. Range map of Crimson Hawaiian damselfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5897.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/5/2019

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Little is known about the abundance, population trends, and demographic features of the crimson Hawaiian damselfly, which is endemic to the island of Oʻahu. Damselfly naiads, the aquatic life-history stage, frequent open water, resting horizontally, or on submerged vegetation. Adults perch on streamside vegetation and patrol along the stream corridor, staying close to breeding pools. All colonies of this damselfly are constrained to portions of streams not occupied by non-native predatory fish, that is, stream portions above geologic or manmade barriers (e.g., waterfalls, steep gradients, dry stream midreaches, or constructed diversions). No estimates of population size for the crimson Hawaiian damselfly are available. Adults feed on native invertebrates. Between 1991 and 2003, over 150 sites were surveyed on the island for native damselflies. The crimson Hawaiian damselfly was known historically from approximately eight areas where it is now extirpated, including the windward side of the Waiʻanae Mountains and scattered locations in the Koʻolau Mountains. In 2003, this species was not found during surveys of Kahana Stream and may be extirpated from this stream system. The crimson Hawaiian damselfly breeds in the slow reaches of streams and seep-fed pools (USFWS 2012). In 2012, critical habitat was identified for the crimson Hawaiian damselfly, and it consists of perennial streams and slow reaches of streams or pools in lowland wet and wet cliff ecosystems on Oʻahu. Currently, only three occurrences of the crimson Hawaiian damselfly are known, all from the Koʻolau Mountains in the lowland wet and wet cliff ecosystems at Moanalua, north Hālawa, and Maʻakua (USFWS 2019, 2023).

The threats posed by conversion of wetlands and other aquatic habitat for agriculture and urban development are ongoing and are expected to continue into the future. These modified areas lack the aquatic habitat features that the crimson Hawaiian damselfly requires for essential life history needs, such as marshes, side pools along streams, and slow sections of perennial streams, and no longer support populations of this species (USFWS 2019).

Representation, resilience, and redundancy appears to be severely limited in the *Megalagrion leptodemas* species. The threat to the crimson Hawaiian damselfly from limited numbers of populations and individuals is ongoing and is expected to continue into the future due to several factors. This species may experience reduced reproductive vigor due to inbreeding depression; it may experience reduced levels of genetic variability, leading to diminished capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence; a single catastrophic event (e.g., hurricane, landslide) may result in extirpation of remaining populations and extinction of this species; and species with few known locations are less resilient to threats that might otherwise have a relatively minor impact on widely distributed species.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect <0.1% of the species' range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 56). None of the species' range occurs on methomyl use sites while <0.1% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 56. Overlap data for the Crimson Hawaiian damselfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	0	<0.1%	<0.1%

Usage

Past methomyl usage data in Hawai'i is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawai'i were treated with insecticides, with methomyl presumably being among these insecticides.

Additional Exposure Considerations

Modified areas of habitat, such as areas converted to agriculture or urban development, lack the aquatic habitat features that the crimson Hawaiian damselfly requires for essential life history needs, such as marshes, side pools along streams, and slow sections of perennial streams, and no longer support populations of this species. As such, we do not expect individuals will experience on-field exposure and will primarily be at risk of off-field exposure through spray drift.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. Given the extent of overlap is low, we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We anticipate indirect effects to this species as it relies on other aquatic invertebrates as food during the adult and naiad stages. However, because prey taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of prey in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift or runoff. Adverse effects to the prey community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl in the action area will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the crimson Hawaiian damselfly has a low extent of exposure (less than 0.1% overlap), we determine the species has a low exposure ranking. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed, we expect the overall risk of adverse effects to the species is low.

Conclusion

The crimson Hawaiian damselfly is an endangered species endemic to the island of Oʻahu. Little is known about its abundance and population trends, other than it has been extirpated from its eight known historical sites and is now found only in three lowland cliff ecosystems of the Koʻolau Mountains. Major threats to the continued existence of this species include the conversion of wetlands and aquatic areas into agriculture and urban development. Consequently, the species lacks resiliency and is subject to low genetic variability and a diminished capacity to adapt to environmental change. For these reasons, we have determined that the vulnerability for the crimson Hawaiian damselfly is high.

The crimson Hawaiian damselfly may experience exposure either through direct contact with spray, or via diet, as adults feed on insects that could have been exposed to methomyl applications. Agricultural and developed areas do not have the habitat features to support the crimson Hawaiian damselfly, and so we expect that the species will not experience on-field exposure but rather off-field exposure through spray drift. We expect that all individuals exposed to methomyl will die. However, we expect low overlap (<0.1%) between the species range and the action area. As such, we determined that the exposure ranking is low.

After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the crimson Hawaiian damselfly in the wild.

References

U.S. Fish and Wildlife Service. 2023. Crimson Hawaiian Damselfly (*Megalagrion leptodemas*). 5-year Review: Short Form Summary. Honolulu, Hawaiʻi.

U.S. Fish and Wildlife Service. 2019. Crimson Hawaiian Damselfly (*Megalagrion leptodemas*). 5-year Review. Honolulu, Hawaiʻi. 19 pp.

U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Endangered Status for 23 Species on Oahu and Designation of Critical Habitat for 124 Species. Final Rule. 77 FR 57647 57862.

Integration and Synthesis Summary: Miami blue butterfly

Scientific Name:	Common Name:	Entity ID:
Cyclargus (=Hemiargus) thomasi bethunebakeri	Miami blue butterfly	4508

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that there is a high overlap and that most exposed individuals are likely to die. However, there is low usage within the species' range (Figure 39) and we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Miami blue butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 2/10/2022; Wherever found; *States within the range:* FL

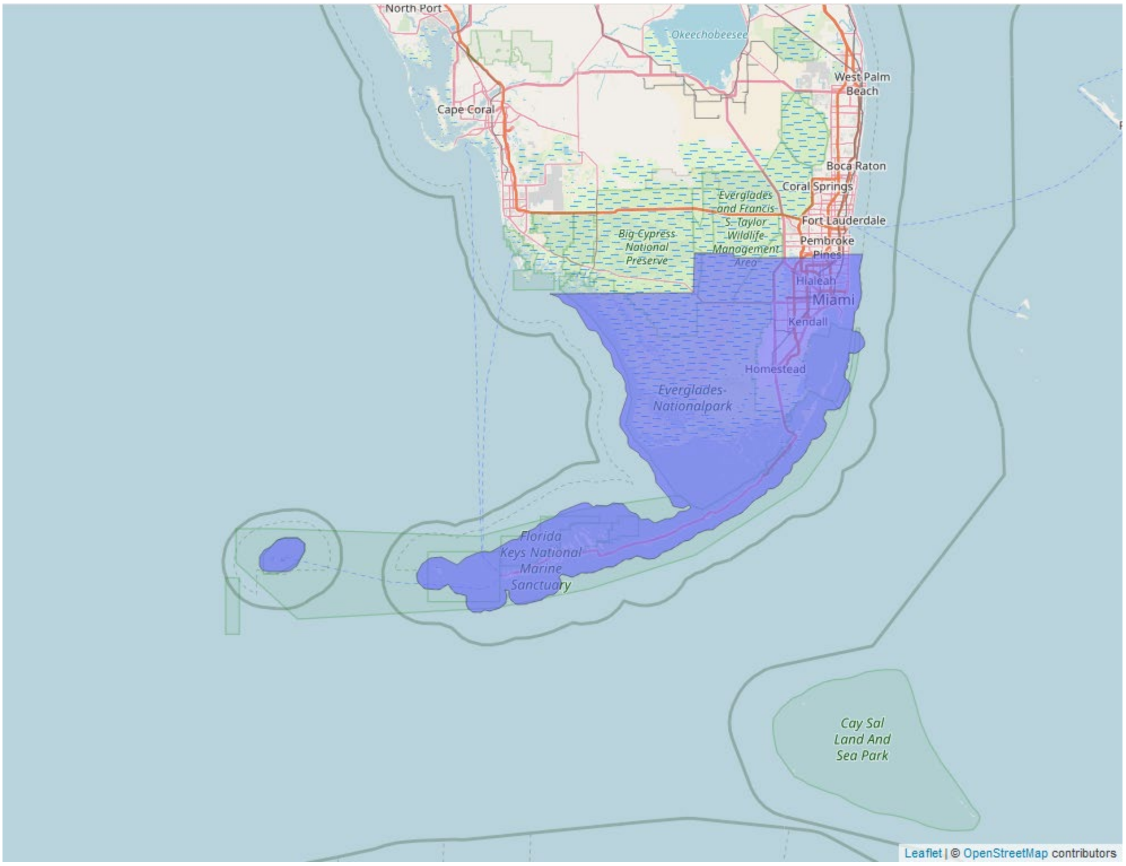

Figure 39. Range map of Miami blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3797.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in Status

Date of most recently completed 5-Year Review: 3/19/2024

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Miami blue butterfly is a coastal butterfly reported to occur in openings and around the edges of hardwood hammocks (forest habitats characterized by broad-leaved evergreens) and in other communities adjacent to the coast that are prone to frequent natural disturbances (e.g., coastal berm hammocks, dunes, and scrub) in southern Florida. It also has been reported to use tropical pinelands and open sunny areas along trails. In the Keys, it was most abundant near disturbed hammocks where weedy flowers provided nectar and it also occurred in pine rocklands (fire-dependent slash pine community with palms and a grassy understory) on Big Pine Key and elsewhere in Monroe and Miami-Dade Counties. In Miami-Dade County, it occurred locally inland, sometimes in abundance. Within Key West National Wildlife Refuge, all occupied areas had coastal strands and dunes fronted by beaches (USFWS 2012a). The only confirmed metapopulation of Miami blue is currently restricted to a few, small insular areas in the extreme southern portion of its historical range, on islands contained within the Refuge (USFWS 2012b, 2024). The population at Bahia Honda State Park appears to be extirpated. The butterfly's range, which once extended from the Keys north along the Florida coasts to about St. Petersburg and Daytona, is now substantially reduced, with an estimated >99% decline in area occupied (USFWS 2012a, 2024). Miami blues have been captive-reared since the early 2000s at the McGuire Center for Lepidoptera and Biodiversity; releases from this population have occurred since 2004 in the Florida Keys (i.e., Long Key State Park, Bahia Honda State Park, Hobe Sound National Wildlife Refuge, Biscayne National Park), but no viable populations have been established through these efforts. Released populations have been documented to persist for multiple generations before being potentially extirpated (USFWS 2024).

Known host plants for the Miami blue include gray nickerbean (*Caesalpinia bonduc*), blackbead (*Pithecellobium* spp.), and balloon vine (*Cardiospermum* spp.). They have mutualistic relationships with some *Camponotus* species; the ants drink liquid secretions from the caterpillar and defend it from predators (USFWS 2024). Like all butterflies, the Miami blue butterfly undergoes complete metamorphosis, with four life stages (egg, caterpillar or larva, pupa or chrysalis, and adult). The generation time is approximately 30–40 days and is similar for males and females. Although a single Miami blue female can lay 300 eggs, high mortality may occur in the immature larval stages prior to adulthood. The Miami blue has been described as having multiple, overlapping broods year-round. Adults can be found every month of the year with one long winter generation from December to April, during which adults are probably in reproductive diapause (a period of suspended development); a succession of shorter generations was thought to occur from May through November, the exact number of which is unknown. Adults are believed to live up to 9 days (USFWS 2012a). They disperse on average 2.0 +/- 3.6 m (USFWS 2024) and it is uncertain what mechanisms are used for dispersal (e.g., active [flight] or passive [wind-assisted]). Initial mark-recapture studies of the butterfly indicate they are nonmigratory and appear to be sedentary (USFWS 2012a).

Many factors likely contributed to the Miami blue's decline, and numerous major threats, acting individually or synergistically, continue today. Habitat loss, degradation, and modification from human population growth and associated development and agriculture have impacted the Miami blue, curtailing its range. Environmental effects from climatic change, especially sea level rise, are expected to become severe in the future, resulting in additional habitat losses (USFWS 2012a, 2024). They are also threatened by several invasive species, including green iguanas that feed on their host plants and slender twig ants (*Pseudomyrmex gracilis*) and brown anoles (*Anolis sagrei*) that feed on individuals. Herbicides are known to have direct and indirect effects on Miami blues, through mortality and damage to host plants and effects to plant metabolites (USFWS 2024).

Efforts to control salt marsh mosquitoes, *Aedes taeniorhynchus*, among others, have increased as human activity and population have increased in south Florida. To control mosquito populations, second-generation organophosphate (naled) and pyrethroid (permethrin) adulticides are applied by mosquito control districts throughout south Florida. In a rare case in upper Key Largo, another organophosphate (malathion) was applied in 2011 when the number of permethrin applications reached its annual limit. All three of these compounds have been characterized as being highly toxic to nontarget insects by the EPA. The use of such pesticides (applied using both aerial and ground-based methods) to control mosquitoes presents a potential risk to nontarget species, including the Miami blue. The potential for mosquito control chemicals to drift into nontarget areas and persist for varying periods of time has been well documented. Mosquito spray residues were found long after application in habitat of the Schaus swallowtail (*Heraclides aristodemus ponceanus*) and other imperiled species in both the upper and lower Keys. Residues of aerially applied naled were found 6 hours after application in a pineland area that was 750 m from the target area; residues of fenthion (an adulticide no longer used in the Keys) applied via truck were found up to 50 m downwind in a hammock area 15 minutes after application in adjacent target areas. Aspects of the Miami blue's natural history may increase its potential to be exposed to and affected by mosquito control pesticides and other chemicals. For example, host plants and nectar sources are commonly found at disturbed sites and often occur along roads in developed areas, where chemicals are applied (USFWS 2012a).

Mosquito control practices currently pose no risk to the Miami blue within the Refuge. However, mosquito control activities, including the use of larvicides and adulticides, are being implemented within suitable and potential habitat for the Miami blue elsewhere in its range. Aerial or truck-based applications of mosquito control chemicals may pose a threat to the Miami blue, if the butterfly exists in other unknown locations. Additionally, mosquito control practices may limit expansion of undocumented populations or colonization of new areas. If the Miami blue colonizes new areas or if additional populations are discovered or reintroduced, adjustments in mosquito control (and other) practices may be needed to help safeguard the subspecies (USFWS 2012a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 10.1% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 57). Up to 3.9% of the species' range overlaps with methomyl use sites while 6.4% of the range occurs off-field but may still be exposed to spray drift or runoff. Other orchards is the use type that is most prevalent within the species' range, which overlaps with the species range by 3.9%. However, overlap with other use sites can still contribute to the overall exposure of the species.

Usage

Based on past usage data, we anticipate up to 7.7% of the species range will be treated with methomyl annually (Table 57).

Table 57. Overlap and usage data for Miami blue butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	0	0	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn[50]	<0.1	<0.1	<0.1	0	0	0
Cotton	0	0	0	0	0	0
Other Grains	0.4	1.9	2.3	<0.1	<0.1	0.1
Other Orchards	1.9	2	3.9	1.9	2	3.9
Other Row Crops	<0.1	<0.1	<0.1	0	0	0
Soybeans	<0.1	<0.1	<0.1	0	0	0
Vegetables and Ground Fruit	1.4	2.3	3.7	1.4	2.3	3.7
Wheat	NA	NA	NA	NA	NA	NA
Total	**3.9**	**6.4**	**10.1**	**3.4**	**4.**	**7.7**

[50] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Additional exposure considerations

The Miami blue is one of the rarest insects in North America, with only one known population remaining in the Key West National Wildlife Refuge. Methomyl has not been used on National Wildlife Refuges since 2009 and as it is only registered for agricultural use, we do not anticipate that it will used on this refuge in the future. The Miami blue is also a myrmecophile; *C. floridanus* was the primary ant symbiont, commonly found tending larvae; other ant species were encountered less often.

Miami blue butterfly eggs are generally laid singly, but may be clustered on developing leaves, shoot tips, and flower buds. There are four stages of development (egg, larvae, pupa, adult) and a generation can be 30-40 days. Diapause (a period of suspended development) occurs in December-April but multiple, overlapping broods are observed year-round and adults and larvae can be found every month of the year. Therefore, the Miami blue butterfly is potentially vulnerable to the effects of methomyl throughout its entire lifecycle.

Additional data from the USDA show very little methomyl is likely to have been used within the species' range in the past. The USDA's Census of Agriculture provides information on reported insecticide usage at the county level. Data from the USDA's 2017 Census of Agriculture shows very low levels of insecticides in general were used within the counties where the species' range occurs, with only 1.46% of the species range treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. Furthermore, given that this data is associated with the specific counties that the butterfly's range occurs, we have high confidence that there has only been a small portion of the species' range treated recently. As such, we have high confidence that only a small portion of the species' range is likely to be treated annually.

Exposure Summary

While there is a large extent of overlap between the action area and the species' range (10.1% overlap), multiple lines of evidence indicate that only a small portion of the range is likely to be treated. Past usage data provided by the EPA suggests up to 7.7% of the species' range will likely be treated annually, while past usage data as reported by the USDA's Census of Agriculture shows only 1.46% of the range has been treated with any insecticide annually in the past. Given that the Census of Agriculture data is specific to the counties where the Miami blue butterfly's range occurs and includes the usage of other insecticides besides methomyl, we expect this represents an upper limit of methomyl use and anticipate only a small portion of the range is likely to be treated annually. As such, we expect only a small number of individuals are likely to be exposed to methomyl as a result of the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that this butterfly species is reliant on for food or habitat. However, we do expect that exposure to methomyl will result in adverse effects to the ant species this butterfly relies on to tend to their larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl in the action area will die.

Overall Toxicity: High

Effects of the Action Summary

The Miami blue butterfly has a low exposure ranking. While there is a high extent of overlap between the species' range and the action area (10.1% total overlap) and a moderate level of past usage (up to 7.7% of the range treated with methomyl annually), additional data from the USDA Census of Agriculture shows very little insecticide usage, in general, has occurred within the species' range in recent years (1.46% of the range treated with any insecticide). As such, we expect only a small portion of the species' range is likely to be treated with methomyl throughout the duration of the proposed action and only a small number of individuals are likely to be exposed to methomyl.

The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. However, due to the low exposure ranking, we anticipate a small number of individuals will likely die. Thus, we determine that the overall risk of adverse effects to the species is low.

Conclusion

The Miami blue butterfly is found in one population in Key West National Wildlife Refuge in beach scrub and possibly maritime hammock habitat. Several reintroduction efforts have been unsuccessful; reintroduced populations persists for a few years before being extirpated. Miami blues rely on several host plants (gray nickerbean (*Caesalpinia bonduc*), blackbead (*Pithecellobium* spp.), and balloon vine (*Cardiospermum* spp.)) and symbiotic relationships with *Camponotus* spp. of ants. The ants drink liquid secretions from the caterpillar and defend it from predators. Miami blues can disperse a few meters but are not believed to be able to disperse far. The species is threatened by habitat loss and degradation from development and agriculture, effects of climate change, invasive species (e.g., predation and host plant damage), and pesticide use (e.g., herbicides and insecticides). Thus, the species' vulnerability is high. While there is a large extent of overlap between the action area and the species' range (10.1%), multiple lines of evidence indicate that only a small portion of the range is likely to be treated with methomyl. Past usage data provided by the EPA suggests up to 7.7% of the species' range will likely be treated annually, while past usage data as reported by the USDA's Census of Agriculture shows only 1.46% of the range has been treated with any insecticide annually in the past. Because the Census of Agriculture data is specific to the counties where the Miami blue butterfly's range occurs and includes the usage of other insecticides besides methomyl, we anticipate only a small portion of the range is likely to be treated annually and we do not anticipate methomyl use on the Key West National Wildlife Refuge. Additionally, while insecticide use for mosquito control is identified as a concern for this species, methomyl is not registered for use as a mosquito control agent. As such, we expect only a small number of individuals are likely to be exposed to methomyl as a result of the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Miami blue butterfly.

References

U.S. Fish and Wildlife Service. 2024. Miami Blue Butterfly (*Cyclargus thomasi bethunebakeri*) 5-Year Status Review: Summary and Evaluation. Vero Beach, Florida. 12 pp.

U.S. Fish and Wildlife Service. 2012a. Endangered and Threatened Wildlife and Plants; Listing of the Miami Blue Butterfly as Endangered Throughout Its Range; Listing of the Cassius Blue, Ceraunus Blue, and Nickerbean Blue Butterflies as Threatened Due to Similarity of Appearance to the Miami Blue Butterfly in Coastal South and Central Florida. Federal Register 77(67):20948-20986.

U.S. Fish and Wildlife Service. 2012b. Recovery Outline for Miami Blue Butterfly (*Cyclargus thomasi bethunebakeri*). Vero Beach, Florida. 5 pp.

Integration and Synthesis Summary: Salt Creek tiger beetle

Scientific Name:	Common Name:	Entity ID:
Cicindela nevadica lincolniana	Salt Creek tiger beetle	4910

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a medium extent of exposure due to high overlap and low past usage of methomyl on use sites within the species' range (Figure 40). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be medium, the risk of adverse effects to the species is high. As such, we expected large numbers of individuals were likely to be exposed and die over the project duration.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Salt Creek tiger beetle to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Salt Creek tiger beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Last updated: 7/12/2022; Wherever found; *States within the range:* NE

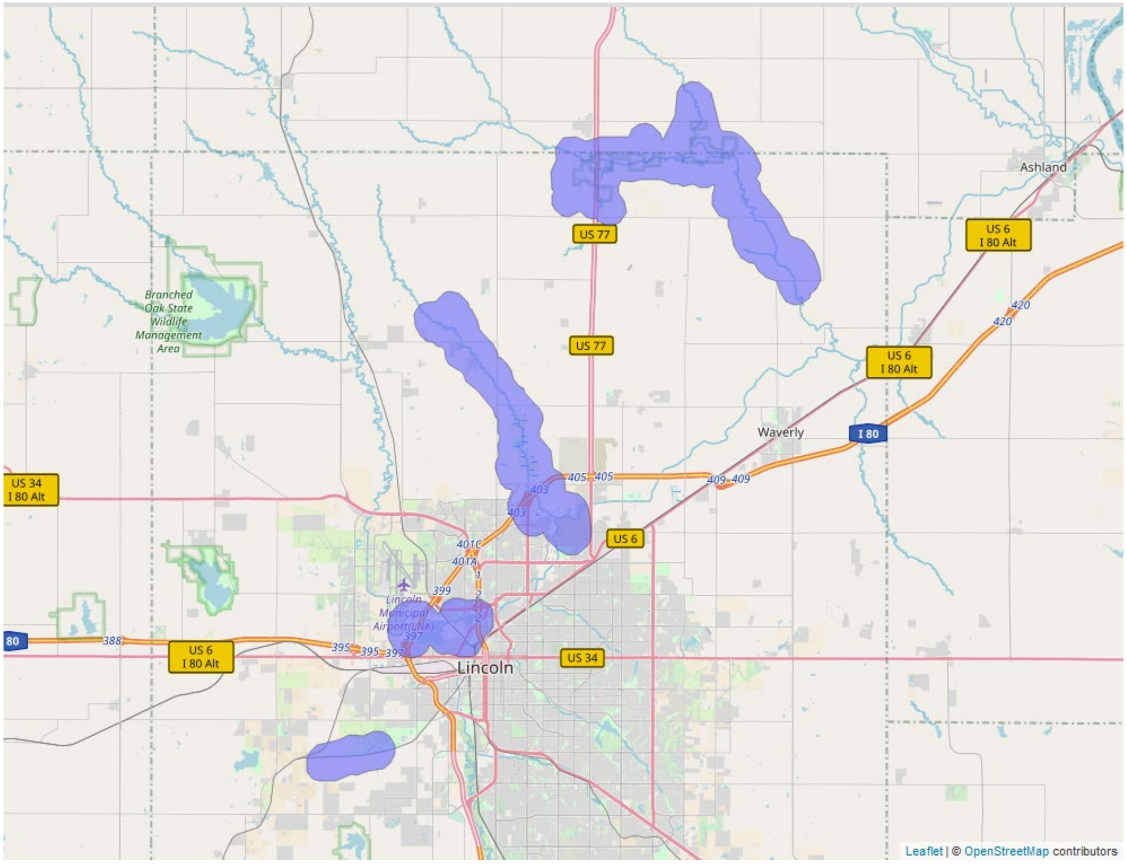

Figure 40. Range map of Salt Creek tiger beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/342.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/31/2022

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) – one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Salt Creek tiger beetle has one of the most restricted ranges of any insect in the United States. The subspecies occurs only on mudbanks along segments of the Little Salt Creek and on sparsely-to-non-vegetated mudflats and seeps containing salt deposits on riparian saline wetlands located in northern Lancaster County, Nebraska. Salt Creek tiger beetles require open, barren salt flat areas for construction of larval burrows, thermoregulation, foraging, and for use as dispersal corridors. Four metapopulations of Salt Creek tiger beetles remain, but these are all located on Little Salt Creek. Metapopulations of the subspecies continue to demonstrate low resiliency, as measured by population size and trends. The subspecies also continues to demonstrate low representation and redundancy due to the limited connectivity between populations and the subspecies' narrow, restricted overall range.

Information indicates that the size of the Little Salt Creek metapopulation is stable-to-decreasing, with only a single population increasing in size. The Little Salt Creek metapopulation reached an all-time low of 115 adult beetles in 1993 and a high of 777 adult beetles in 2002. The estimated size of this metapopulation in 2022 was approximately 275 adults. Populations of the larger Little Salt Creek metapopulation are being augmented with captive propagated adults and larvae. The success of these annual reintroduction efforts has been difficult to measure, perhaps due to the small size of the current Salt Creek tiger beetle populations along Little Salt Creek, the lack of large contiguous blocks of suitable saline stream and wetland habitat, and the lack of connectivity between the populations. This lack of connectivity may also reduce the subspecies' genetic diversity and limit recolonization rates.

The Nebraska Game and Parks Commission has opened lands to beetle reintroductions, increased the amount of suitable habitat available and improved connectivity between existing sites and sites that may allow for future large-scale reintroductions. In 2020, the Lower Platte South Natural Resources District allowed reintroductions on a 150-acre saline wetland restoration project completed in 2019. The Saline Wetland Conservation Partnership continues to purchase private land parcels from willing sellers containing saline wetland or stream habitat, helping to support the conservation of the ecosystem and Salt Creek tiger beetle populations by creating larger contiguous expanses of suitable habitat for the subspecies. Public partners are managing saline wetland and stream habitats with a goal to achieve no net loss of saline wetlands and their associated functions with a long-term gain in sustaining wetland functions through the restoration of hydrology, prescribed wetland management, and watershed protection.

The type and level of threats faced by the Salt Creek tiger beetle have varied over time. Prior concern about widespread commercial and residential development occurring along Little Salt Creek has declined given that the City of Lincoln is developing to the east and south and not to the north in the Little Salt Creek area, although habitat loss and fragmentation and other threats continue to affect the subspecies. While substantial progress has been made by the Saline Wetlands Conservation Partnership and other entities toward acquisition, restoration, and management of saline wetlands and streams along Little Salt and Rock Creeks, and rearing, propagation, and reintroduction efforts have had some success, population surveys generally show a downward trend over time. Existing metapopulations are all located along stream banks in high-risk habitat subject to scouring by flood water. There is also considerable concern that these sites cannot provide sufficient prey for developing larvae. Saline wetlands, a lower-risk habitat because it is located away from Little Salt Creek, in most cases no longer provides suitable habitat for the subspecies; saline wetlands with intact hydrology remain rare. Efforts are underway to study the risk of cattle trampling on Salt Creek tiger beetles, particularly their slow, fossorial larvae. For these reasons, metapopulations of the Salt Creek tiger beetle remain on the brink of extinction even though progress has been made toward achieving some of the recovery priorities (USFWS 2016, 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 74.7% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 58). Up to 46% of the species' range overlaps with methomyl use sites while 28.7% of the range occurs off-field but may still be exposed to spray drift or runoff. Corn/soybean rotation is the use type most prevalent within the species' range, with 62% overlap. However, overlap with other use types may still contribute to the overall exposure of the species.

Usage

Based on past usage data, we anticipate 4.9% of the species range will be treated with methomyl annually (Table 58). We expect the highest usage in the species range to result from corn/soybean rotation, with up to 3.1% usage within the species range. However, usage on other use site types may still contribute to the overall exposure of the species.

Table 58. Overlap and usage data for the Salt Creek tiger beetle. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	1.6	7.1	8.8	0.2	1.1	1.3
Citrus	NA	NA	NA	NA	NA	NA
Corn[51]	44	18	62	2.2	0.9	3.1
Cotton	0	0	0	0	0	0

[51] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Grains	0.3	3.3	3.6	<0.1	0.2	0.2
Other Orchards	0	0	0	0	0	0
Other Row Crops	<0.1	<0.1	<0.1	0	0	0
Soybeans	43.1	17.8	60.9	2.1	0.9	3.0
Vegetables and Ground Fruit	<0.1	0.3	0.3	<0.1	0.3	0.3
Wheat	NA	NA	NA	NA	NA	NA
Total	**46**	**28.7**	**74.7**	**2.5**	**2.4**	**4.9**

Additional exposure considerations

The Salt Creek tiger beetle occurs in remnant saline wetlands on exposed mudflats and along the banks of streams and seeps that contain salt deposits. Moist, saline, open flats are needed for thermoregulation, reproduction, and foraging. The Salt Creek tiger beetle typically has a 2-year life cycle of egg, larval, and adult stages. Eggs are laid and after two weeks, upon hatching, each larva excavates a burrow where it lives for the next 2 years; the burrow is enlarged by the larva as it grows. Larvae are sedentary predators, catching prey that passes nearby. Larval tiger beetles ambush prey passing near the burrow entrance. Once it has captured its prey, the larval tiger beetle pulls it into the burrow with the aid of two pairs of hooks on the abdomen. These hooks also function to prevent the larva from being pulled from its burrow by larger prey or predators. Larvae are more directly affected by a limited food supply than adults because they are not as mobile as adults and almost never leave their burrows.

Following pupation, adults emerge from the burrows in the late spring to early summer of their second year and mate. Adult Salt Creek tiger beetles prey on other insects on sandbars, mid-stream gravel areas, and salt flats (USFWS 2017). Adults are mobile predators as they use their mandibles to catch other prey insects and microorganisms. Reproduction takes place in May, June, and July.

The Salt Creek tiger beetle makes use of mudflats where beetles live, breed, and forage. If pesticide applications are made, it will be in these areas where these beetles will be impacted the most (no name, pers. comm. USFWS species co-occurrence Ask to Field 2016).

Exposure Summary

There is a large extent of overlap between the species' range and the action area (74.7% total overlap). While past usage data suggests that only a small portion of the range is likely to be treated (up to 4.9% annually), the large overlap indicates that at least a moderate number of individuals are likely to experience exposure.

Overall Exposure: Medium

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We anticipate adverse effects to the insect prey base from methomyl exposure on or near use sites. Because insects taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of the insects in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. Adverse effects to the insect community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Salt Creek tiger beetle has a medium exposure ranking. There is a large extent of overlap between the species' range and the action area (74.4%), however there is a low level of expected usage within the species range (up to 4.9% of the range treated, annually), suggesting that a moderate number of individuals are likely to experience exposure. The species has a high toxicity ranking as available data indicate that exposed individuals are likely to die. Furthermore, we anticipate that individuals that do not die will have reduced prey availability as the arthropod species that serve as prey for the Salt Creek tiger beetle are similarly sensitive to methomyl exposure. We anticipate this level of direct and indirect effects, coupled with the medium exposure ranking, will result in at least a moderate number of individuals experiencing mortality or prey resource loss. As such, we determine the overall risk of adverse effects to the species is high.

Preliminary Conclusion

The Salt Creek tiger beetle is listed as endangered. The species has one of the most limited ranges of any insects in the United States, and recent studies indicate that nearly all populations are stable or decreasing in size. Currently, the beetle is observed in the mudbanks of the Little Salt River and the salt mudflats of Lancaster County, Nebraska. The Salt Creek beetle requires open, barren, salt flat areas for the construction of burrows, feeding, and dispersing. A captive rearing program has augmented the larger metapopulation of the Salt Creek beetle, but it continues to exhibit low resiliency and remain on the brink of extinction. Considering information about the species status, we have determined that the species has a high vulnerability ranking.

Methomyl use sites overlap with 46% of the Salt Creek tiger beetle's range, indicating a high potential for exposure, while 28.7% of the species' range occurs off-site and is susceptible to spray drift. Past pesticide usage reporting data indicates that 4.9% of the species range will be treated with methomyl, indicating a medium portion of the species' range will be exposed to methomyl. As such, we expected that a moderate number of individuals would experience exposure and die from the proposed action.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Salt Creek tiger beetle:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Salt Creek tiger beetle by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

The PULA for the Salt Creek tiger beetle will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Salt Creek tiger beetle in the wild.

References

U.S. Fish and Wildlife Service. 2022. 5-Year Status Review for the Salt Creek Tiger Beetle (*Cicindela nevadica lincolniana*). Wood River, Nebraska. 6 pp.

U.S. Fish and Wildlife Service. 2017. Recovery Plan for the Salt Creek tiger beetle (*Cicindela nevadica lincolniana*). Wood River, Nebraska. 48 pp.

U.S. Fish and Wildlife Service. 2016. Salt Creek tiger beetle 5-Year Review. Wood River, Nebraska. 22 pp.

Integration and Synthesis Summary: Franklin's bumble bee

Scientific Name:	Common Name:	Entity ID:
Bombus franklini	Franklin's bumble bee	5066

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range (Figure 41), and low past usage of methomyl within the species' range. Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Franklin's bumble bee. We discuss our rationale for the species in the sections below.

Species range

Last updated: 2/1/2022; Wherever found; *States within the range:* CA, OR

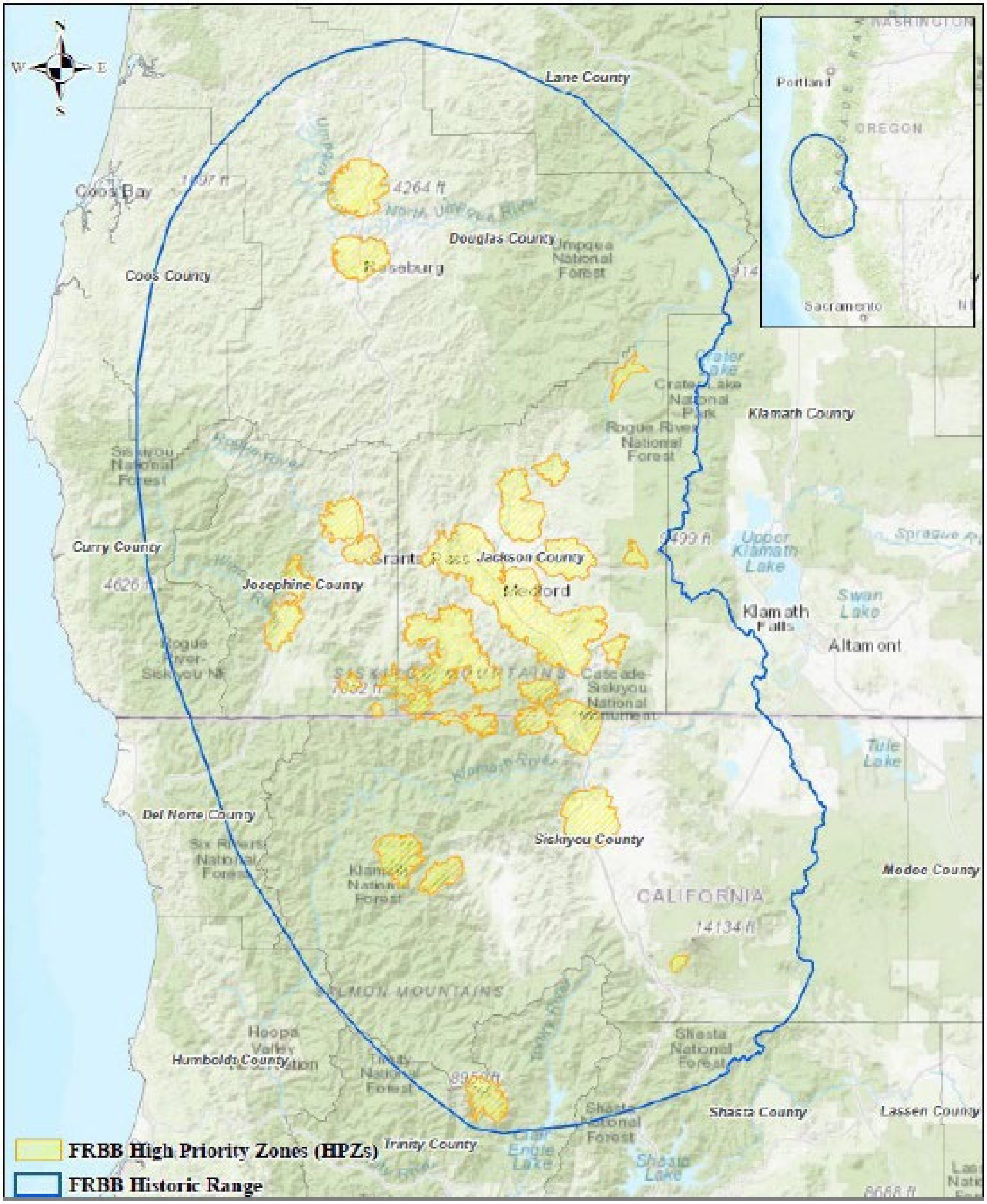

Figure 41. The Franklin's bumble bee species' range is outlined in blue and the high-priority zones are highlighted in yellow. Species' experts anticipate the species is most likely to be found in areas of high elevation in the high-priority zones (OFWO pers. comm., 2024). Figure copied from OFWO 2024.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: Not available.

Date of most recently completed 5-Year Review: Not available.

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Franklin's bumble bee was listed as endangered August 24, 2021 (86 FR 47221). It has the most restricted range of any North American bumble bee and very little is known about the species. Historically, Franklin's bumble bee occupied portions of Douglas, Jackson, and Josephine Counties in southern Oregon, as well as Trinity and Siskiyou Counties in northern California. Elevations where it has been observed range from 162 m in the northern part of its range, to over 2,340 m in the southern part. Since the late 1990s, observations have declined significantly, and no individuals have been observed since 2006, despite an expanded and focused survey effort. While the decline of Franklin's bumble bee observations is contemporaneous with the decline of other Bombus species, the causal factors behind these declines are poorly understood. The species has likely been affected by pathogens, pesticides, and the effects of small population size. The synergistic effects of these stressors have likely exacerbated declines.

The 2021 recovery outline for the species concluded that the resiliency of the species has decreased since the 1990s. Further, its genetic and ecological representation as well as redundancy have decreased since the 1990s, since no extant populations of Franklin's bumble bee, distributed across any level of ecological conditions or spatial extent, are known to exist. Due to the lack of observations since 2006, anticipated future states of resiliency, redundancy or representation have not been projected. Although the failure to detect a species during surveys cannot be equivalent to a conclusive demonstration of its absence and may simply reflect the very low detection probability for rare species, the reduction in both the number of populations and their spatial extent render Franklin's bumble bee, if indeed extant, vulnerable to extinction even without further external stressors acting on the species.

Very little is known about Franklin's bumble bee's specific habitat needs and behaviors, although the habitat elements the Franklin's bumble bee appears to depend on are relatively plentiful and widely distributed. Bumble bees are habitat generalists and utilize a wide variety of flora throughout the growing season. The Franklin's bumble bee requires floral resources for gathering pollen and nectar throughout the colony cycle and relatively protected areas for breeding and sheltering but is not obligated to a specific host plant and many of the flora it has been documented using are widely distributed across the western United States. A key information gap is why Franklin's bumble bee is so narrowly endemic compared to other bumble bee species in the western United States. We lack fundamental information about specific habitat requirements, colony site selection, and hibernacula site selection. To account for the lack of species-specific information on Franklin's bumble bee, we rely heavily on information from closely related species in the same sub-genus, specifically rusty-patched bumble bee (*Bombus affinis*) and western bumble bee (*Bombus occidentalis*). Franklin's bumble bee is found from 540 feet to 7,800 feet in elevation and nests in abandoned rodent burrows or other cavities, although it may occasionally nest on the ground or in rock piles. We assume that Franklin's bumble bee nests in upland grasslands and shrublands that contain forage during the summer and fall, and as far as 100 meters into the edges of forest and woodland. We also assume that the species overwinters exclusively beneath trees in upland forest and woodlands. Palustrine wetlands – vegetated wetlands traditionally called by such names as marsh, swamp, bog, and fen provide nectar and pollen but are not suitable for nesting or overwintering due to their flooded or saturated soils (Oregon Fish and Wildlife Office, pers. comm. 2022).

Within the historical range of the Franklin's bumble bee, total acres in agricultural cropland decreased in all three counties in Oregon (Douglas, Jackson, and Josephine) by greater than 50 percent from 1997 to 2012. While the total number of acres of agricultural cropland is not synonymous with agricultural intensification (specifically, the expansion of monocultures), a decrease in total acres of agriculture leads us to conclude that agricultural intensification was not likely a factor in the decline of the Franklin's bumble bee. We have no documentation in our files or any direct evidence that agricultural intensification has contributed to the decline of the Franklin's bumble bee or will increase in the future to a degree that may affect the viability of the species. Approximately 42 percent of sites where Franklin's bumble bees have ever been reported (18 of 43) occur on federally-owned land, primarily U.S. Forest Service and Bureau of Land Management land; very little habitat on these lands has been permanently altered or lost through agricultural intensification (86 FR 47221).

The inferred primary threats to Franklin's bumble bee are introduced pathogens and pesticides. Here, pesticides is a broad term that includes herbicides, insecticides, fungicides, and the adjuvants often used in their application. A number of diseases are known to naturally occur in bumble bee populations. These include the protozoan parasite *Crithidia bombi*, the tracheal mite *Locustacarus buchneri*, and the microsporidium (parasitic fungus) *Nosema bombi*, as well as deformed wing virus. *Nosema bombi* has been implicated as a causal factor in widespread and sudden declines in many native North American pollinators, including Franklin's bumble bee.

Secondary threats include habitat loss and degradation, livestock grazing, competition for food and potentially nesting resources from managed and non-native bees, small population dynamics, and climate change. In general, even well-managed livestock grazing may deplete bee food resources, trample bee nest sites, and affect ground-nesting rodents, which in turn can affect bees that use their burrows. In addition, over-grazing removes native vegetation and facilitates the creation of invasive monocultures that do not provide the high-quality and diverse season-long resources that native plant communities provide. Based on information from other bee species, climate change may lead to decreased resource availability because of spatial and/or temporal shifts in food plants, decreased availability of nesting habitat, and increased threats from pathogens and non-native species. The synergistic effect of multiple threats, such as exposure to pathogens and pesticides simultaneously, have been documented to have compounding direct and indirect effects on bumble bees. In addition, the breeding system of bumble bees leaves them very susceptible to inbreeding depression and collapse from small-population dynamics.

To date, given the lack of known populations, few conservation actions have been implemented for the Franklin's bumble bee. Efforts to find the Franklin's bumble bee have been increasing and is key for recovery. Once populations of the Franklin's bumble bee are located, conservation actions can be aimed at protecting those populations and gathering information from them to close critical knowledge gaps, which in turn will enable the development of species-specific recovery actions (USFWS 2018, 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicates 3.8% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 59). Up to 1.5% of the species' range overlaps with methomyl use sites while 2.3% of the range that occurs off-field is likely to be exposed to spray drift or runoff.

Usage

Past usage data indicates that 0.6% of the species range has been treated with methomyl annually (Table 59).

Table 59. Overlap and usage data for Franklin's bumble bee. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	1.2	1.3	2.5	0.2	0.2	0.4
Citrus	NA	NA	NA	NA	NA	NA

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Corn[52]	<0.1	<0.1	<0.1	0	0	0
Cotton	<0.1	<0.1	<0.1	0	0	0
Other Grains	0.3	0.7	1	0	0	0
Other Orchards	<0.1	<0.1	<0.1	0	0	0
Other Row Crops	<0.1	<0.1	<0.1	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	<0.1	0.2	0.2	<0.1	0.2	0.2
Wheat	0	0	0	0	0	0
Total	**1.5**	**2.3**	**3.8**	**0.2**	**0.4**	**0.6**

Additional exposure considerations

Franklin's bumble bee is found from 540 feet to 7,800 feet in elevation and nests in abandoned rodent burrows or other cavities, and possibly on the ground or in rock piles. We assume that Franklin's bumble bee nests in upland grasslands and shrublands that contain forage during the summer and fall, and as far as 100 meters into the edges of forest and woodland (USFWS 2022). We also assume that they overwinter exclusively beneath trees in upland forest and woodlands. Palustrine wetlands provide nectar and pollen but are not suitable for nesting or overwintering due to their flooded or saturated soils (OFWO, pers. comm. 2022).

The flight season is mid-May to the end of September. The species may forage up to 6.2 miles from the nest, but the typical dispersal distance is likely around 1.9 miles. Franklin's bumble bee may prefer wet fen, riparian, and other wetland type area habitat seasonally, as drier areas during the latter part of the summer cease to provide floral resources. Floral resources that bloom

52 We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

throughout the colony's life cycle, from spring to autumn, will typically be found in open (non-forested) meadows in proximity to seeps and other wet meadow environments (OFWO, pers. comm. 2022).

The low level of past usage data reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 0.38% of the species range likely treated with any insecticides. Given that methomyl is likely only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

The Service identified areas where Franklin's bumble bee may be most likely to occur called "high-priority zones" (Figure 41). High-priority zones are based on the species' historic observation locations, in addition to modeled habitat characteristics, and are updated every five years with available survey and ground-verification information. As stated in our guidance document for this species, Franklin's bumble bees may be found outside of the high-priority zones, but the zones can be used to guide consultations and assess the likelihood of impacts to the species. Reasonable certainty of impacts to the species increases from a consultation perspective when within a high-priority zone. Outside of high-priority zones, we consider the species not reasonably certain to occur (USFWS 2024). Some agriculture occurs within the high-priority zones, but we expect that the Franklin's bumble bee, when it is found, will occur in the higher elevation areas of the high-priority zones, like has been documented for the western bumble bee (a closely related bumble bee species with an overlapping range). It is unlikely that the species currently occurs in lower elevation areas, even within high-priority zones, where land uses are no longer suitable (i.e., agricultural and developed), and the bee is not likely to nest or forage on agricultural sites (OFWO pers. comm., 2024). In addition, over half (62.5%) of the species' range occurs on federally-owned land (i.e., Bureau of Land Management or US Forest Service) and approximately 42% of sites where Franklin's bumble bees have ever been reported (18 of 43) occur on federal lands where very little habitat has been permanently altered (86 FR 47221). An even higher proportion of the high-priority zones is federal land where we expect any pesticide usage will be done with considerations for listed species and their resources.

Exposure Summary

There is a low extent of overlap between the action area and the species' range (3.8% total overlap). Past usage data suggests that only a small proportion of the range will likely experience exposure (up to 0.6% of range treated annually). This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticide usage, in general, within the species' range. In addition, the Franklin's bumble bee is a ground nesting bee, preferring areas near forests edges and within open wet fens that are not likely to be near agricultural areas. As such, we anticipate only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the Franklin's bumble bee is reliant on for food or habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Franklin's bumble bee has a low exposure ranking. There is a low extent of overlap between the species' range and the action area (3.8% total overlap), a low level of past usage (up to 0.6% of the range treated annually), and individuals tend to prefer habitat away from agricultural areas, reducing the likelihood of exposure. The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. However, we anticipate the low level of exposure will result in only a small number of individuals likely to die. As such, we determine the overall risk of adverse effects to the species is low.

Conclusion

Very little is known about Franklin's bumble bee habitat, although it is likely a habitat generalist based on habitats used by closely related bumble bee species. No individual Franklin's bumble bees have been observed since 2006. While there are many gaps in what is known about the species, inferred primary threats to the species include pesticides and the effects of small population size. Exposure of an extant population will likely have severe consequences to the species. However, the risk of exposure to methomyl is anticipated to be low due to the low overlap of the range with use sites and low anticipated usage on those use sites. Methomyl is only used on agricultural sites, which have been declining in the range. In addition, the species is believed to only occur on high-elevation areas of the Franklin's bumble bee high-priority zones where agricultural uses will not occur, and 62.5% of the range (with an even higher proportion for the high-priority zones) is managed by either the BLM or USFS where we expect minimal, if any, insecticide use to occur.

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Even though the species is highly vulnerable, we expect the likelihood of methomyl exposure to Franklin's bumble bee to be extremely low. While pesticides are a likely threat to the species, could potentially be one of the causes for extirpation of the species at historic sites, and may impede successful dispersal and recolonization, we expect that any remaining extant populations are most likely to occur in areas that are not regularly exposed to methomyl or other pesticides. We do not expect Franklin's bumble bees to forage or nest on agricultural lands and spray drift that would expose individuals is expected to be a rare event with very few, if any, individuals adversely affected over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Franklin's bumble bee in the wild.

References

Oregon Fish and Wildlife Office, U.S. Fish and Wildlife Service, personal communications. 2022 and 2024. Portland, Oregon.

U.S. Fish and Wildlife Service. 2021. Recovery Outline for Franklin's Bumble bee (*Bombus franklini*). Portland, Oregon. 9 pp.

U.S. Fish and Wildlife Service. 2024. Franklin's Bumble Bee (*Bombus franklini*) Endangered Species Act Section 7(a)(2) Voluntary Implementation Guidance. Version 2.0. Portland, Oregon. 64 pp.

U.S. Fish and Wildlife Service. 2018. Species Status Assessment for the Franklin's bumble bee (*Bombus franklini*), Version 1. Portland, Oregon. 73 pp.

Integration and Synthesis Summary: Bartram’s scrub-hairstreak butterfly

Scientific Name:	Common Name:	Entity ID:
Strymon acis bartrami	Bartram's scrub-hairstreak butterfly	5067

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species’ vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a medium extent of exposure due to high overlap and medium past usage of methomyl on use sites within the species’ range (Figure 42). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. Given that toxicity is high, and exposure is anticipated to be medium, the risk of adverse effects to the species is medium. As such, we expected moderate number of individuals were likely to be exposed and die over the project duration.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Bartram's scrub-hairstreak butterfly to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Bartram's scrub-hairstreak butterfly. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Last updated: 2/10/2022; Wherever found; *States within the range:* FL

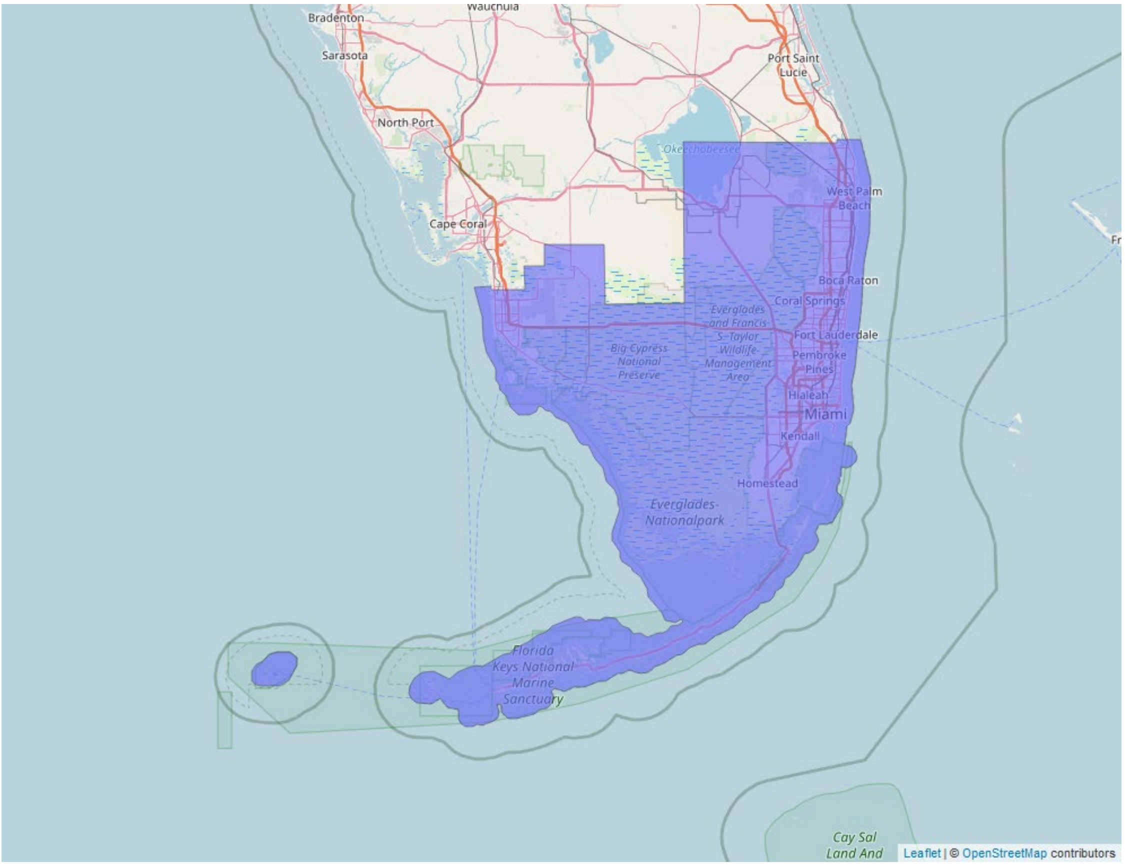

Figure 42. Range map of Bartram's scrub-hairstreak butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4837.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes (from mosquito adulticides)

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Bartram's scrub-hairstreak is a small (approximately one inch in length) butterfly native to the pine rockland habitat of south Florida. At rest, this species is easy to recognize by the broad white bands with a black edge that can be seen when the wings are closed. Bartram's scrub-hairstreaks seldom fly very far (no more than 5m) from their only known host plant, pineland croton (*Croton linearis*). Adults can be found during every month of the year; however, the exact number of broods appears to vary sporadically from year to year.

Based on the results of historic and recent surveys and natural history studies, there are extant Bartram's scrub-hairstreak populations in Everglades National Park, locally within pineland fragments in mainland Miami-Dade County, and on Big Pine Key in Monroe County.

Populations of Bartram's scrub-hairstreak have become increasingly localized as pine rockland habitat has been lost or altered through anthropogenic activity. Destruction of pine rocklands for economic development has reduced this habitat in Miami-Dade County, including Everglades, to about 11% of its natural extent, from approximately 74,000 ha (183,000 ac) to only 8,140 ha (20,100 ac) in 1996. Outside of Everglades, only about 1% of the Miami Rock Ridge pinelands have escaped clearing, and much of what is left is in small remnant fragments isolated from other natural areas.

Habitat loss, fragmentation, degradation, and associated pressures from increased human population are major threats; these threats are expected to continue, placing these butterflies at greater risk. Although efforts are being made to conserve natural areas and apply prescribed burns, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future. At this time, we consider predation, parasitism, and disease to be threats to this species due to its current tenuous status. We have no information to suggest that vulnerability to these threats will change in the future. We find that existing regulatory mechanisms, due to their inherent limitations and constraints, are inadequate to address threats to this species throughout its range. We have no information to indicate that poaching, inconsistent fires, pesticide use, or habitat loss will be ameliorated in the future by enforcement of existing regulatory mechanisms. Therefore, we find it reasonably likely that the effects on the Bartram's scrub-hairstreak will continue at current levels or potentially increase in the future. Effects of small population size, isolation, and loss of genetic diversity are likely significant threats as well as natural changes to habitat and anthropogenic factors (e.g., pesticides, fire, processes affected by climate change). Collectively, these threats have impacted the butterflies in the past, are impacting this species now, and will continue to impact this species in the future.

Efforts to control salt marsh mosquitoes (*Aedes taeniorhynchus*) among others, have increased as human activity and population have increased in south Florida. To control mosquito populations, second-generation organophosphate (naled) and pyrethroid (permethrin) adulticides are applied using both aerial and ground-based methods by mosquito control districts throughout south Florida. The use of such pesticides to control mosquitoes presents a potential risk to nontarget species, including the Bartram's scrub-hairstreak. The Long Pine Key region of Everglades is not treated with pesticides for mosquito control. Outside of the Everglades, occupied butterfly habitat within Miami-Dade County remains vulnerable to the effects of adulticide applications. This species may be particularly vulnerable to truck applications based on their tendency to roost within low-lying vegetation (including along roadsides), an area with maximal exposure to ground-based treatments. However, use of mosquito control pesticides within Miami-Dade County pine rockland habitat areas is limited. Miami-Dade County and the Florida Key Mosquito Control District coordinate annually with the Service in order to avoid or minimize any impacts to pine rockland and butterfly habitat. In addition, extensive no spray and buffer zones have been established around Bartram's scrub-hairstreak critical habitat both on Big Pine Key and throughout Miami-Dade County (USFWS 2014, 2015).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 16.5% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 60). Up to 10.5% of the species' range overlaps with methomyl use sites while 6% of the range occurs off-field but may still be exposed to spray drift or runoff. Other grains use sites have the greatest prevalence within the species' range, with 10.4% overlap with the species' range.

Usage

Based on past usage data, we anticipate only 6.5% of the species range will be treated annually with methomyl annually (Table 60).

Table 60. Overlap and usage data for Bartram's scrub-hairstreak butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	<0.1	<0.1	<0.1	0	0	0
Citrus	NA	NA	NA	NA	NA	NA

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Corn[53]	<0.1	0.1	0.2	0	0	0
Cotton	<0.1	<0.1	<0.1	0	0	0
Other Grains	7.8	2.5	10.4	0.4	0.1	0.5
Other Orchards	0.9	1.2	2.1	0.9	1.2	2.1
Other Row Crops	<0.1	<0.1	<0.1	0	0	0
Soybeans	<0.1	<0.1	<0.1	0	0	0
Vegetables and Ground Fruit	1.7	2.2	3.9	1.7	2.2	3.9
Wheat	NA	NA	NA	NA	NA	NA
Total	**10.5**	**6**	**16.5**	**3.0**	**3.5**	**6.5**

Additional exposure considerations

The Bartram's scrub-hairstreak butterfly reproduction and larval development occur entirely within the pine rocklands, and the species is multivoltine, with an entire life cycle of about 2-3 months. Continuous broods are maintained. Females lay the eggs singly on both the lower and upper surface of the host plant. Therefore, the Bartram's scrub-hairstreak butterfly is potentially vulnerable to the effects of methomyl throughout its entire lifecycle. The majority a remaining pine rockland habitat is found within the Everglades National Park, where we do not anticipate any methomyl exposure is likely to occur as there is no agriculture occurring within or near the park boundaries. Additional populations can be found in fragments of pine rockland habitat occur in Big Pine Key in Monroe County and in mainland Miami-Dade County, where exposure to methomyl is more likely to occur.

[53] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Truck-applied pesticides were found to drift considerable distances from target areas with residues that persisted for weeks on the host plant, possibly threatening larvae. Adult Bartram's scrub-hairstreak may be particularly vulnerable to aerial applications based on their tendency to roost within the pineland canopy, an area with maximal exposure to such treatments (USFWS 2014).

Exposure Summary

There is a large extent of overlap between the species' range and the action area (16.5% total overlap). While past usage data suggests that a smaller portion of the species' range is likely to be treated with methomyl (up to 6.5% of the range treated annually), we consider this a moderate level of usage. We anticipate the majority of individuals are protected from methomyl exposure as the majority of remaining pine rockland habitat is found within Everglades National Park. However, there are some populations found in fragments of pine rockland habitat in Monroe and Miami-Dade counties that are in closer proximity to methomyl use sites and are likely to experience exposure. As such, we anticipate a moderate number of individuals are likely to experience exposure.

Overall Exposure: Medium

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any plant species that this butterfly species is reliant on for food such as flowers that provide nectar for adults or host plants that provide food and shelter for larvae, or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Bartram's scrub-hairstreak butterfly has a medium exposure ranking. There is a large extent of overlap between the species' range and the action area (16.5%), a moderate level of past methomyl usage within the species' range (up to 6.5% of the range treated annually), and while some populations are protected from exposure in Everglades National Park, remaining populations in Monroe and Miami-Dade counties will likely experience exposure. As such, we anticipate a moderate number of individuals are likely to experience exposure. The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to methomyl, suggesting that any exposed individuals are likely to die. This high toxicity, coupled with the medium exposure ranking, suggests that a moderate to large number of individuals may die. As such, we determine the overall risk of adverse effects to the species is medium.

Preliminary Conclusion

The Bartram's scrub-hairstreak butterfly is listed as endangered and is endemic to south Florida. The species is found only in fragmented pine rockland habitat in Everglades National Park, mainland Miami-Dade County and Big Pine Key. The Bartram's scrub-hairstreak butterfly depends on and is rarely far from its only known host plant, the pineland croton (*Croton linearis*). Habitat loss and mosquito control programs present threats to the continued existence of the species. Human activity has converted and diminished pine rockland habitat throughout the species' range. The species also remains vulnerable from the use of pesticides like naled and permethrin for mosquito control in Miami-Dade County; however, coordinated efforts between the County and the mosquito control district have resulted in limited use (and drift) of these pesticides in pine rockland habitat.

There is large overlap (16%) between the species range and the action area, with up to 10% of the species range overlapping with use sites, and 6% susceptible to off-site exposure. Usage data indicates that a moderate amount of the range (6.5%) will be treated with methomyl. The Bartram's scrub-hairstreak butterfly is multivoltine, producing several broods per year. The female lays eggs on both sides of the croton leaf throughout the year, making the species vulnerable to methomyl exposure throughout its life cycle. We anticipated a moderate number of individuals would experience exposure and die from the proposed action.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Bartram's scrub-hairstreak butterfly:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Bartram's scrub-hairstreak butterfly by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Do not apply methomyl from two hours after sunrise until two hours before sunset on cucurbits, peppers, and tomatoes. Do not apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on lima beans and snap beans and all methomyl registered crops in the 'other orchards' UDL. We expect these mitigations to reduce on-field exposure.*

The PULA for the Bartram's scrub-hairstreak butterfly will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Bartram's scrub-hairstreak butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2015. Status of the Species – Bartram's scrub-hairstreak butterfly. Available from the Service Field Office (Vero Beach).

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Endangered Status for the Florida Leafwing and Bartram's Scrub-Hairstreak Butterflies. Federal Register 79(155):47222-47244.

Integration and Synthesis Summary: Mariana wandering butterfly

Scientific Name:	Common Name:	Entity ID:
Vagrans egistina	Mariana wandering butterfly	5168

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 43). We expect exposed individuals to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mariana wandering butterfly. We discuss our rationale for this conclusion in the sections below.

Species range

Last updated: 8/10/2021; Wherever found; *States within the range:* GU, MP

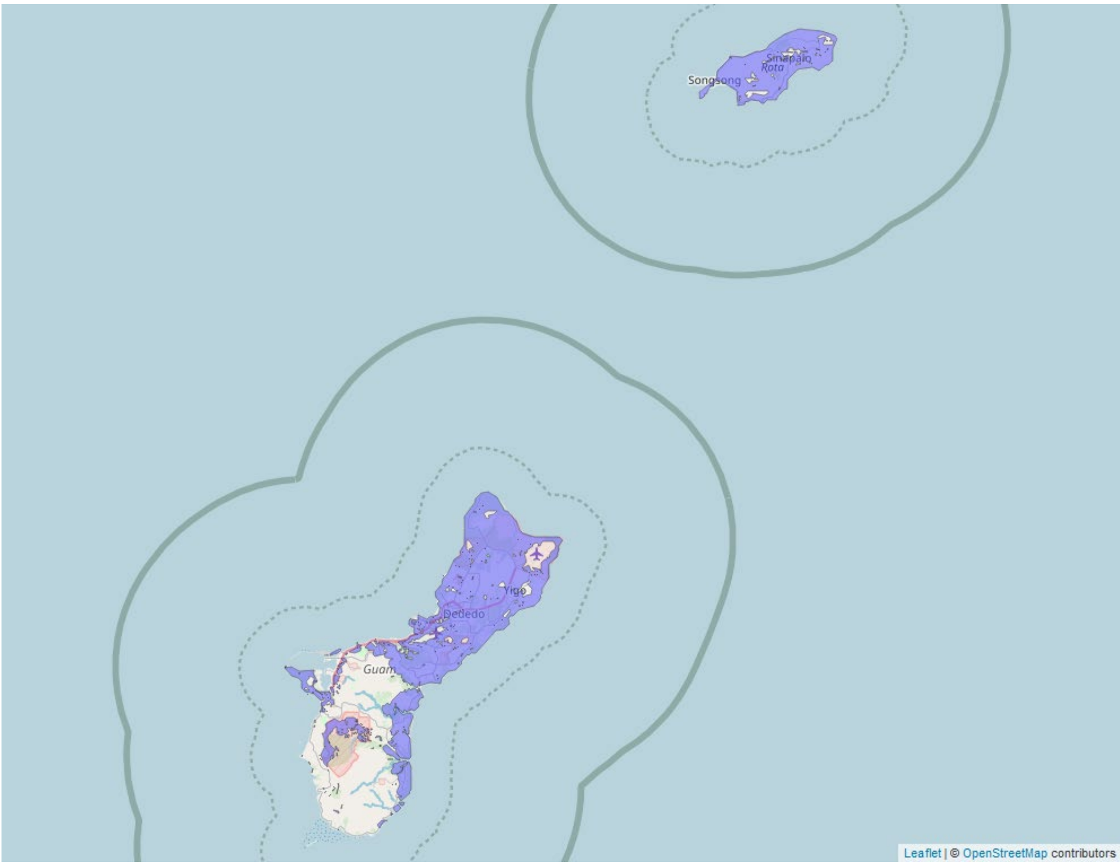

Figure 43. Range map of Mariana wandering butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7121.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/28/2020

Distribution: Unknown (likely limited to one or a few islands)

Number of populations: Unknown (no populations found during recent surveys)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes (a past threat)

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Mariana wandering butterfly is endemic to the forest ecosystem of the islands of Guam and Rota in the Mariana archipelago. Mariana wandering butterflies are known to be good fliers, and in earlier times, probably existed as a series of meta-populations with considerable movement, interbreeding, colonization, and extinctions between local and stable populations. The larvae feed on a host plant, *Maytenus thompsonii* (luluhut), that is endemic to the Mariana Islands. *M. thompsonii* occurs within the forest ecosystem on Guam, Rota, Saipan, and Tinian. Historically, the Mariana wandering butterfly was collected and described from the island of Guam where it was considered to be rare, but widespread. The species has not been observed on Guam since 1979, where it was last collected in Agana.

The species was first collected on Rota in the 1980s. During several 1995 surveys on Rota, it was recorded at only one location among six different sites surveyed. From June through October 2008, extensive surveys for the Mariana wandering butterfly were conducted on the island of Tinian under the direction of the Service. While several *Maytenus thompsonii* host plant populations were identified in limestone forest habitat, no life stages of the Mariana wandering butterfly were observed. Hundreds of hours of surveys on Guam were conducted annually between 2011 to 2015, but no evidence of Mariana wandering butterfly (i.e., egg, larva, or adult) was recorded in areas of suitable limestone forest habitat often containing abundant host plants. Similarly, rare butterfly surveys by other biologists in Guam over the years failed to detect the Mariana wandering butterfly. In 2012 on Rota, entomologists conducted approximately 40 hours of surveys across four days and examined the habitat in and near the last locality where the butterfly was observed, I-Chenchon Bird Sanctuary. While the Mariana wandering butterfly was not found, hundreds of square meters of very dense and healthy stands of the *Maytenus thompsonii* host plant were observed. It is possible this species occurs on the northern islands where host plants are found (USFWS 2015), although there is no record of its presence. Based on the population trend and lack of detections in recent surveys, the Mariana wandering butterfly is likely extirpated on Guam, but may still exist on Rota in small numbers (USFWS 2020). The native limestone forest in Guam and Rota that supports the wandering butterfly's presumed host plant continues to decline due to development and modification, ungulate pressure, typhoons, non-native plants, and fire. The primary direct stressors to the butterfly likely include high egg mortality and predation from native and non-native insects including ants and parasitic wasps. Pesticides were once applied in great quantities in Guam, Saipan, and Tinian (USFWS 2020) and may have contributed to the early decline and loss of the Marian wandering butterfly.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 3.2% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 61). Up to 0.6% of the range occurs on-field and 2.6% of the range overlaps with potential runoff and/or spray drift areas.

Table 61. Overlap data for the Mariana wandering butterfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	0.6	2.6	3.2

Usage

Past methomyl usage data in the Pacific Islands are unavailable, however, prior reporting data in other island territories and Hawai'i has indicated that insecticide usage is likely to occur, with methomyl presumably being among these insecticides. While we are not able to use this generic data to adjust overlap estimates, we can broadly use this data as confirmation that insecticide usage likely occurs on these islands.

Additional exposure considerations

Surveys on the island of Rota found that the host plant, *Maytenus thompsonii*, was abundant (USFWS 2020), so it is likely the butterflies range widely over the island, especially given that it is a strong flier.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. While we cannot adjust these overlap estimates with the generic insecticide usage data available for the Pacific Islands, we infer from this data that methomyl usage within the species' range is likely to occur. Given the extent of overlap is low, we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including its host plant *Maytenus thompsonii* (luluhut) upon which the larvae feed or other flowering plants that adults may use for nectar.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Mariana wandering butterfly has a low extent of exposure (3.2% overlap), we determine the species has a low exposure ranking. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given that we anticipate only a small number of individuals are likely to be exposed and that these individuals are likely to experience severe adverse effects, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Mariana wandering butterfly is listed as endangered. It was formerly found on Guam and Rota in the Mariana Islands but is believed to be extirpated on Guam. On Rota, the species may exist in very small numbers, but it has not been observed in decades despite researchers observing many areas of its host plant. Threats to the species include habitat loss from development, ungulate pressure, storms, and non-native plants. We believe historical pesticide use contributed to the species drastic decline, but there is no mention that current pesticide use is considered a threat to the species. If populations of the Mariana wandering butterfly are located, conservation actions can be aimed at protecting those populations and gathering information from them to close critical knowledge gaps, which in turn will enable the development of species-specific conservation and recovery actions.

Potential methomyl use sites overlap with 3.2% of the species' range, indicating a low potential for exposure. Past methomyl usage data is unavailable for the Pacific Islands, but we expect insecticide usage to occur. We expect a low likelihood of individuals experiencing methomyl exposure based on the overlap information. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Mariana wandering butterfly in the wild.

References

U.S Fish and Wildlife Service. 2020. Wandering Butterfly (*Vagrans egistina*) 5-Year Review. Honolulu, Hawai‘i. 15 pp.

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Endangered Status for 16 Species and Threatened Status for 7 Species in Micronesia. Federal Register 80(190): 59424-59497.

Integration and Synthesis Summary: Island marble butterfly

Scientific Name:	Common Name:	Entity ID:
Euchloe ausonides insulanus	Island marble butterfly	5610

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure due to medium overlap and low past usage of methomyl on use sites within the species' range (Figure 44). We expect individuals to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the island marble butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 3/1/2022; Wherever found; *States within the range:* WA

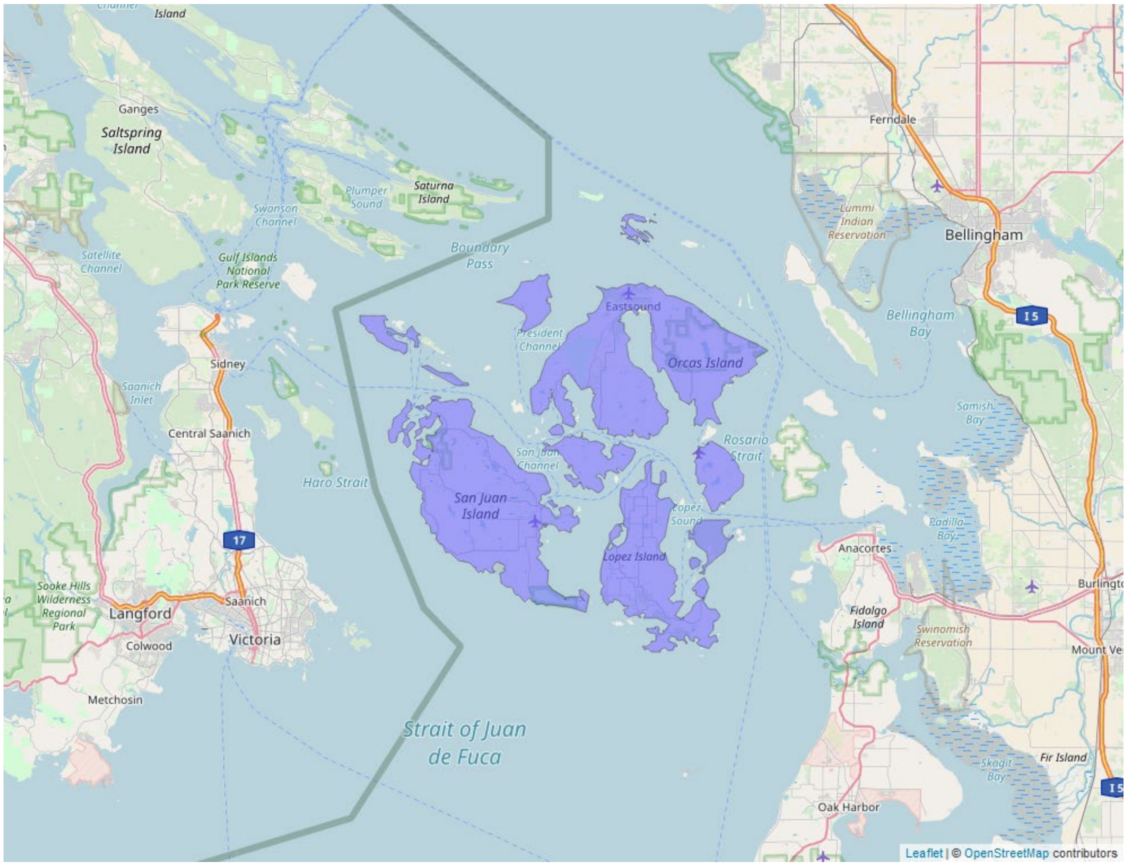

Figure 44. Range map of island marble butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3285.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Historically, the island marble butterfly has always been rare and was only known from Vancouver Island and the Canadian Gulf Islands, which are part of the same geologic formation as the San Juan Archipelago. It is now considered extirpated from Canada (last known specimen collected in 1908). Reasons for the disappearance are unknown, but hypotheses include increased parasitoid loads associated with the introduction of the cabbage white butterfly or heavy grazing of natural meadows by cattle and sheep, which severely depressed the butterfly's presumed larval food plant. The butterfly was discovered on San Juan Island, Washington, in 1998 by John Fleckenstein, a biologist with the Natural Heritage Program of the Washington Department of Natural Resources. At the time of discovery, there were five identified populations of island marble butterfly, and the number and distribution of populations declined since 2006. Currently, the species is only observed in one location at San Juan Island National Historic Park (American Camp). In 2006, abundance was estimated "probably less than 500 butterflies, possibly as low as 300 individuals" with uncertain accuracy (USFWS 2006, 2023).

The island marble butterfly is an early-spring flying butterfly and adults emerge between April and June, mate and lay eggs on three known species of host plants: the native Menzies' pepperweed (*Lepidium virginicum*), non-native field mustard (*Brassica rapa*), and non-native tumble mustard (*Sisymbrium altissiumum*). While all three larval host plants occur in open grass- and forb-dominated systems, each species is most robust in one of three specific habitat types: Menzies' pepperweed at the edge of low-lying coastal lagoon habitat; field mustard in upland prairie habitat, disturbed fields, and disturbed soils; and tumble mustard in sand dune habitat (USFWS 2023). In one study, individual butterflies were rarely observed to move greater than 600 m from their origin site; just one marked individual was recaptured 1.9 km from its site of origin (USFWS 2006).

Primary threats include habitat loss and degradation from plant succession and invasion by plants that displace larval host plants; browsing by black-tailed deer (*Odocoileus hemionus*), European rabbits (*Oryctolagus cuniculus*), and brown garden snails (*Cornu aspersum*); storm surges; direct predation by spiders and wasps, and incidental predation by black-tailed deer; and vulnerabilities associated with small population size and environmental and demographic stochasticity, and other chance events that increase mortality or reduce reproductive success (USFWS 2020). Threats have affected the island marble butterfly throughout the entirety of its range, are ongoing, and are likely to persist into the foreseeable future. Other causes of habitat loss for the island marble butterfly that have likely resulted in the extirpation of the island marble butterfly from much of its former range include: (1) development; (2) road maintenance activities; (3) agricultural practices; and (4) herbivory by black-tailed deer and livestock. When considered individually and cumulatively, these threats are of a high magnitude. Despite existing regulatory mechanisms and other conservation efforts, the threats to the subspecies remain sufficient to put the subspecies is in danger of extinction or likely to become so in the foreseeable future.

Each year since 2013, the National Park Service has collected and reared a small number of eggs and larvae in a captive-rearing Program. In 2015, the captive individuals emerged from diapause much later than the wild population. Despite the use of the experimental plots for oviposition by these late-flying, captive-reared females, none of the eggs and larvae tracked in the experimental plots survived. The high mortality was attributed to increased predation pressure by late-season spiders and wasps. Results of captive-rearing were better in 2016, when captive-reared island marble butterflies emerged in synchrony with the wild population. Survivorship from egg to fifth instar larvae was also higher in the experimental plots in 2016; three percent of the tracked larvae survived to the fifth instar, which is a relatively high survival rate for the island marble butterfly. After recovery efforts and captive-rearing between 2013-2018, over 500 captive-raised butterflies have been released to supplement the extant population at American Camp. Despite considerable advances in habitat restoration, new habitat establishment, captive rearing, herbivore exclusion, and outreach and education, the number of individual island marble butterflies remains small in the single remaining population (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect up to 8.5% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area. Up to 0.8% of the species' range overlaps with methomyl use sites while 7.6% of the range occurs off-field but may still be exposed to spray drift or runoff. Other grains are the most prevalent use type within the species' range, which overlaps with the species range by 4.2%. However, overlap with other use sites may still contribute to the overall exposure of the species.

Usage

Based on past usage data (Table 62), we anticipate only 2.5% of the species range will be treated with methomyl annually.

Table 62. Overlap and annual usage data for the island marble butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	<0.1	0.8	0.8	<0.1	<0.1	0.1
Citrus	NA	NA	NA	NA	NA	NA
Corn[54]	<0.1	1.3	1.4	<0.1	<0.1	0.1

[54] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Cotton	0	0	0	0	0	0
Other Grains	0.5	3.6	4.2	<0.1	0.2	0.2
Other Orchards	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0.1	1.9	2	0.1	1.9	2.0
Wheat	0	0	0	0	0	0
Total	**0.8**	**7.6**	**8.5**	**0.2**	**2.3**	**2.5**

Additional exposure considerations

The island marble butterfly is a highly endemic species that lives its entire lifecycle within upland grasslands, sand dunes, or coastal lagoon habitat. The flight season for this butterfly is remarkably long, from sometime in April into June in many or even all years in the San Juan Islands, Washington, while individuals rarely live more than two weeks (average about nine days). Larvae have five instar stages before over-wintering as pupae. The island marble butterfly is univoltine, meaning just one brood is produced each year. Eggs may be observed for a week beyond when adults are observed, and larvae have been observed into mid-July (USFWS 2020, 2023). Because the height of feeding and reproductive activities for this butterfly occur essentially from April through July, it may be more vulnerable to the effects of methomyl during the larval and adult stages if applications are made at this time.

The island marble butterfly is found at American Camp, San Juan Island National Historic Park, Washington. The National Park Service is the caretaker for the largest parcel (600 ac) of suitable habitat and the largest population of island marble butterflies in this area. In 2006, the National Park Service developed a Conservation Agreement for the island marble butterfly and this document provides guidance for conserving the island marble butterfly on lands administered by the National Park Service, and specifically for implementation of grassland restoration activities at American Camp.

The low level of past usage reported above is further corroborated by data from the USDA's Census of Agriculture, which reports general insecticide usage. Results from 2017 indicate that very low levels of insecticides in general were used within the counties where the species' range occurs, with only 1.95% of the species range reported to be treated with any insecticides. Given that methomyl is only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. As such, we further expect a low likelihood of methomyl usage, and subsequent exposure of individuals, is likely to occur.

Exposure Summary

There is a medium extent of overlap between the species' range and the action area (8.5% total overlap). Past usage data suggests that only a small portion of the range has been treated with methomyl in the past (up to 2.5% range treated annually). This low level of past usage is corroborated by the USDA's Census of Agriculture, which shows very little insecticides, in general, have been used within the species' range. Additionally, the National Park Service protects the largest parcel of suitable habitat and largest population of island marble butterflies in the area. As methomyl is only registered for use on agricultural crops, we expect a low likelihood that it will be used on National Park Service lands. As such, we anticipate only a small number of individuals are likely to be exposed to methomyl.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any plant species that this butterfly species is reliant on for food such as flowers that provide nectar for adults or host plants that provide food and shelter for larvae, or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The island marble butterfly has a low exposure ranking. While there is a moderate level of overlap between the species' range and the action area (8.6% total overlap), past usage data indicates only a small portion of the range has been treated with methomyl (up to 2.5% range treated annually). Additionally, the largest population of butterflies occurs in National Park Service land, where we do not anticipate agricultural use of methomyl. As such, we expect only a small number of individuals are likely to be exposed to methomyl. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. However, given the low exposure potential, we anticipate only a small number of individuals are likely to die. Therefore, we determine the overall risk of adverse effects to the species is low.

Conclusion

The island marble butterfly is listed as endangered. The species has always been rare and is considered extirpated from its historic range in Canada. Currently, it is observed at only one known location at San Juan Island National Historic Park. The island marble butterfly lays its eggs on three host plants-the native Menzies pepperweed, and the non-native field mustard and tumble mustard. These host species all occur in open grass- and forb-dominated systems, and more specifically lagoon habitat (pepperweed), upland prairie (field mustard) and sand dunes (tumble mustard). Individual butterflies rarely move more than 600 m from their origin site. A captive rearing program has faced challenges with high mortality over the years but has successfully released over 500 individuals into the wild between 2013-2018. Despite habitat restoration and a captive rearing program, the species remains small and confined to the single remaining population. Considering information about the species status, we have determined that the species has a high vulnerability ranking.

Methomyl use sites overlap with only 0.8% of the Island marble butterfly's range, indicating a low potential for exposure, though 7.6% of the species' range occurs off-site and is susceptible to spray drift. However, past pesticide usage reporting data indicates that only 2.5% of the species range will be treated with methomyl, further indicating a low likelihood of individuals experiencing methomyl exposure. Additionally, the largest parcel of suitable habitat is managed by the National Park Service, which developed a Conservation Agreement for island marble butterfly and provides guidance for management of the lands. As such, we anticipate a relatively small number of individuals are likely to experience exposure from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Island marble butterfly.

References

U.S. Fish and Wildlife Service. 2023. Recovery Plan for Island Marble Butterfly (*Euchloe ausonides insulanus)*. Portland, Oregon. 40 pp.

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Endangered Status for the Island Marble Butterfly and Designation of Critical Habitat. Federal Register 85(87):26786-26820.

U.S. Fish and Wildlife Service. 2006. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Island Marble Butterfly (*Euchloe ausonides insulanus*) as Threatened or Endangered. Federal Register 71(219):66292-66298.

Integration and Synthesis Summary: Oceanic Hawaiian damselfly

Scientific Name:	Common Name:	Entity ID:
Megalagrion oceanicum	Oceanic Hawaiian damselfly	6231

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 45). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the oceanic Hawaiian damselfly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 1/25/2022; Wherever found; *States within the range:* HI

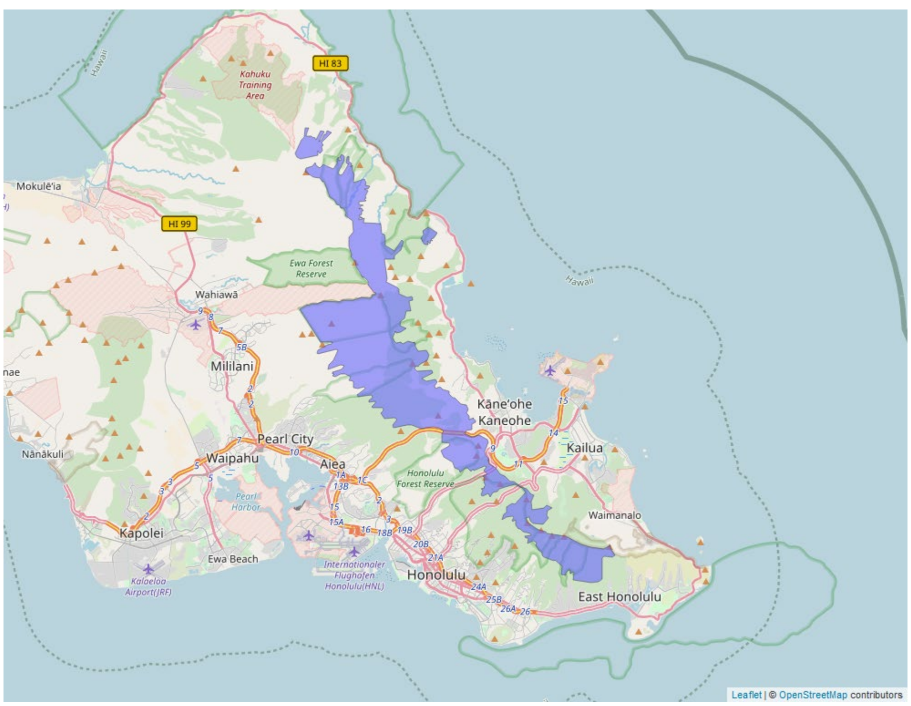

Figure 45. Range map of Oceanic Hawaiian damselfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/663.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 7/20/2023

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Historically, the oceanic Hawaiian damselfly occurred on both the leeward and windward sides of the Koʻolau and Waianae Mountains on Oʻahu. The oceanic Hawaiian damselfly now occupies 12 sites above 100 m in elevation on the windward side of the Koʻolau Mountains at Kahawainui, Wailele, Koloa, Kaipapau, Maʻakua, upper Kalaunui, Kawaiʻiki, Opaeula, upper Helemano, Waihee, and Kahaluu. Habitat consists of perennial streams, swift-flowing sections and riffles of streams in lowland mesic, lowland wet, and wet cliff ecosystems. Little is known about the abundance, population trends, and demographic features of the oceanic damselfly. Observations of adults suggest breeding may take place along stream corridors. Individuals of the immature stage of the oceanic Hawaiian damselfly are found in swiftly flowing sections of streams, usually amid rocks and gravel in stream riffles and small cascades on waterfalls. While capable of swimming, the naiads usually crawl among gravel or submerged vegetation. Older naiads frequently forage out of the actual stream channel and have been observed among wet moss on rocks and wet rock walls and seeps. Adults are very bold and strong flyers, and when disturbed, frequently fly upward into the forest canopy overhanging the stream or waterfall (USFWS 2019, 2023). Adults feed on native invertebrates (USFWS 2012).

Current threats to the oceanic Hawaiian damselfly include non-native predatory fish, bullfrogs, and ants; lack of population representation, resiliency, and redundancy due to its apparent low population number (USFWS 2019); an unidentified invasive pathogen; and *Hydra vulgaris*, an invasive predatory invertebrate (USFWS 2023). The threats posed by conversion of wetlands and other aquatic habitat for agriculture and urban development are ongoing and are expected to continue into the future. These modified areas lack the aquatic habitat features that the oceanic Hawaiian damselfly requires for essential life history needs, such as marshes, side pools along streams, and slow sections of perennial streams, and no longer support populations of this species (USFWS 2019). Habitat poisoning is a potential threat to the oceanic Hawaiian damselfly. Exposure to pesticide contamination can cause acute and chronic poisoning and lead to the mortality of non-target aquatic organisms. Hawaiian damselfly larvae and eggs can be exposed to pesticide contaminated water through direct contact (USFWS 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect less than 1% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 63). There are no methomyl use sites within the species' range, indicating that individuals will only be exposed off-field through spray drift and runoff.

Table 63. Overlap data for the oceanic Hawaiian damselfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
HI state agriculture layer	0	<0.1%	<0.1%

Usage

Past methomyl usage data in Hawaiʻi is unavailable, however, prior reporting data has indicated that 8-45% of agricultural crops in Hawaiʻi were treated with insecticides, with methomyl presumably being among these insecticides.

Exposure Summary

There is a low extent of overlap between the action area and the species' range (less than 0.1% total overlap). Given the extent of overlap is low, we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We anticipate indirect effects to this species if exposed as it relies on other aquatic invertebrates as food during the adult and naiad stages. However, because prey taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of prey in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. Adverse effects to the prey community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the oceanic Hawaiian damselfly has a low extent of exposure (less than 0.1% total overlap), we determine the species has a low exposure ranking. The species has a high toxicity ranking as available data that any individuals exposed are likely to die. However, given that we anticipate only a small number of individuals are likely to be exposed, we expect the overall risk of adverse effects to the species is low.

Conclusion

The oceanic Hawaiian damselfly is listed as endangered and is found in twelve perennial streams and cliff ecosystems in the Koʻolau Mountains on Oʻahu. It is believed to be extirpated from the Waianae Mountains. Adults feed on native invertebrates and little is known about species abundance or population trends. Threats to the species include habitat loss from ungulate pressure, non-native predatory fish and Hydra vulgaris, and pesticide poisoning.

Potential methomyl use sites overlap with <1% of the species' range, indicating a low potential for exposure. Even though prior reporting data indicated that 8-45% of agricultural crops on Hawai'i were treated with insecticides, potentially including methomyl, we expect a low likelihood of individuals experiencing methomyl exposure based on the overlap information. The species relies on native invertebrate prey, species of which could experience a range of sensitivities to methomyl exposure. We expect a short-term reduction in prey in areas where methomyl is used, but not a complete prey elimination and the species overlap is so small that we do not expect much prey reduction from methomyl to occur. As such, we anticipate, at most, a very small number of individuals are likely to experience effects from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the oceanic Hawaiian damselfly in the wild.

References

U.S. Fish and Wildlife Service. 2023. 5-Year Review Short Form Summary: Oceanic Hawaiian Damselfly (*Megalagrion oceanicum*). Honolulu, Hawai‘i. 7 pp.

U.S. Fish and Wildlife Service. 2019. Oceanic Hawaiian Damselfly (*Megalagrion oceanicum*). 5-year Review. Honolulu, Hawai‘i. 17 pp.

U.S. Fish and Wildlife Service. 2012. Endangered and Threatened Wildlife and Plants; Endangered Status for 23 Species on Oahu and Designation of Critical Habitat for 124 Species. Final Rule. September 18, 2012. 77 FR 57647 57862

Integration and Synthesis Summary: Taylor's (=whulge) checkerspot

Scientific Name:	Common Name:	Entity ID:
Euphydryas editha taylori	Taylor's (=whulge) checkerspot	7495

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined that while there is high overlap and high usage of methomyl within the species' range (Figure 46), there is likely to be low exposure due to the non-agricultural habitat preferences of the Taylor's checkerspot butterfly. The toxicity of methomyl to the species is high, as most exposed individuals are likely to die. However, considering the low exposure, the risk to the species from the registration of methomyl is low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Taylor's checkerspot butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 10/13/2021; Wherever found; *States within the range:* OR, WA

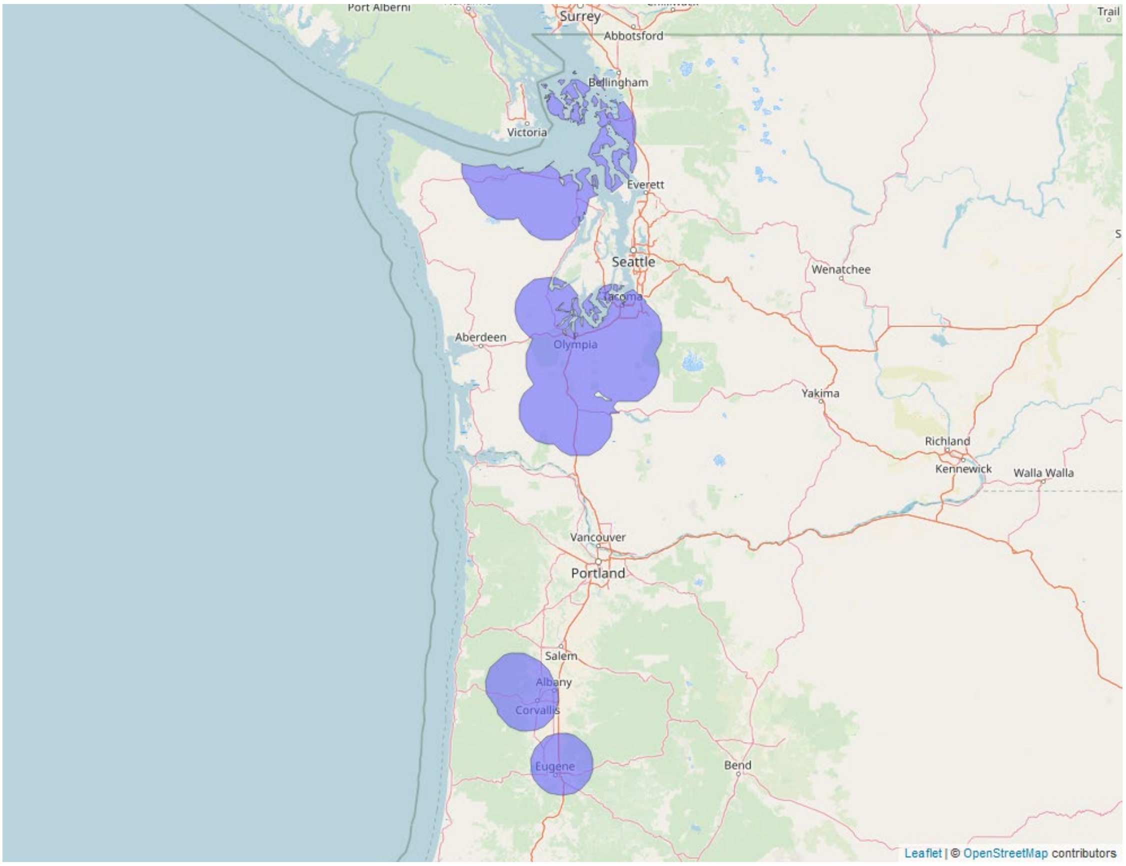

Figure 46. Range map of Taylor's (=whulge) checkerspot (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5907.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Taylor's checkerspot butterfly was listed as endangered in 2013 (78 FR 61451). The distribution of the Taylor's checkerspot butterfly has been reduced from more than 80 populations to the 14 occupied locations with small populations that are known range-wide today. Some of the populations that were extirpated disappeared in the decade prior to listing, and some declined from robust population sizes of 1,000s of individual butterflies to zero within a 3-year interval and have not returned. In the south Puget prairies, only one native local population remains, while others are the result of reintroduction efforts. Most remaining populations of Taylor's checkerspot butterflies are small; 5 of the 14 known populations are estimated to have fewer than 100 individuals. In addition, nearly all the sites are isolated or substantially degraded and most harbor few of the larval food and nectar plants needed to support viable Taylor's checkerspot butterfly populations. Taylor's checkerspot butterflies occupy a matrix of forested, agricultural, urbanized, and coastal habitats such as, but not limited to, prairies, meadows, coastal bluffs, coastal beach deposits, montane meadows, old forest clearings, and rocky balds in forested areas. These habitats are unevenly distributed throughout the species' historical range with extensive suitable or restorable but unoccupied habitat in the south Puget Sound and with smaller areas of occupied, suitable habitat in the Willamette Valley, North Olympic peninsula, and British Columbia (USFWS 2013, 2024).

In the original listing documents for the Taylor's checkerspot, spraying of *Bacillus thuringiensis* var. *kurstaki* (BtK) on over 100,000 acres to control a spongy moth (*Lymantria dispar*, formerly referred to by the common name "gypsy moth") was listed as a possible contributor to the extirpation of some populations in Pierce County, Washington around 1992, though there were contemporaneous large changes in habitat and application areas did not include all the populations that were extirpated (USFWS 2013). As of 2023, the BtK threat is addressed through coordination with the Service when a spongy moth infestation is detected near occupied Taylor's checkerspot habitat. In addition, known extant populations and planned translocations are on sites managed for natural resource conservation, including federal lands, where pesticide usage is likely to be constrained to restoration or management that will benefit the Taylor's checkerspot and include conservation measures, where appropriate. Based on currently known locations, Taylor's checkerspot are unlikely to occur within close proximity to agricultural lands (D. Grosboll, pers comm. June 2023).

The threats of land development and loss of habitat from conversion to other uses (agriculture); impacts of military training and recreation; existing and likely future habitat fragmentation and habitat disturbance; long-term fire suppression; and ongoing loss and degradation of habitat associated with native and non-native invasive species continue. These factors have resulted in the present isolation and limited distribution of the subspecies and are currently ongoing and will continue into the foreseeable future. The combination of ongoing threats coupled with small population sizes and highly variable population dynamics leads us to conclude that the Taylor's checkerspot butterfly is currently in danger of extinction throughout its range (USFWS 2013, 2024).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 17.2% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 64). Up to 4.6% of the species' range overlaps with methomyl use sites and 12.6% of the range that occurs off-field is likely to be exposed to spray drift or runoff. Vegetables and ground fruit and other orchards are the use types with the greatest overlaps with the species' range (5.4% and 4.5%, respectively). However, overlap with other sites may still contribute to the overall exposure of the species.

Usage

Past usage data indicate that up to 10.9% of the species range will be treated with methomyl annually (Table 64).

Table 64.Overlap and annual usage data for the Taylor's checkerspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0.2	0.9	1.0	<0.1	0.2	0.2
Citrus	NA	NA	NA	NA	NA	NA
Corn[55]	0.9	1.8	2.7	<0.1	<0.1	0.1
Cotton	0	0	0	0	0	0
Other Grains	0.7	2.0	2.7	<0.1	<0.1	0.1
Other Orchards	0.7	3.9	4.5	0.7	3.8	4.5
Other Row Crops	0.2	0.7	0.8	<0.1	0.3	0.4
Soybeans	0	0	0	0	0	0

[55] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Vegetables and Ground Fruit	2.1	3.4	5.4	2.1	3.3	5.4
Wheat	0	0	0	0	0	0.2
Total	**4.6**	**12.6**	**17.2**	**2.9**	**7.8**	**10.9**

Additional exposure considerations

The Taylor's checkerspot butterfly flight period begins in late April and extends into early July. In Oregon, the flight season may last for up to 45 days. Eggs hatch after 13 to 15 days (Murphy et al. 2004, p. 25) and then live colonially in a loose silk web during early development, Larvae then enter diapause during mid- to late summer and overwinter in this state until the following late winter or early spring (late February or March). Because the height of feeding and reproductive activities for this butterfly occurs essentially from April through July, it may be more vulnerable to the effects of methomyl during the larval and adult stages if applications are made at this time. Taylor's checkerspot uses prairies, meadows, balds, forest openings, and coastal beach deposits with abundant host plants, nectar sources, limited woody vegetation, and generally low growing native herbaceous vegetation. It has been found on and immediately adjacent to U.S. Forest Service Roads, roads on private lands, and roads on a Department of Defense installation. This species also inhabits a powerline corridor in Oregon. Therefore, habitats used by this species include "rights of ways," which are not a use site for methomyl (D. Grosboll, pers comm. June 2023).

Additional data from the USDA show very little methomyl is likely to have been used within the species' range in the past. The USDA's Census of Agriculture provides information on reported insecticide usage at the county level. Data from the USDA's 2017 Census of Agriculture shows very low levels of insecticides in general were used within the counties where the species' range occurs, with only 2.29% of the species range treated with any insecticides. Given that methomyl is only one of many insecticides covered by this data, this low level of insecticide usage suggests there is likely even lower levels of methomyl used in the past. Furthermore, given that this data is associated with the specific counties that the butterfly's range occurs, we have high confidence that there has only been a small portion of the species' range treated. As such, we have high confidence that only a small portion of the species' range is likely to be treated annually.

Exposure Summary

There is a high extent of overlap between the species' range and the action area (17.2% total overlap), however, multiple lines of evidence indicate that only a small portion of the range is likely to be treated. Past usage data provided by the EPA indicate up to 10.9% of the range has been treated annually, while past usage data as reported by the USDA's Census of Agriculture shows only 2.29% of the range has been treated with any insecticide annually in the past. Given that the Census of Agriculture is specific to the counties where the Taylor's checkerspot range occurs in and includes the usage of other insecticides besides methomyl, we anticipate only a small portion of the range is likely to be treated annually. Additionally, we know that extant populations and planned translocations are currently on sites managed for natural resource conservation and/or federal lands where pesticide usage is likely to be constrained to habitat restoration or management that will benefit the Taylor's checkerspot, and include conservation measures to protect the species, where appropriate (D. Grosboll, pers comm. June 2023). As such, we anticipate a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

Adult butterflies are opportunistic nectivores and larvae are known to feed and find shelter in a number of plant species. We do not expect that exposure to methomyl will result in adverse effects to plants. Thus, we do not expect any adverse indirect effects will occur.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Taylor's checkerspot butterfly has a low exposure ranking. While there is a high extent of overlap between the action area and the species' range (17.2% total overlap) and a high rate of past usage (up to 10.9% range treated annually), we anticipate most individuals will not be in close proximity to agricultural areas where methomyl will be used. Extant populations and planned translocations are in areas that are managed for the conservation of natural resources and the species and have pesticide use practices that limit usage to conservation and restoration actions that help conserve the species. As such, we expect only a small number of individuals are likely to experience exposure. The species has a high toxicity ranking, as available data indicates insect species are highly sensitive to methomyl and any individuals exposed are likely to die.

Despite this high toxicity, given the low exposure potential, we anticipate only a small number of individuals are likely to die. As such, we determine the overall risk of adverse effects to the species is low.

Conclusion

Considering information about the species status, we have determined that the species has a high vulnerability. The Taylor's checkerspot butterfly is listed as endangered. There are currently only 14 known occupied locations with small populations range-wide, reduced from 80 known populations historically. Ongoing threats to the species include small population sizes, habitat loss and degradation, habitat fragmentation, long-term fire suppression. Pesticides from spraying to control a spongy moth was a possible contributor to the extirpation of some populations in the past, but risks associated with pesticides have been reduced by improved coordination with the Service when moth infestations arise and because extant populations occur on federal and other lands managed for conservation with considerations for the Taylor's checkerspot butterfly.

Methomyl use sites overlap with a large portion (17.2%) of the Taylor's checkerspot butterfly's range. Pesticide usage data indicates high methomyl usage in the range annually (10.9%), indicating a high level of methomyl exposure that will lead to high levels of mortality. However, while the variety of habitat types used by this species includes a matrix of land uses that include agricultural areas, this species is not anticipated to occur in close proximity to agricultural lands based on known locations of extant populations and planned translocations on lands that are managed for natural resource conservation. Therefore, we do not anticipate high levels of mortality, although we expect the loss of a small number of individuals due to exposure to methomyl from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Taylor's checkerspot in the wild.

References

Murphy, D.D., N. Wahlberg, I. Hanski, and P.R. Ehrlich. 2004. Chapter 2 - Introducing checkerspots: taxonomy and ecology. Pages 17-33 in P.R. Ehrlich, and I. Hanski, eds. On the wings of checkerspots: a model system for population biology. Oxford University Press, New York. 371 pp.

U.S. Fish and Wildlife Service. 2024. Recovery Plan for Taylor's Checkerspot Butterfly (*Euphydryas editha taylori*). Portland, Oregon. 41 pages.

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the Taylor's Checkerspot Butterfly and Threatened Status for the Streaked Horned Lark. Federal Register 78(192):61452-61503.

Appendix C-A6. Insects: Integration and Synthesis Summaries

Integration and Synthesis Summary: Florida leafwing butterfly

Scientific Name:	Common Name:	Entity ID:
Anaea troglodyta floridalis	Florida leafwing butterfly	8083

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure. While overlap is estimated to be moderate, given the species' very limited distribution we anticipate low usage of methomyl on use sites within the species' range (Figure 47). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Florida leafwing butterfly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 2/10/2022; Wherever found; *States within the range:* FL

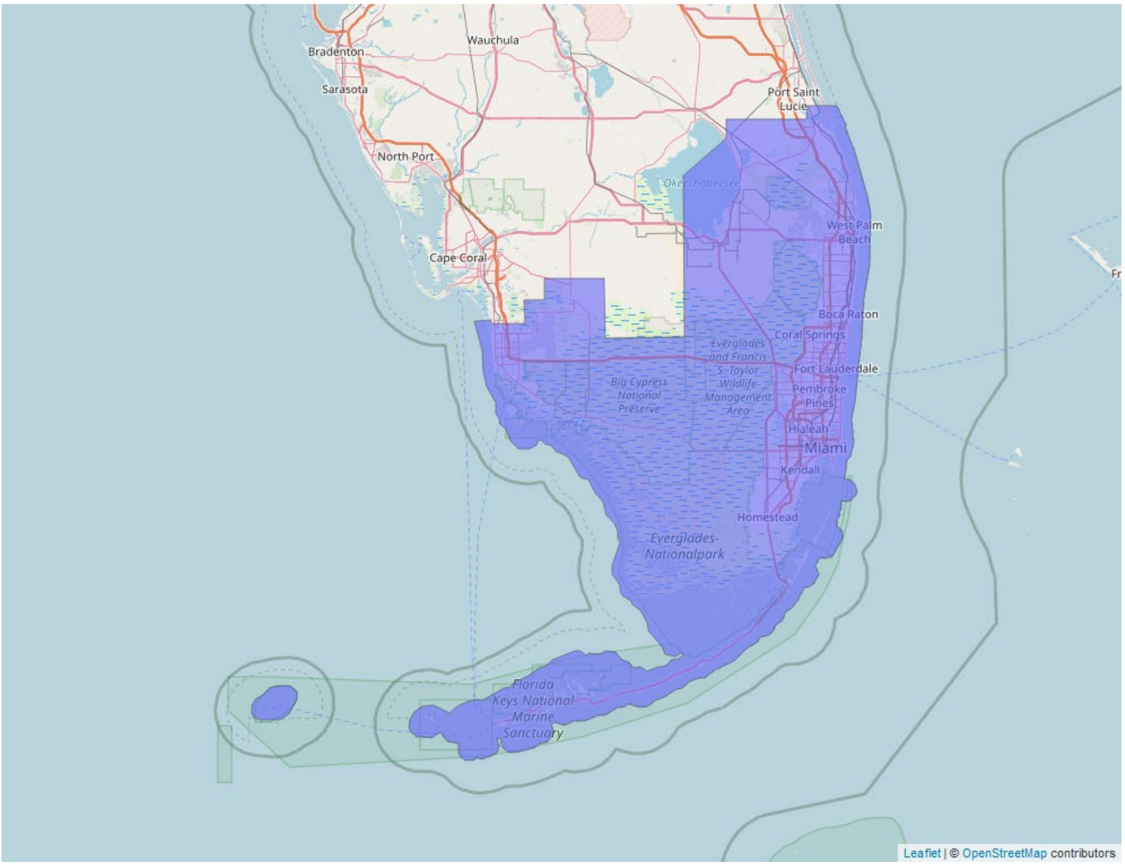

Figure 47. Range map of Florida leafwing butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6652.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Population size/location(s) unknown

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Florida leafwing occurs only within pine rocklands that retain its hostplant, pineland croton (*Croton linearis*). Populations of Florida leafwing have become increasingly localized as pine rockland habitat has been lost or altered through anthropogenic activity. Destruction of pine rocklands for economic development has reduced this habitat in Miami-Dade County, including Everglades National Park, to about 11% of its natural extent, from approximately 74,000 ha (183,000 ac) to only 8,140 ha (20,100 ac). Outside of Everglades National Park, only about 1% of the Miami Rock Ridge pinelands have escaped clearing, and much of what is left is in small remnant fragments isolated from other natural areas.

The Florida leafwing butterfly is considered to have low population size, roughly several hundred or fewer. Adults are rapid, wary flyers and extremely territorial, with both sexes flying out to pursue other butterflies (USFWS 2010). The Florida leafwing is multivoltine (i.e., produces multiple generations per year), with an entire life cycle of about 60 days and maintains continuous broods throughout the year. The precise number of broods per year remains unknown, but the leafwing has been recorded in every month.

Habitat loss, fragmentation, degradation, and associated pressures from increased human population are major threats, and these threats are expected to continue. Although efforts are being made to conserve natural areas and apply prescribed burns, the long-term effects of large-scale and wide-ranging habitat modification, destruction, and curtailment will last into the future. There is no evidence to suggest that vulnerability to collection and risks associated with scientific or conservation efforts will change and, instead, are likely to continue into the future. Predation, parasitism, and disease are also threats to this species due to its current tenuous status. Effects of small population size, isolation, and loss of genetic diversity are likely significant threats as well as natural changes to habitat and anthropogenic factors (e.g., pesticides, fire, processes affected by climate change) (USFWS 2014).

The potential for mosquito control chemicals to drift into non-target areas and persist for varying periods of time has been well documented. In addition to mosquito control chemicals entering non-target areas, the toxic effects of mosquito control chemicals to non-target organisms have also been documented. Lethal effects on non-target Lepidoptera have been attributed to fenthion and naled in both south Florida and the Keys. In the lower Keys, declines in populations of the Florida leafwing were also partly attributable to mosquito control chemical applications. Populations of the Florida leafwing on Big Pine Key within National Key Deer Refuge increased during drier years when adulticide applications over the pinelands decreased, although other butterfly species did not follow this pattern.

Chad Anderson, biologist at National Key Deer Refuge, estimated roughly 243 ha (600 acres) of croton on Big Pine Key, based upon Bradley's pine rockland data and personal observations (USFWS 2010). The Florida leafwing butterfly is currently known to occur only within the Long Pine Key area within Everglades National Park (Miami-Dade County). Populations on Big Pine Key, in the lower Florida Keys (Monroe County), as well as the Navy Wells Pineland Preserve and the various parcels that compose the Richmond Pine Rocklands in Miami-Dade County are no longer extant. The extant population within the Everglades remains threatened by inconsistent fire management of pine rockland habitat, small population size, and illegal poaching (USFWS 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 8% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 65). Approximately 0.8% of the species' range overlaps with methomyl use sites and 7.1% of the range that occurs off-field is likely to be exposed to spray drift of runoff.

Usage

Past usage data indicate that up to 4.6% of the species range has been treated with methomyl annually (Table 65). Usage data indicates that methomyl applications to vegetables and ground fruit has the highest past usage, with 2.5% of the species' range treated on these crops. However, usage on other crop types may still contribute to the overall exposure of the species.

Table 65. Overlap and usage data for the Florida leafwing butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	<0.1	<0.1	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn[56]	0	0.1	0.1	0	0	0.
Cotton	0	<0.1	<0.1	0	0	0
Other Grains	0	3.4	3.4	0	0.2	0.2
Other Orchards	0.8	1.1	1.9	0.8	1.1	1.9

[56] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Other Row Crops	0	<0.1	<0.1	0	0	0
Soybeans	0	<0.1	<0.1	0	0	0
Vegetables and Ground Fruit	0	2.5	2.5	0	2.5	2.5
Wheat	NA	NA	NA	NA	NA	NA
Total	**0.8**	**7.1**	**8**	**0.8**	**3.8**	**4.6**

Additional exposure considerations

The Florida leafwing butterfly reproduction and larval development occur entirely within the pine rocklands. The species may have multiple broods a year, with an entire life cycle of about 2-3 months. Continuous broods are maintained throughout the year, indicating that exposure may occur at all stages of the species' life cycle.

The Florida leafwing is only found within the Pine Rockland habitat within Everglades National Park, and methomyl use sites are located several miles outside the park, therefore it is unlikely the majority of butterflies will be exposed from spray drift. Individuals may occasionally occur wander or disperse outside of the park, but we expect this will happen very infrequently.

Exposure Summary

Based on both overlap and past methomyl usage data, we anticipate a medium proportion of the Florida leafwing butterfly's range will be exposed to methomyl (primarily through spray drift from nearby use sites). However, we anticipate very few individuals are likely to experience methomyl exposure as the species is only found within pine rockland habitats within the Everglades National Park, which do not contain any methomyl use sites and is not likely to experience spray drift exposure as there are no use sites in adjacent areas. While there is a low probability of exposure, in rare instances, adult Florida leafwing butterflies may wander outside of the national park and may experience methomyl exposure. Thus, we determine that the species has a low exposure ranking, with very few individuals likely to experience exposure over the duration of the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as the plants it relies on for food or habitat (such as flowers that provide nectar for adults or those that larvae feed on) are not expected to experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

While there is a medium extent of overlap between the species' range and methomyl use sites and spray drift areas, past usage within the species' range is low. Additionally, the only extant population is located within Everglades National Park, which does not contain any methomyl use sites and is not located near any use sites that might result in spray drift entering the park. As such, we determined that the Florida leafwing butterfly has a low exposure ranking. Given that insects are highly sensitive to methomyl, we anticipate individuals that are exposed to methomyl at predicted environmental concentrations are likely to die. While we generally expect individuals are not likely to be exposed, exposure may occur in rare instances where adult butterflies leave the national park boundaries and enter methomyl use sites or adjacent areas that are exposed to spray drift. As such, we anticipate only a very small number of individuals, at most, will likely experience adverse effects from the proposed action.

Conclusion

The Florida leafwing butterfly is a narrow endemic species that historically occurred throughout Miami-Dade County in southern Florida and in the Florida Keys. Outside of Everglades National Park, only 1% of the species' preferred habitat, pine rocklands, remains intact due to widespread destruction from anthropogenic activities. What remains is highly fragmented. As of the 2023 5-year Status Review, the species is only extant in the Long Pine Key area within Everglades and has been extirpated from the rest of its range. The number of individuals remaining in the single population in Everglades fluctuates considerably from year to year, but recent surveys suggest a declining trend. Breeding populations of Florida leafwing butterfly have not been documented in pine rockland fragments adjacent to Everglades for roughly 30 years, though individual adults will, on very rare occasions, stray outside of park boundaries (USFWS 2023).

While toxicity is expected to be high for this species if exposure occurs, we anticipate minimal exposure due to the extant population's existence entirely within Everglades National Park. Agriculture does not occur within Everglades National Park boundaries, nor is spray drift from agricultural use sites outside the park expected to reach individuals in the Long Pine Key area. Rare, stray adults that wander outside park boundaries may experience exposure from nearby agricultural use sites, leading to the loss of a very small number of individuals over the duration of the proposed action. However, we do not anticipate this level of mortality will result in species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Florida leafwing butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2023. Florida Leafwing Butterfly (*Anaea troglodyta floridalis*) Status Review: Summary and Evaluation. Vero Beach, Florida. 20 pp.

U.S. Fish and Wildlife Service. 2015. Biological Opinion on Everglades National Park Fire Management Plan; Service CPA Code: 04EF2000- 2013-CPA-0083; Service Consultation Code: 04EF2000-20 1 3-F-0294. Available at: https://ecos.fws.gov/tails/sec/document/2303919.action.

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Endangered Status for the Florida Leafwing and Bartram's Scrub-Hairstreak Butterflies. Federal Register 79(155):47222-47244.

U.S. Fish and Wildlife Service. 2010. Species Assessment and Listing Priority Assignment Form for Florida Leafwing Butterfly. Southeast Region. May 7, 2010. 33 pp.

Integration and Synthesis Summary: Casey’s June Beetle

Scientific Name:	Common Name:	Entity ID:
Dinacoma caseyi	Casey's June Beetle	8503

Species Overview

In our review of the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species’ vulnerability is high. Our evaluation of the effects of the proposed action to the species indicates a low extent of exposure due to low overlap and low past usage of methomyl on use sites within the species’ range (Figure 48). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While the toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be exposed and die over the project duration. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Casey's June beetle. We discuss our rationale for the species in the sections below.

Species range

Last updated: 6/10/2022; Wherever found; *States within the range:* CA

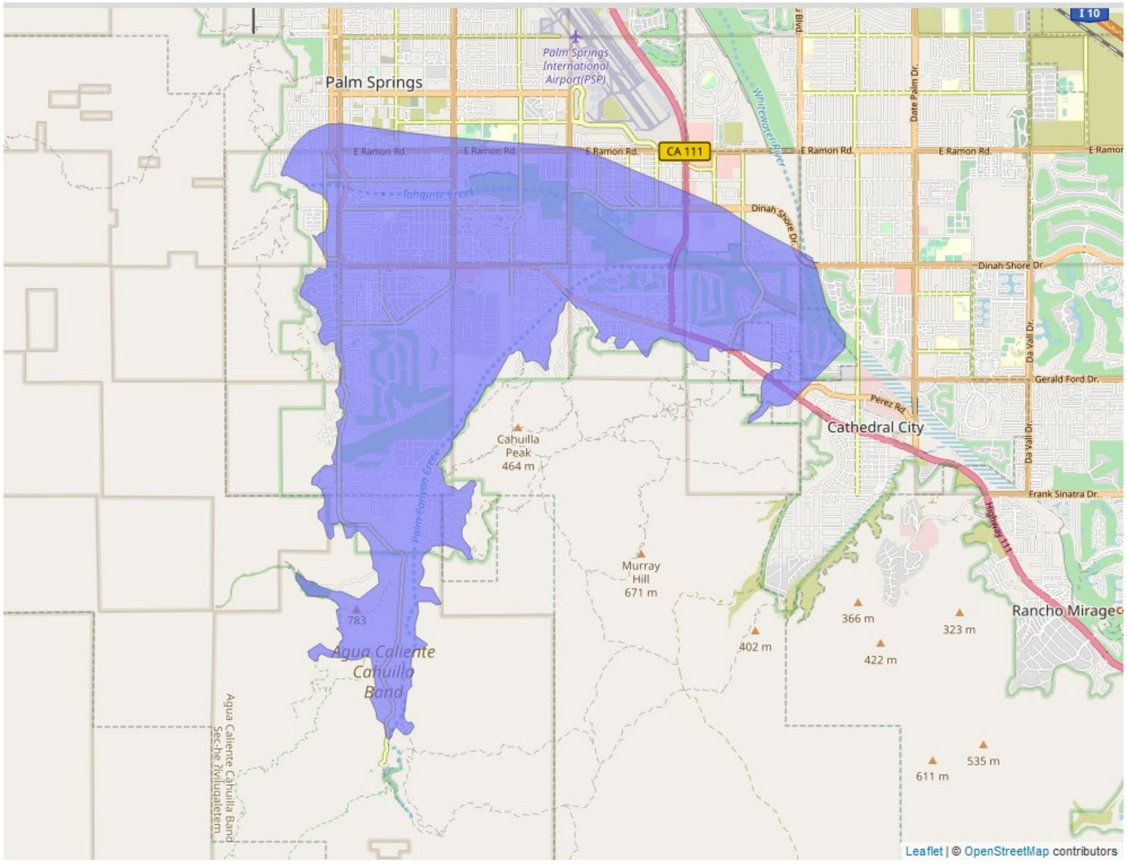

Figure 48. Range map of Casey's June beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4897.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 7/15/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The known historical distribution of Casey's June beetle included alluvial fan and river wash areas within Palm Springs, and similar habitats south to the City of Indian Wells. Casey's June beetle has a limited distribution, an extremely limited ability to disperse, and a limited number of unoccupied habitats suitable for reintroduction and management. Expanding, and perhaps even maintaining, the current species' range will require moving females into unoccupied habitat or augmenting declining areas.

The threats posed by habitat loss and modification are the greatest impediments to recovery (USFWS 2013). Development of formerly occupied habitats, impacts to occupied habitat from adjacent developed areas, human activities, and natural events (such as flood or drought) that cause adult mortality are threats of moderate but imminent magnitude throughout the majority of the species' limited range.

A total of 267.1 ac (108.1 ha) or 72.5% of the remaining critical habitat is currently preserved in perpetuity through a conservation easement. Smoke Tree Ranch affords protection from existing threats to approximately 126.8 ac (51.3 ha) where there is a conservation easement and ongoing compliance monitoring. In addition, there are two new conservation easements that may benefit the beetle. In October 2019, the Agua Caliente Band of the Cahuilla Indians established a 38.6 ac (15.6 ha) conservation easement on a tribal allotment (80E) within Indian Canyons. The parcel is considered occupied by the beetle in addition to containing important biological and physical habitat features. The parcel is located on the upland terrace, adjacent to Palm Canyon Wash near the southern limit of the distribution. The habitat may support individuals that could recolonize the wash if flooding results in local extirpations. The second parcel, (Oswit Canyon parcel), a result of efforts to conserve a parcel within South Palm Springs from development, is 114 ac (46.1 ha) located in upland habitat along South Palm Canyon Drive. The parcel is outside of designated critical habitat but within the recommended survey boundary. Additional protection of occupied and undeveloped formerly occupied habitats is necessary for recovery (USFWS 2011, 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 1.9% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 66). Less than 0.1% of the species' range overlaps with methomyl use sites while 1.8% of the range occurs off-field and may be exposed to spray drift or runoff. Vegetables and ground fruit and citrus use sites are the most prevalent within the species' range, with 1.3%, and 0.5% overlap, respectively. However, overlap with other use sites may still contribute to the overall exposure of the species.

Table 66, Overlap data for Casey's June beetle. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0	<0.1	<0.1
Citrus[57]	<0.1	0.5	0.5
Corn	0	0	0
Cotton	0	0	0
Other Grains	0	0	0
Other Orchards	<0.1	<0.1	<0.1
Other Row Crops	0	0	0
Soybeans	0	0	0
Vegetables and Ground Fruit	0	1.3	1.3
Wheat	NA	NA	NA
Total	**<0.1**	**1.8**	**1.9**

Usage

Mandatory reporting data from the state of California indicates that, between 2012-2021, the maximum percent of the species' range treated with any pesticide was 0.5% (Table 67). Up to 0.1% of the range was reported to have been treated with any insecticides, and no methomyl usage was reported within the species' range for the same time period. Based on this reporting data, there is a low likelihood that methomyl will be used in the species' range.

Table 67. Annual percent of the Casey's June beetle's range treated with any pesticides, insecticides, and methomyl from 2012-2021. Pesticide usage data collected by the California Department of Pesticide Regulations.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
0.5	0.1	0

[57] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

Additional exposure considerations

Both male and female Casey's June beetles emerge from underground burrows between late March and early June, with abundance peaks generally occurring in April and May. Females are flightless, emerging only briefly at dusk to mate and then re-entering the ground, presumably to deposit eggs. Males flying in the area are attracted to females by pheromones sometimes even prior to complete emergence of the female. The larval life-stage of Casey's June beetle has not been well-studied. We believe that the larval cycle for the species is likely one year, based on the absence of larvae (grubs) in burrows during the adult flight season.

Casey's June beetle is known to reproduce, forage, and travel through agricultural areas, developed areas (road medians in particular in right of ways), and golf courses (Chris Gregory, pers. comm. USFWS species co-occurrence Ask to Field 2016). Males may be more likely to be exposed traveling through areas as females are flightless but both are susceptible if applications are made between March and June.

Casey's June beetle larvae, like other June beetle species, are assumed to feed on organic matter or detritus, and associated decaying organisms, below ground (76 FR 58954). It is assumed that Casey's June beetle larvae do not require any particular species of host plants for feeding. However, native plant species are likely an important habitat component because native plant species are an integral component of the ecosystem in which Casey's June beetle evolved (76 FR 58954). In addition, areas with higher soil moisture are associated with higher densities of vegetation and microorganisms, such as fungi and bacteria, believed to provide a more diverse food source for beetle larvae (74 FR 32857). Adult Casey's June beetles have not been observed feeding and have not been associated with any particular species or type of plant (76 FR 58954), therefore it is uncertain as to what food sources upon which they rely.

Casey's June beetle is found on the Reservation for the Agua Caliente Band of Cahuilla Indians.

Exposure Summary

There is a small extent of overlap between the species' range and the action area (1.9% total overlap). State mandated pesticide usage reporting data indicates that very little insecticide usage, and no methomyl usage occurred within the species' range from 2012-2021, suggesting a low likelihood of exposure. While we cannot completely rule out future exposure due to possible changes in pesticide usage patterns, we anticipate exposure will be limited to a very small number of individuals given the low level of overlap.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Given the high sensitivity that insect species have towards methomyl at estimated environmental concentrations, we anticipate that any exposure within the action area will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will reduce the availability of leaf litter or other decomposed organic material upon which Casey's June beetle larvae relies on for its food source.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Casey's June beetle has a low exposure ranking. There is a low extent of overlap between the species' range and the action area (1.9% total overlap) and state mandated pesticide usage reporting data indicates no methomyl usage within the species range from 2012-2021. While we cannot rule out future exposure, we anticipate exposure will be limited to a small number of individuals given the low level of overlap. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Despite this high toxicity, given the low exposure potential, we anticipate only a small number of individuals are likely to die. Therefore, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Casey's June beetle is an endangered species, endemic to the Palm Springs region of California. It has a limited distribution and an extremely limited ability to disperse. Fragmented and unsuitable habitats make reintroduction and management efforts difficult. Habitat loss remains the primary threat to recovery of the species, with natural events (like flooding and drought) remaining an imminent threat to the survival of adult individuals. Considering information about the species status, we have determined that the species has a high vulnerability ranking.

Methomyl use sites overlap with a small portion (1.9%) of the Casey's June beetle's range, indicating a low potential for exposure. Mandatory pesticide usage reporting data from the state of California confirms low pesticide usage overall, further indicating a low likelihood of individuals experiencing methomyl exposure. As such, we anticipate, at most, a very small number of individuals are likely to experience exposure from the proposed action. As with other insects, toxicity is high for the species, and we expect all individuals exposed to methomyl will die.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Casey's June beetle in the wild.

References

U.S. Fish and Wildlife Service. 2021. Casey's June Beetle 5-Year. Carlsbad, California. 12 pp.

U.S. Fish and Wildlife Service. 2013. Recovery Outline for Casey's June Beetle. Carlsbad, California. 21 pp.

U.S. Fish and Wildlife Service. 2011. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Casey's June Beetle and Designation of Critical Habitat. Federal Register 76 (184):58954-58998.

Integration and Synthesis Summary: Rota blue damselfly

Scientific Name:	Common Name:	Entity ID:
Ischnura luta	Rota blue damselfly	9282

Species Overview

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low overlap of the action area with the species' range (Figure 49). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Rota blue damselfly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 1/25/2022; Wherever found; *States within the range:* MP

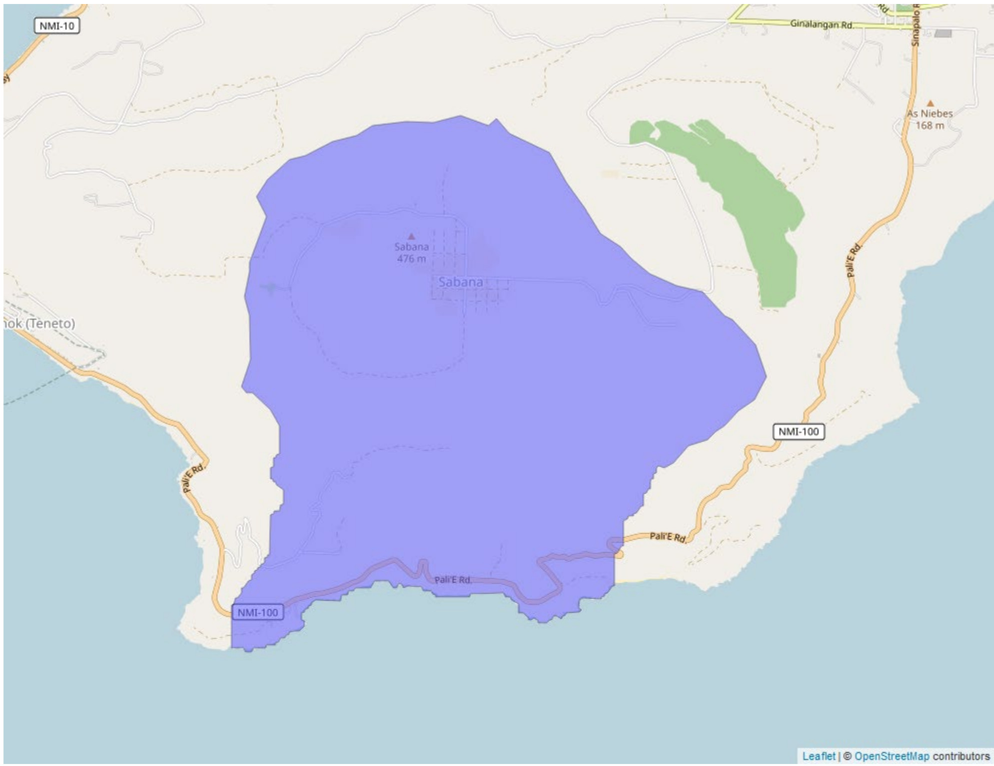

Figure 49. Range map of Rota blue damselfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3087.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/29/2020

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Single population

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Rota blue damselfly is endemic to the island of Rota (part of the Northern Mariana Island chain). The damselfly is a stream-obligate insect that inhabits one confirmed stream system on Rota in Talakhava, a forested portion of the island that contains all available stream habitat. In the past, adults were observed in association only with the single perennial stream; therefore, it is believed that the larval stage of the Rota blue damselfly is aquatic. There have been no specific studies of life history, so we inferred from similar species. Like all stream-obligate damselflies, the larval or naiad life stage requires stream water of sufficient duration (3-4 months) and an adequate abundance of aquatic invertebrate prey to complete its development to the adult stage. Additionally, the stream water must be sufficiently cool, and relatively free of pollution, silt, and other particulate matter. Following its metamorphosis into the adult stage, the damselfly requires sufficiently complex forest understory to support abundant insect prey and provide places to evade predators. The species is found in two populations in the Talakhava watershed: downstream from Talakhava Water Cave and east of Talakhava Water Cave. We assume that all Rota blue damselflies on the island represent a single interbreeding population (USFWS 2020).

The two Rota blue damselfly's population sites are afforded some protection from human impact by their remote and relatively inaccessible location. However, the first documented location (downstream from the Talakhaya Water Cave) is threatened by reduction or removal of stream flow due to increased interception for municipal usage and from lower water quantities from the effects of future climate change, which could eliminate one of the only two known populations of the species. The species is further threatened by loss and degradation of habitat from feral ungulates, non-native plants, wildfire, typhoons, and development (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.9% of the species range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 68). Up to 0.2% of the species' range occurs on methomyl use sites while 0.7% of the range occurs off-field but may still be exposed through spray drift and runoff.

Table 68. Overlap data for the Rota blue damselfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	0.2	0.7	0.9

Usage

Past methomyl usage data in the Pacific islands are unavailable, however, prior reporting data in other island territories and Hawai‘i has indicated that insecticide usage is likely to occur, with methomyl presumably being among these insecticides. While we are not able to use this generic data to adjust overlap estimates, we can broadly use this data as confirmation that insecticide usage occurs on these islands.

Additional Exposure Considerations

The Rota blue damselfly is a stream-obligate insect that inhabits one confirmed stream system on the island of Rota (USFWS 2020). The only known populations of the Rota blue damselfly is restricted to two streams in the upper Talakhaya watershed, which is afforded some protection from human impact by its remote and relatively inaccessible location (USFWS 2015). As such, we do not believe individuals are likely to be exposed to methomyl.

Exposure Summary

There is a low extent of overlap between the action area and the species’ range. While we cannot adjust these overlap estimates with the generic insecticide usage data available for Hawai'i, we infer from this data that insecticide usage within the species’ range is likely to occur. Given the extent of overlap is low, and the fact that the only known population occurs in a remote and inaccessible location where no agriculture is expected, we anticipate only a small number of individuals are likely to experience exposure. As such, we determine the species has a low exposure ranking.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We anticipate indirect effects to this species as it relies on other aquatic invertebrates as food during the adult and naiad stages. However, because prey taken as food items exhibit a range of sensitivities to methomyl, we expect exposure will reduce the abundance of prey in these areas, but not completely eliminate the prey base in these portions of the range. We anticipate this reduction will be greater on use sites, where estimated environmental concentrations are higher than will be anticipated from spray drift. Adverse effects to the prey community will vary based on the environmental factors influencing species exposure and are likely temporary (based on application frequency) with community recovery over a short period of time.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the Rota blue damselfly has a low extent of exposure (0.9% overlap), we determine the species has a low exposure ranking. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Additionally, the only known population occurs in a remote area relatively inaccessible to humans, indicating that exposure to methomyl is unlikely. Given that we anticipate only a small number of individuals are likely to be exposed and that these individuals are likely to experience severe adverse effects, we expect the overall risk of adverse effects to the species is low.

Conclusion

The Rota blue damselfly is listed as endangered. It is known from two areas of the same stream in the Talakhava watershed on Rota. It is a stream-obligate species that requires sufficient water flow, duration, and quality (i.e., relatively free of pollutants and silt). Like other damselflies, adults likely eat insects. Threats to the species include habitat loss from development, ungulate pressure, storms, and non-native plants. Pesticides are not mentioned as a current threat to the species.

Potential methomyl use sites overlap with 0.9% of the species' range, indicating a low potential for exposure. Past methomyl usage data is unavailable for the Pacific Islands, but insecticide usage is likely to occur. We expect a low likelihood of individuals experiencing methomyl exposure based on the overlap information. We expect a short-term reduction in prey in areas where methomyl is used, but not a complete prey elimination and the species overlap is so small that we do not expect much prey reduction from methomyl to occur. As such, we anticipate, at most, a very small number of individuals are likely to experience effects from the proposed action.

In summary, we anticipate minimal exposure to methomyl on field and through spray drift and expect impacts to be highly localized and affect only a very few individuals over the duration of the proposed action. While the species is highly vulnerable, we do not expect the very small number of individuals experiencing mortality will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Rota blue damselfly in the wild.

References

U.S Fish and Wildlife Service. 2020. 5-Year Review. Summary and Evaluation. Rota Blue Damselfly (*Ischnura luta*). Honolulu, Hawai‘i. 8 pp.

U.S. Fish and Wildlife Service. 2015. Endangered and Threatened Wildlife and Plants; Endangered Status for 16 Species and Threatened Status for 7 Species in Micronesia. Final Rule. 80 FR 59423-59497.

Integration and Synthesis Summary: Puerto Rico harlequin butterfly

Scientific Name:	Common Name:	Entity ID:
Atlantea tulita	Puerto Rican harlequin butterfly	10007

Species Overview

In our review of the current status of the species, as well as the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range (Figure 50). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. Given that exposure is low, and toxicity is high, the risk of adverse effects to the species is low. As such, we expect only a small number of individuals are likely to be exposed and die. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Puerto Rico harlequin butterfly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 4/17/2024; Wherever found; *States within the range:* PR

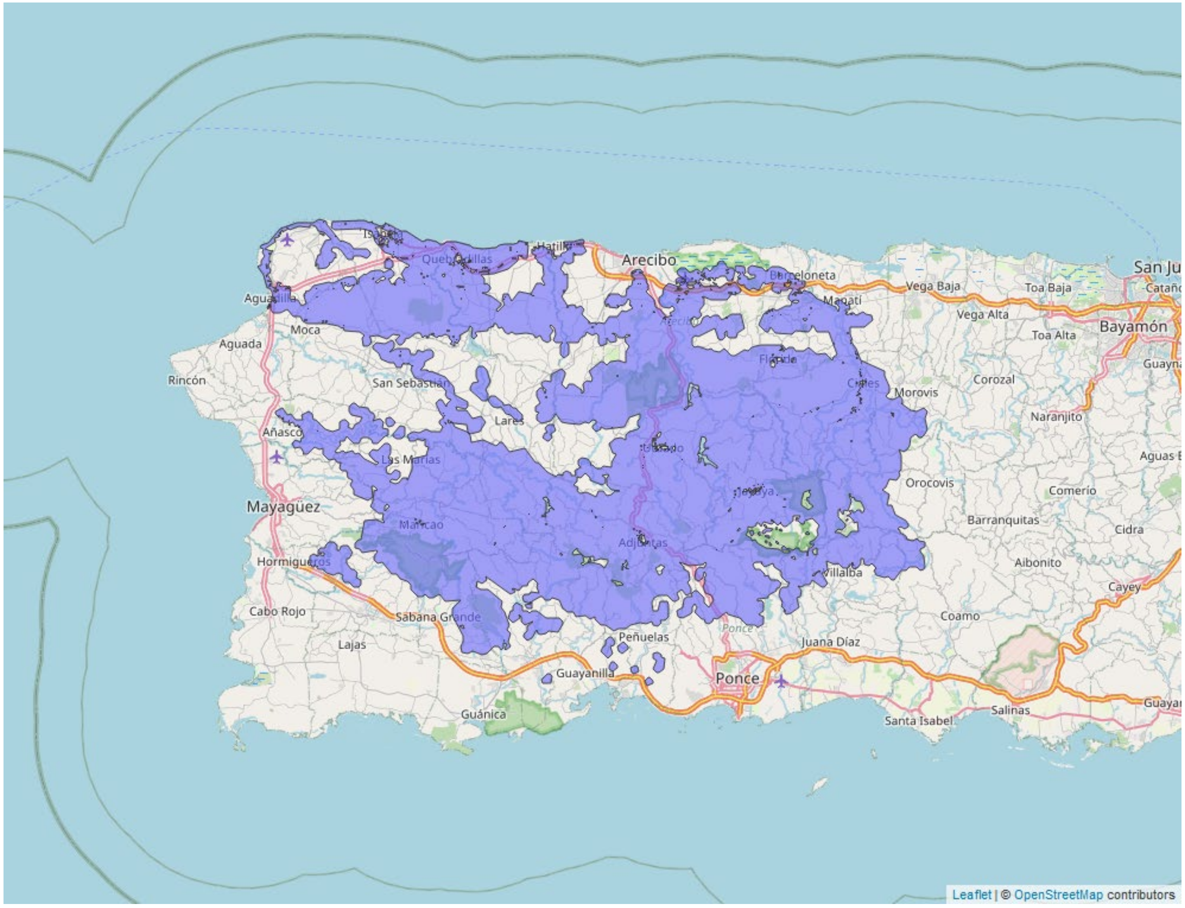

Figure 50. Range map of Puerto Rican harlequin butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9005.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Puerto Rican harlequin butterfly occurs within the subtropical moist forest life zone on limestone-derived soil in the northern karst region and in the subtropical wet forest on serpentine derived soil in the Maricao Commonwealth Forest. The subtropical moist forest life zone on limestone derived soil covers about 1.15% (10,338 ha (25,545.75 ac)) of Puerto Rico's total area, whereas the subtropical wet forest on serpentine-derived soil covers approximately 0.04% (358 ha or 884.63 ac) of the island's total area.

The species has been observed on forested areas in the coastal cliffs in Quebradillas and on sclerophyllous forest (type of vegetation characterized by hard, leathery, evergreen foliage that is specially adapted to prevent moisture loss) in the Maricao Commonwealth Forest. The Puerto Rican harlequin butterfly has only been observed utilizing the *Oplonia spinosa* (prickly bush) as its host plant (plant used for laying the eggs and serves as a food source for the development of the larvae). *Oplonia spinosa* is a common tropical coastal shrub that is widely distributed in Puerto Rico.

The historic range of the Puerto Rican harlequin butterfly includes the northern and southern karst, and the central western volcanic, regions of Puerto Rico. Within these three regions, the species has been historically reported from five municipalities: (1) Quebradillas and Arecibo in the northern karst region; (2) Maricao and Sabana Grande in the central-western volcanic region; and (3) Peñuelas in the southern karst region, it was reported from the municipality of Peñuelas. Recent surveys have identified six known populations of the Puerto Rican harlequin butterfly, with four of these populations located within the northern karst region and the remaining two situated in the central-western volcanic-serpentine region (USFWS 2022). On the northern karst region, the species is known to occur in an approximately 144 ha (356 ac) strip of forested habitat located on the northern coastal cliff that extends along the municipalities of Isabela, Quebradillas, and Camuy. Here, the species' habitat is limited on the east by quebrada Bellacas (creek), on the west by the Royal Isabela Gulf Court, on the north by the Atlantic Ocean, and on to the south by PR-2 and some deforested areas utilized for agricultural practices such as cattle grazing.

Habitat modification and fragmentation have been identified as the main threat to the Puerto Rican harlequin butterfly. Available information indicates that these Puerto Rican harlequin butterfly populations occupy a small geographic area harboring remnants of native forest and are physically separated from other populations by natural and manmade barriers (e.g., grasslands, agricultural lands, highways, urban developed areas). The consequences of the loss and fragmentation of natural habitat for the species is detrimental because: (a) it seems to have low dispersal capabilities, (b) has limited distribution, (c) has highly specialized ecological requirements, and (d) is considered a specialist species because of the larvae's monophagous habit of feeding only on the plant *Oplonia spinosa*. The Puerto Rican harlequin butterfly faces numerous threats, including large-scale residential and touristic projects, limited distribution, low reproductive capacity, and specific ecological requirements (USFWS 2022). Additionally, it is vulnerable to human-induced fires, the use of herbicides and pesticides, vegetation management practices, and the impacts of climate change.

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.8% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 69). Up to 0.3% of the species' range occurs on methomyl use sites while 0.5% of the range occurs off-field but may still be exposed through spray drift and runoff.

Note: The overlap was calculated using a 2023 range map for the Puerto Rican harlequin butterfly, which covered a smaller area compared to what is shown in Figure 50. As of June 11, 2024, a new species range map was developed, but the overlap between the species' current range and the action area is not available. Because the species inhabits forested areas, coastal cliffs, and sclerophyllous forests, where we expect minimal impacts from methomyl use, we believe the results of our analysis will remain accurate for the updated range.

Table 69. Overlap data for the Puerto Rico harlequin butterfly.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Cultivated land layer	0.3	0.5	0.8

Usage

Past methomyl usage data in Puerto Rico is unavailable, however, prior reporting data has indicated that 20-71% of agricultural crops in Puerto Rico were treated with insecticides, with methomyl presumably being among these insecticides. While we are not able to use this generic data to adjust overlap estimates, we can broadly use this data as confirmation of insecticide usage on agricultural crops across Puerto Rico.

Additional Exposure Considerations

Due to their preference for forested habitats, harlequin butterflies are not expected to be directly exposed to methomyl on use sites. However, individuals in the lower-elevation Quebradillas municipality may encounter spray drift if methomyl use sites are adjacent to their habitat. Nevertheless, we anticipate that the forest vegetation will minimize spray drift, thereby limiting exposure within interior habitats.

Exposure Summary

There is a low extent of overlap between the action area and the species' range. Given the extent of overlap is low and given the species' general preference for forested areas that will reduce the likelihood of spray drift exposure, we expect only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar or the larval host) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Puerto Rico harlequin butterfly has a low exposure ranking as there is a low level of overlap between the species' range and the action area (0.8% total overlap). Additionally, we anticipate that individual butterflies are not likely to occur on methomyl use sites or be exposed to spray drift as their preferred habitat is in forested areas, which we anticipate will intercept most spray drift entering the butterfly's habitat. As such, we expect only a small number of individuals are likely to be exposed. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Despite this high toxicity, given the low level of potential exposure, we anticipate only a small number of individuals are likely to die. Therefore, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Puerto Rican harlequin butterfly, a threatened narrow endemic species, occupies a fragmented range within Puerto Rico's karst and volcanic regions. Despite facing significant habitat loss and fragmentation, recent surveys have identified six populations, primarily concentrated in the northern karst and central-western volcanic-serpentine regions. Habitat modification and fragmentation pose significant threats to the species, compounded by additional challenges such as limited dispersal capabilities, specialized ecological requirements, and vulnerability to various anthropogenic activities, including residential and touristic developments, pesticide use, and climate change.

Our evaluation of the effects of the proposed action on the Puerto Rican harlequin butterfly indicates a low extent of exposure to methomyl due to limited overlap between the action area and the species’ range. Although the species is highly sensitive to methomyl toxicity, the low extent of exposure suggests that only a small number of individuals are likely to die. Furthermore, the species' preference for forested habitats reduces the likelihood of spray drift exposure, further minimizing potential impacts. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Puerto Rican harlequin butterfly.

References

U.S. Fish and Wildlife Service. 2022. Threatened Species Status with Section 4(d) Rule for Puerto Rican Harlequin Butterfly and Designation of Critical Habitat. 28 pp.

Integration and Synthesis Summary: Western glacier stonefly

Scientific Name:	Common Name:	Entity ID:
Zapada glacier	Western glacier stonefly	10123

Species Overview

In our review of the current status of the species, and the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range, and very low past usage of methomyl within the species' range (Figure 51). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. While toxicity is high, given that exposure is anticipated to be low, the risk of adverse effects to the species is low. As such, we expect a very small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the western glacier stonefly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 6/21/2022; Wherever found; *States within the range:* MT, WY

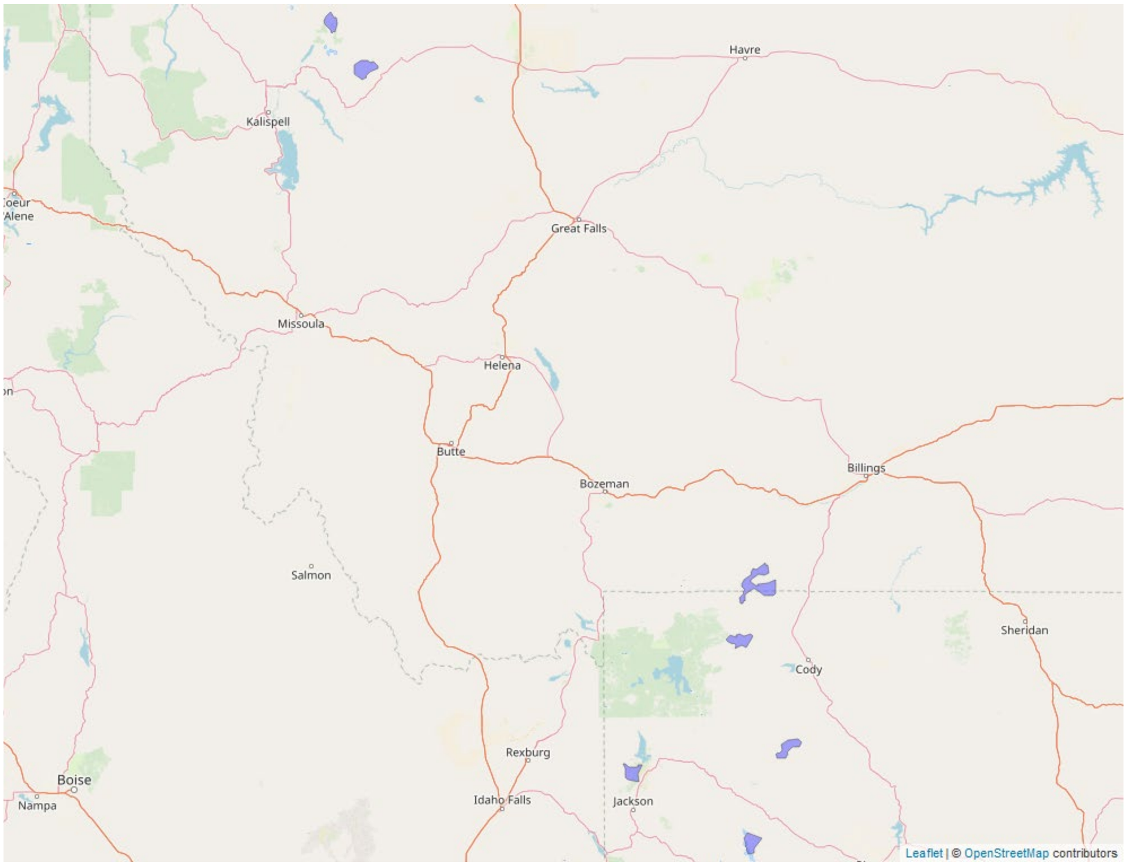

Figure 51. Range map of western glacier stonefly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9133.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Threatened

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (numerous)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The western glacier stonefly was originally described in 1971 from adult specimens collected from five locations in Glacier National Park. Western glacier stoneflies are small insects that begin life in aquatic environments, then emerge from the water as short-lived adults on nearby vegetation. They are found in high-elevation, fishless, alpine streams originating from meltwater sources, including glaciers and small icefields, snowpack, alpine springs, and glacial lake outlet. Western glacier stoneflies are known to occur in 16 streams (6 in Glacier National Park, 4 in Grand Teton National Park, and 6 in the Absaroka/Beartooth Wilderness within National Forests. As such, all known occurrences are either within National Parks or National Forests. We estimate abundance to be in the tens of thousands of individuals, and they have decreased in distribution among and within the 6 streams in Glacier National Park. The western glacier stonefly occupies a relatively narrow range of alpine habitats that are expected to become fragmented and degraded by climate change.

Desiccation of their habitats, even periodically, could eliminate entire populations of the western glacier stonefly because nymphs need perennial flowing water to breathe and to mature before reproducing. Habitats for the western glacier stonefly originate from meltwater sources that will be impacted by climate change, including glaciers, rock glaciers and small ice fields, perennial and seasonal snowpack, alpine springs, and glacial lake outlets. The alteration or loss of these meltwater sources and perennial habitat has direct consequences on western glacier stonefly populations. Desiccation (drying) of these habitats, even periodically, could eliminate entire populations of the western glacier stonefly because nymphs need perennial flowing water to breathe and to mature before reproducing. Given that the species is believed to be a poor disperser (similar to other Plecopterans), recolonization of previously occupied habitats is not expected following dewatering and extirpation events. Lack of recolonization by the species is expected to lead to further isolation between extant occupied streams. Western glacier stoneflies have decreased in distribution among and within 6 streams in Glacier National Park where the species was known to occur in the 1960s and 1970s. There are no active conservation programs that we are aware of for the western glacier stonefly. The northern distributional limits of the species are not known, and specimens were not found during surveys of potential habitat in Banff and Jasper National Parks in Canada (USFWS 2016, 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 0.4% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport within the action area (Table 70). There are no methomyl use sites within the species’ range, indicating that exposure to individuals will only occur in off-field areas through spray drift or runoff.

Usage

Based on past usage data, we do not expect methomyl will be used within the species' range in the future as a result of the proposed action.

Table 70. Overlap and annual usage data for the western glacier stonefly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	0.2	0.2	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn	0	0	0	0	0	0
Cotton	0	0	0	0	0	0
Other Grains	0	0.2	0.2	0	0	0
Other Orchards	0	0	0	0	0	0
Other Row Crops	0	<0.1	<0.1	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0	0	0	0	0	0
Wheat	0	0	0	0	0	0
Total	**0**	**0.4**	**0.4**	**0**	**0**	**0**

Additional Exposure Considerations

The species is primarily found in alpine ecosystems within Glacier National Park, Grand Teton National Park, and the Absaroka/Beartooth Wilderness area. As we do not expect agricultural uses of methomyl are likely to occur in or near these protected areas, we do not expect individuals are likely to experience exposure to methomyl.

Exposure Summary

A small portion of the species' range will be exposed to methomyl give the low overlap between the action area and the species' range. Past usage data indicates that no methomyl has been used within the species' range in recent years. Given that known occurrences of this species primarily occur in high alpine streams within two national parks and a wilderness area, we have high confidence that the likelihood of exposure is low. While we cannot completely rule out exposure as pesticide usage patterns may change, we anticipate any exposure that occurs will be rare and infrequent, primarily limited to instances where an adult wanders away from park boundaries. As such, we anticipate a very small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites. This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. However, despite the incorporation of the rain restriction mitigation, toxicity remains high for this species.

Aquatic habitat buffers: The methomyl label also has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet, of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds" for which vernal pools would be included.

Effects of the Action: Toxicity

Aquatic Phase and Terrestrial Phase Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed during the aquatic or terrestrial phase.

Aquatic Phase and Terrestrial Phase Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to biofilms (bacteria, fungi, and algae) that the larvae feed on or including any species of plant that the stonefly may also rely on for food.

Adult stoneflies have no mouth parts and therefore do not feed.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Given that the action area (including use sites and spray drift areas) overlaps with only a small portion of the species' range and that we expect no usage in the species' range, we determine that the overall exposure for the western glacier stonefly is low. As known occurrences of the species primarily occur in protected areas such as Glacier National Park, Grand Tetons National Park, and the Absaroka/Beartooth Wilderness area, we have high confidence that individuals are not likely to be exposed to methomyl. However, we cannot completely rule out exposure to individuals as pesticide usage trends may change in the future. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. While toxicity is high, given the low exposure potential, we expect only a small number of individuals are likely to die during the aquatic or terrestrial phase. Therefore, we determine the overall risk of adverse effects to the species is low.

Conclusion

After reviewing the current status of the species, the environmental baseline for the action area, the effects from the proposed action, and the cumulative effects, it is our biological opinion that the registration of methomyl is not likely to jeopardize the continued existence of the Western glacier stonefly. Despite its high vulnerability, the low overlap between the action area and the species' range, along with minimal past usage of methomyl within its habitat, results in a low extent of exposure to the proposed action. Consequently, the anticipated risk of adverse effects to the species is low, with only a very small number of individuals expected to die from exposure to methomyl.

The Western glacier stonefly, listed as threatened, inhabits multiple populations primarily in alpine streams within Glacier National Park, Grand Teton National Park, and the Absaroka/Beartooth Wilderness area. These habitats are essential for the species' survival, yet they face threats from habitat loss and climate change. However, the limited overlap between methomyl use sites and its habitat suggests a low likelihood of exposure to the proposed action.

In summary, we anticipate minimal exposure. While the species is highly vulnerable, we do not expect any individuals will die. The low extent of exposure and the species' occurrence primarily within remote, protected areas contribute to the conclusion that the proposed action is not likely to result in adverse effects at the population level. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Western glacier stonefly.

References

U.S. Fish and Wildlife Service. 2019. Recovery Outline Meltwater lednian stonefly (*Lednia tumana*) and Western glacier stonefly (*Zapada glacier*). Helena, Montana. 14 pp.

U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Western Glacier Stonefly as an Endangered or Threatened

Species; Proposed Threatened Species Status for Meltwater Lednian Stonefly and Western Glacier Stonefly. Federal Register 81(192):68379-6839.

Integration and Synthesis Summary: Poweshiek skipperling

Scientific Name:	Common Name:	Entity ID:
Oarisma poweshiek	Poweshiek skipperling	10147

Species Overview

In our review of the current status of the species, as well as the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a high extent of exposure due to the high overlap of the action area with the species' range and high past usage of methomyl within the species' range (Figure 52). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. Given that both exposure and toxicity are high, the risk of adverse effects to the species is also high. As such, we expected a large number of individuals were likely to die from exposure to methomyl.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Poweshiek skipperling to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Poweshiek skipperling. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Last updated: 9/9/2022; Wherever found; *States within the range:* MI, WI

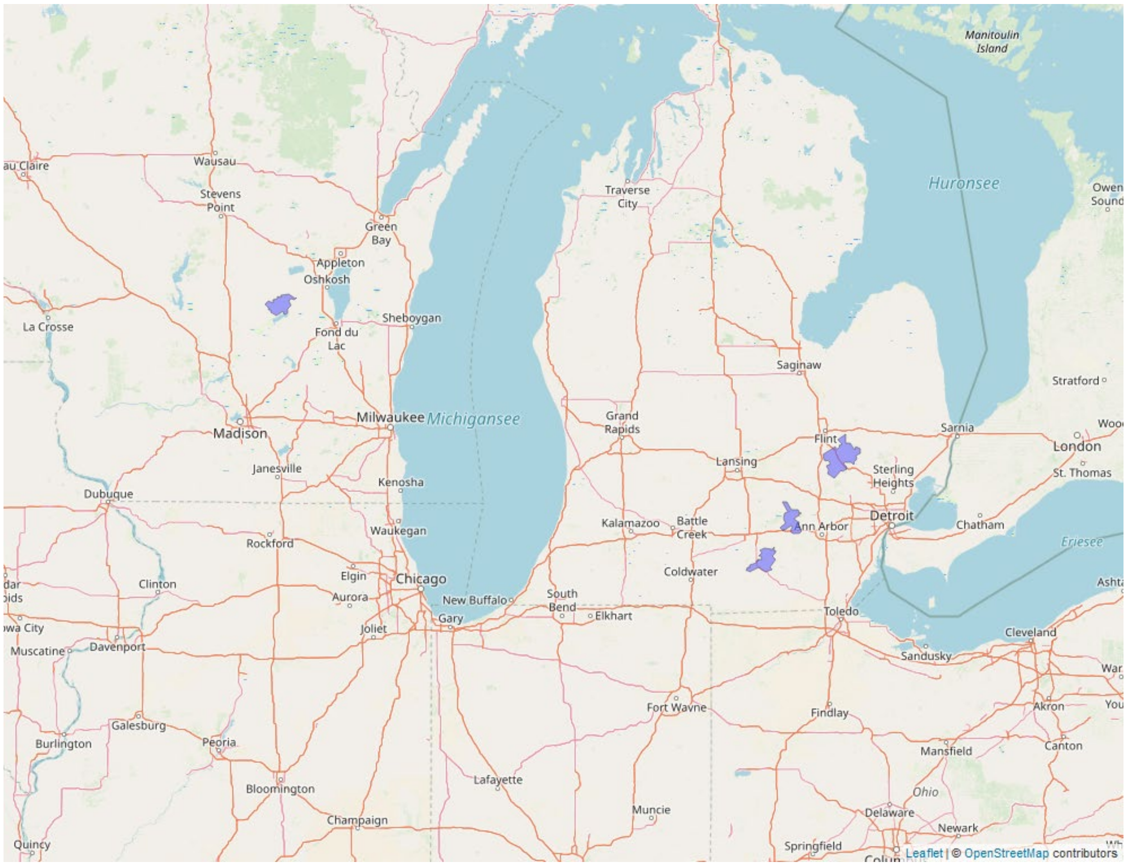

Figure 52. Range map of Poweshiek skipperling (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9161.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 9/30/2019

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Poweshiek skipperlings are obligate residents of undisturbed (remnant, untilled) high-quality prairie, ranging from wet-mesic tallgrass prairie to dry-mesic mixed-grass prairie. A drastic decline in this species was observed range-wide. Between 1985 and 2003, researchers surveyed 10 or more sites in 7 different years (excluding new sites in the first year); the average positive detection rate for those years is 71% across the range. Since 2003, the percent of surveyed sites with positive detections for Poweshiek skipperling has dropped to an average of 31% each year (2004–2013), with a low of 12% at sites surveyed in 2012 and 2013. The Poweshiek skipperling was once a common prairie butterfly widely dispersed in eight States, extended from Michigan to North Dakota, and portions of Manitoba, Canada. However, its range is now substantially reduced such that the Poweshiek skipperling is restricted to small patches of fragmented native prairie remnants in portions of two States and one Canadian province. The species is presumed extirpated from Illinois and Indiana, and the status of the species is unknown in four of the six States with relatively recent records (within the last 20 years). Survey data indicate that the Poweshiek skipperling has declined to zero or to undetectable levels in approximately 96% of sites where it was recorded. Since listing, the number of populations has declined. Out of the 298 historically documented Poweshiek skipperling sites, there are currently 7 sites where the species is considered present (at the time of listing, 12 sites were considered to have Poweshiek skipperling present). Researchers have studied host plant relations and have found Poweshiek skipperlings ovipositing in Michigan on 4 different plant species (*Muhlenbergia richardsonis* [muhly grass], *M. glomerata* [marsh muhly], *C. sterilis* [dioecious sedge], and *Dasiphora fruticosa* [shrubby cinquefoil]), the latter three of which had no observed Poweshiek oviposition at the time of listing and had not previously been suggested as potential host plants. During a recent study in Manitoba, Poweshiek skipperlings were observed ovipositing and then feeding on big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), prairie dropseed, and mat muhly grasses (and moving between these nearby host plant species as larvae) (USFWS 2019). Poweshiek skipperlings are not known to disperse widely and are considered to have low mobility (USFWS 2014).

Of the various threats to Poweshiek skipperling habitat, conversion, invasive species, secondary succession, and reduction in the diversity of native prairie plant communities have moderate- to high-level impacts to populations throughout the species' range. Other factors including non-agricultural development, chemical contaminants, pesticides, and intensive grazing are also current and ongoing threats to the Poweshiek skipperling and its habitat (USFWS 2014). Within the remaining native-prairie patches, degradation of habitat quality is now the primary threat to the Poweshiek skipperling. Habitat loss and degradation have impacted the species and reduced its range. Extensive historical conversion of prairie and associated habitats, nearly complete in some areas, has isolated many Poweshiek skipperling populations. These small and isolated populations are subject to loss of genetic diversity through genetic drift and are susceptible to a variety of stochastic (e.g., wildfires, droughts, and floods) and deterministic (e.g., overgrazing, invasive species) factors that may kill all or a substantial proportion of a population. Although much of the habitat conversion occurred in the past, the effects of the dramatic reduction and fragmentation of habitat have persistent and ongoing effects on the viability of populations; furthermore, conversion of native prairies to agriculture or other uses still occurs today. Native tallgrass prairies have been reduced by 85 to 99.9% of their former area, and native mixed-grass prairies have been reduced by 72 to 99% of their former area in North Dakota, Manitoba, and Saskatchewan (USFWS 2014, 2019).

Pesticide sampling has been done at both occupied and previously occupied (but now unoccupied) sites in Michigan, Manitoba, Minnesota, and South Dakota. Researchers sampled for a suite of 214 pesticides in sedge leaves, grass leaves, duff, and floral nectar sources. Certain pesticides were detected at sites in Michigan and Manitoba at low concentration levels. In Michigan, a greater number of pesticides were detected at the now unoccupied sites than at the currently occupied sites. It is difficult to ascertain the impact of these low-level pesticides on Poweshiek skipperlings because of limited research on Poweshiek skipperling or similar species. Landscape analyses of Michigan Poweshiek skipperling sites and the areas upwind revealed that unoccupied sites were surrounded by more agriculture (52% agriculture) than currently occupied sites (17% agriculture), although this trend was reversed at Manitoba sites (7% vs. 13%; USFWS 2019).

A Habitat Conservation Plan for the Poweshiek skipperling includes all occupied prairie fens for the Poweshiek skipperling in Michigan and has a duration of 20 years. All four sites occupied by Poweshiek skipperling are in Oakland County and are considered protected land; two occur on state owned land, one is owned by a Township, and the other site is owned by a non-governmental organization. Activities that must be maintained under this Plan include: restoring hydrology, prescribed burning, seeding and planting, grazing (only in areas where this has been a historical practice), mowing, control of invasive species, and regularly conducted surveys to monitor for the presence of the butterfly (USFWS 2020).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 100% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 71). Approximately 68.9% of the species' range overlaps with methomyl use sites and 40.9% of the range that occurs off-field is likely to be exposed to spray drift or runoff. Corn/soybean rotation use sites are the most prevalent within the species' range with 79.8% overlap. However, overlap with other use sites may also contribute to the overall exposure of the species, as shown in Table 71 below.

Usage

Past usage data indicate that up to 10.1% of the species' range has been treated with methomyl annually. Usage data indicates that methomyl applications to corn (and soybean) and alfalfa account for the highest past usage, with 4.0% (3.9%) and 2.3% of the species' range treated on these crops alone. However, usage on other crop types may also contribute to the overall exposure of the species.

Table 71. Overlap and annual usage data for the Poweshiek skipperling. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	3.6	11.4	15.1	0.6	1.7	2.3
Citrus	NA	NA	NA	NA	NA	NA
Corn[58]	61	18.8	79.8	3.1	0.9	4.0
Cotton	0	0	0	0	0	0
Other Grains	2.1	7.6	9.6	0.1	0.4	0.5
Other Orchards	<0.1	<0.1	<0.1	0	0	0
Other Row Crops	1.8	1.9	3.7	0.8	0.9	1.7
Soybeans	60.1	18.7	78.8	3.0	0.9	3.9
Vegetables and Ground Fruit	0.4	1.2	1.6	0.4	1.2	1.6
Wheat	NA	NA	NA	NA	NA	NA
Total[59]	**68.9**	**40.9**	**100**	**5.0**	**5.1**	**10.1**

Additional exposure considerations

Poweshiek skipperling butterflies are obligate residents of untilled, high-quality prairie, ranging from wet-mesic tall grass prairie to dry-mesic dry grass prairie, to prairie fens. The annual single generation of adults emerges mid-June to early July, and the flight period lasts two to four weeks

[58] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range. Total overlap is capped at 100%.

[59] Total overlap is capped at 100%.

during which mating occurs. Females lay eggs near the tip of leaf blades, and larvae hatch after around nine days.

The Poweshiek skipperling larvae enter diapause (a period of suspended development) near the end of September and overwinter at the base of a host plant. After hatching, larvae crawl to the base of a grass, develop at least 7 instars, and then becomes a chrysalis (pupa). The Poweshiek skipperling is vulnerable to the effects of methomyl throughout its entire life cycle if applications are made from Spring through September.

Exposure Summary

There is a high degree of overlap between the action area and the species' range (100%). Past usage data suggests that a high proportion of the range will likely experience exposure (10.1%). As such, we anticipate a large number of individuals are likely to experience exposure from the proposed action. In addition, Poweshiek skipperlings are obligate residents of untilled, high-quality prairie, ranging from wet-mesic tall grass prairie to dry-mesic dry grass prairie, to prairie fens that are surrounded by agriculture. Pesticide sampling has been done at both occupied and previously occupied (but now unoccupied) sites in Michigan, Manitoba, Minnesota, and South Dakota (USFWS 2019). Researchers sampled for a suite of 214 pesticides in sedge leaves, grass leaves, duff, and floral nectar sources and certain pesticides were detected at both Michigan and Manitoba sites at low concentration levels. Additionally, given that methomyl use likely coincides with periods of high larval and adult activity, we determined that the species has a high exposure ranking.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including those species of plants that the Poweshiek skipperling is reliant on for food (plants used for nectaring by adults or host plants for larvae) or vegetation within their habitat.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Poweshiek skipperling has a high exposure ranking. The entire species' range overlaps with methomyl use sites and past usage data indicates that large portions of the species' range have been treated in the past (up to 10.1% range treated annually), suggesting a high likelihood of exposure. As such, we anticipate a large number of individuals are likely to be exposed. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Coupled with the high potential exposure, we anticipate a large number of individuals are likely to experience exposure. Therefore, we determine the overall risk of adverse effects to the species is high.

Preliminary Conclusion

The Poweshiek skipperling is listed as endangered and is an obligate resident of high-quality prairie habitats. It is now found in two states and Manitoba, Canada, a drastic reduction in range from historical records that span 8 states and Manitoba. Poweshiek skipperlings remain present at 7 out of 298 historical occurrence locations. Because they are known to have low mobility, if individuals are lost from one population due to methomyl exposure, the species cannot recover by gaining individuals from a nearby population. Agricultural pesticides are documented as a threat to the species and in Michigan, sites occupied by Poweshiek skipperling were surrounded by less agriculture than sites that were formerly occupied by the species. All Poweshiek skipperlings in Michigan are on protected lands and the state has a Habitat Conservation Plan that requires restoration and other beneficial actions to occur. Threats persist from agricultural development, contaminants and pesticides, and intensive grazing.

The species range occurs in close proximity to methomyl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range. Additionally, methomyl exposure and resultant mortality is likely throughout some of the most critical time periods in the Poweshiek skipperling's life cycle, between mid-June to September. Due to the fragmented and isolated nature of habitat and populations, in addition to low numbers of individuals and declining trends, the species is unlikely to regain most individuals lost due to methomyl exposure. We expected a large number of individuals would experience exposure and die from the proposed action.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Poweshiek skipperling:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Poweshiek skipperling by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

The PULA for the Poweshiek skipperling will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect these pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Poweshiek skipperling in the wild.

References

U.S. Fish and Wildlife Service. 2020. Multi-state Mitchells' satyr butterfly and Poweshiek skipperling Habitat Conservation Plan.

U.S. Fish and Wildlife Service. 2019. Poweshiek skipperling (*Oarisma poweshiek*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 17 pp.

U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling. Federal Register 79(206):63671-63748.

Integration and Synthesis Summary: Rusty patched bumble bee

Scientific Name:	Common Name:	Entity ID:
Bombus affinis	Rusty patched bumble bee	10383

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is high overlap of the action area with the species' range (Figure 53), and medium past usage of methomyl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure and toxicity are high, we determined the risk of adverse effects to the species is high. As such, we expected a large number of individuals were likely to be exposed and die.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Rusty patched bumble bee to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the rusty patched bumble bee. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 3/9/2023; Wherever found; *States within the range:* IA, IL, IN, MA, ME, MN, OH, VA, WI, WV

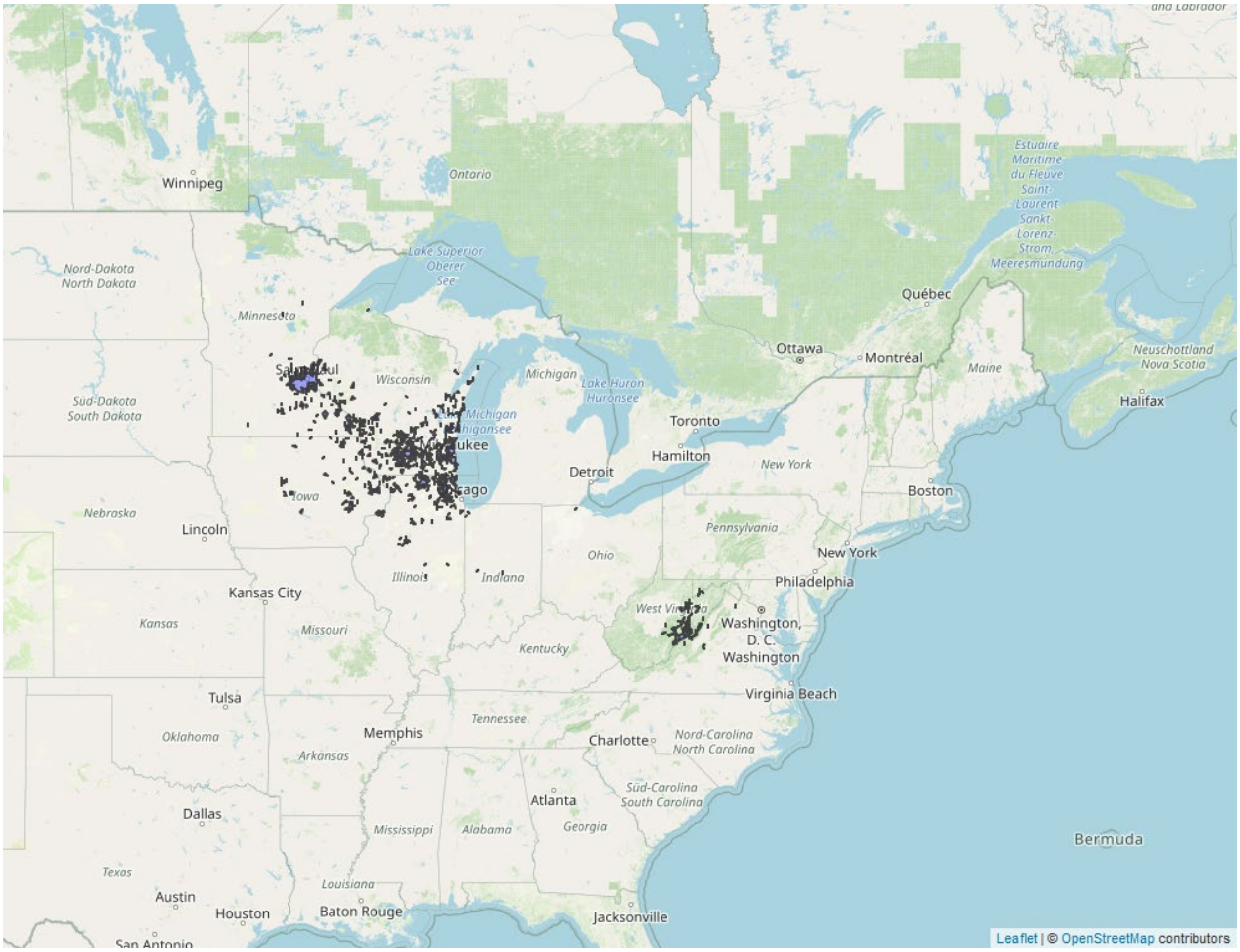

Figure 53. Range map of rusty patched bumble bee (blue polygons and black areas). Range map accessed at https://ecos.fws.gov/ecp/species/9383.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/18/2022

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The rusty patched bumble bee is a colonial species with an annual cycle that starts in early spring when colonies are initiated by solitary queens emerging from overwintering sites, progresses with the production of workers throughout the summer, and ends with the production of males and new queens in late summer and early fall. Survival and successful recruitment require floral resources (for food) from early spring through fall, undisturbed nest sites in proximity to foraging resources, and overwintering sites for the next year's queens. The maximum dispersal distance of the rusty patched bumble bee is likely to be 1 to 10 km. It has been suggested they need floral resources near their nest sites, with foraging distances of less than 1 km based on studies of other *Bombus* species.

The rusty patched bumble bee has been observed and collected in a variety of habitats, including prairies, woodlands, marshes, agricultural landscapes, and residential parks and gardens. The rusty patched bumble bee requires areas that support sufficient food (nectar and pollen from diverse and abundant flowers), undisturbed nesting sites in proximity to floral resources, and overwintering sites for hibernating queens. Bumble bees are generalist foragers and gather pollen and nectar from a wide variety of flowering plants. The rusty patched bumble bee is a short-tongued species, so they are not able to easily access the nectar in flowers with deep corollas (all the petals of a flower). The species is one of the first to emerge early in the spring and the last to go into hibernation, so to meet its nutritional needs, the rusty patched bumble bee requires a constant and diverse supply of flowers that bloom throughout the colony's long lifecycle, from April through September. Records from 2000-2016 indicate that the rusty patched bumble bee range has declined. The species currently exists in 13 states and 1 province (Illinois, Indiana, Massachusetts, Maryland, Maine, Minnesota, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, Wisconsin, and Ontario), 41 counties, and 6 ecoregions. The number of states occupied has declined by 68%, the number of counties occupied by 89%, and the number of ecoregions occupied by 60%.

Populations consist of tens to hundreds of colonies, and the health (long-term productivity) of populations is affected by the quantity and quality (diversity of floral resources) of nectar and pollen available and the proximity of these resources to nesting habitat. Since the late 1990s, rusty patched bumble bee distribution and abundance has declined. Five percent of the historical locations (grids) are currently (the last 2 decades, as of the 2016 species status assessment) occupied by the rusty patched bumble bee, and the relative abundance of the rusty patched bumble bee declined from 8% historically to 1%. Along with the loss of populations, the spatial extent is currently 8% of its historical extent. This reduction has likely led to loss of spatial heterogeneity and adaptive diversity. Similarly, the loss of occurrences has increased the risk of ecoregion-wide extirpations due to catastrophic events (e.g., severe drought and prolonged, high temperatures) (USFWS 2016).

Prior to listing as endangered in 2017 (82 FR 10285), the species experienced a widespread and precipitous declines in spatial extent and in the number of extant populations. The cause of the decline is unknown, but evidence suggests a synergistic interaction between an introduced pathogen and exposure to pesticides. A variety of pesticides are widely used in agricultural, urban, and even natural environments. Native bees are simultaneously exposed to multiple pesticides, including insecticides, fungicides, and herbicides. The pesticides with greatest effects on bumble bees are insecticides and herbicides: insecticides are specifically designed to directly kill insects, including bumble bees, and herbicides reduce available floral resources, thus indirectly affecting bumble bees. Herbicides can also have direct effects on bees (USFWS 2016).

Since the species was listed in 2017, the number of observations of rusty patched bumble bee has increased in the Upper Midwest and Appalachia, and the total number of individual bees observed across its range increased from 450 to 1,301 in 2021. Although the increased number of detections of individual bees in new locations is encouraging, this does not provide a complete assessment of overall population health. Survey effort has generally increased across the range, and these positive trends may be an artifact of the increased survey effort (USFWS 2022).

Many of the existing populations continue to face the effects of past and ongoing stressors, including pathogens, pesticides, habitat loss and degradation, climate change, and small population dynamics (USFWS 2016). Estimated spring food resource availability declined over the past 22 years, specifically the availability of spring-flowering forest understory plants. This is particularly important for the rusty patched bumble bee because poor resource availability early in the spring can compound the effects of other stressors, including pesticides, climate change, and pathogen exposure (considered primary contributors to rusty patched bumble bee decline). These threats continue to adversely affect the species and may have increased in severity and imminence (USFWS 2022). It is likely that several of these risk factors are acting synergistically on the species, and the combination of multiple stressors is likely more harmful than a single stressor acting alone. At the species level, the rusty patched bumble bee needs a sufficient number and distribution of healthy populations to withstand environmental stochasticity (resiliency), catastrophes (redundancy), and biological and physical changes in its environment (representation). Our analyses indicate that the resiliency, representation, and redundancy of the rusty patched bumble bee have all declined since the late 1990s and are projected to continue to decline over the next several decades. As fewer and fewer populations persist, the ability to withstand normal environmental stochasticity is diminished, and thus the decline to extinction is accelerated. Furthermore, as fewer populations persist and the spatial extent of the species declines, the species' ability to withstand catastrophic events and changes in its environment is likely to be greatly reduced (USFWS 2016).

Only 2% of the extant sites are known to be within federally protected lands and 18% are within a broader group of protected lands, including state, tribal, and multijurisdictional properties (USFWS 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicates 63.2% of the species range overlaps with areas that are likely be exposed to methomyl in the action area (Table 72). Methomyl use sites occur on approximately 22.1% of the species' range while 41% of the range that occurs off-field is likely to be exposed due to spray drift or runoff. Corn and soybean rotation and alfalfa are the crop types with the largest overlap with the species' range, with 28.2-34.3% and 20.6% overlap, respectively. Overlap with other use sites contributes to the total overlap with the species range.

Usage

Past usage data indicates that up to 8.3% of the species range has been treated with methomyl annually. We expect usage on alfalfa and vegetables and ground fruit will result in the largest amount of range treated with methomyl, as past usage data shows up to 3.1% and 3% of the species' range has been treated for these use types alone, respectively. Usage on other use sites contributes to the total annual usage in the species range, as shown in Table 72 below.

Table 72. Overlap and annual usage data for the rusty patched bumble bee. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	4.6	15.9	20.6	0.7	2.4	3.1
Citrus	NA	NA	NA	NA	NA	NA
Corn[60]	16.2	18.2	34.3	0.8	0.9	1.7
Cotton	0	0	0	0	0	0
Other Grains	0.7	4.2	4.9	<0.1	0.2	0.2
Other Orchards	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Row Crops	<0.1	0.1	0.1	<0.1	<0.1	0.1
Soybeans	12.3	15.9	28.2	0.6	0.8	1.4
Vegetables and Ground Fruit	0.6	2.4	3.0	0.6	2.4	3.0

[60] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Wheat	NA	NA	NA	NA	NA	NA
Total	**22.1**	**41.0**	**63.2**	**2.2**	**6.1**	**8.3**

Additional Exposure Considerations

The rusty patched bumble bee has been observed and collected in a variety of habitats, including prairies, woodlands, marshes, agricultural landscapes, and residential parks and gardens (USFWS 2016).

The rusty patched bumble bee is typically most active from spring to late summer/early fall. We expect methomyl applications are likely to coincide with the species' most active periods, indicating that exposure is likely to occur throughout the bee's life cycle.

Exposure Summary

There is a high extent of overlap between the species' range and the action area (63.2% total overlap). Past usage data indicate that a smaller portion of the range has been treated in the past (up to 8.3% range treated annually). Additionally, we anticipate that most methomyl applications are likely to coincide with periods of peak adult activity, suggesting that exposure is likely to occur. As such, we anticipate a large number of individuals are likely to be exposed.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effect

We do not anticipate indirect effects to this species as we do not expect the plants it relies on for food or habitat (such as flowers that provide nectar) will experience adverse effects from methomyl exposure.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The rusty patched bumble bee has a high exposure ranking. There is a high extent of overlap between the species' range and action area (63.2% total overlap), a moderate level of past usage (up to 8.3% range treated annually), and we expect the timing of most methomyl applications will coincide with periods of peak adult activity. As such, we anticipate a large number of individuals are likely to experience exposure. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Based on this high toxicity, coupled with the high potential exposure, we expect a large number of individuals are likely to die. Therefore, we determine the overall risk of adverse effects to the species is high.

Preliminary Conclusion

Evidence suggests the cause of the species decline at the time of listing as endangered in 2017 was due to an introduced pathogen and exposure to insecticides and fungicides. Many of the existing populations continue to face the effects of past and ongoing stressors, including pathogens and pesticides, as well as habitat loss and degradation, climate change, and small population dynamics. The species is currently only found within 8% of its historical range. With fewer populations and the loss of the species across much of its historical range, the species' ability to withstand catastrophic events and changes in its environment has likely been greatly reduced.

The risk of methomyl to the species is anticipated to be high due to high overlaps of the species range with use sites, high anticipated usage over the project duration, and high toxicity leading to mortality of exposed individuals. While there is uncertainty about the causative factors in the species decline, stressors that are likely to continue affecting remaining populations include the ongoing usage of insecticides. For these reasons, we anticipate the loss of a large number of individuals across the extensive overlapping portion of the species range with use sites where usage is anticipated. These losses and impacts to the species' ability to successfully recolonize and reproduce at other sites in the range where exposure is likely to occur, are likely to reduce the reproduction, numbers and distribution of the species.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the rusty patched bumble bee:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for rusty patched bumble bee by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

2. *Do not apply methomyl from two hours after sunrise until two hours before sunset on cucurbits. Do not apply methomyl within three days prior to bloom, during bloom, and until petal fall is complete on apple, blueberries, dry beans, fresh beans, peach, peas, and snap beans. We expect these mitigations to reduce on-field exposure.*

The PULA for the rusty patched bumble bee will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in on-field exposure and off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the rusty patched bumblebee in the wild.

References

U.S. Fish and Wildlife Service. 2022. Rusty Patched Bumble bee (*Bombus affinis*): Status Review Summary and Evaluation. Bloomington, Minnesota. 21 pp.

U.S. Fish and Wildlife Service. 2021. Recovery Plan for the Rusty Patched Bumble bee (*Bombus affinis*). Bloomington, Minnesota.

U.S. Fish and Wildlife Service. 2016. Rusty Patched Bumble bee (*Bombus affinis*) Species Status Assessment. Bloomington, Minnesota. 100 pp.

Integration and Synthesis Summary: Miami tiger beetle

Scientific Name:	Common Name:	Entity ID:
Cicindelidia floridana	Miami tiger beetle	10909

Species Overview

In our review of the current status of the species, as well as the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high. Our evaluation of the effects of the proposed action on the species indicates a high extent of exposure due to the high overlap of the action area with the species' range and high past usage of methomyl within the species' range (Figure 54). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. Given that both exposure and toxicity are high, the risk of adverse effects to the species is also high. As such, we expected a large number of individuals were likely to die from exposure to methomyl.

Because of the effects described in our preliminary evaluation and conclusion, EPA and the applicant agreed to incorporate the species-specific conservation measures as part of the action. We now expect exposure for the Miami tiger beetle to be low. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Miami tiger beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 3/3/2022; Wherever found; *States within the range:* FL

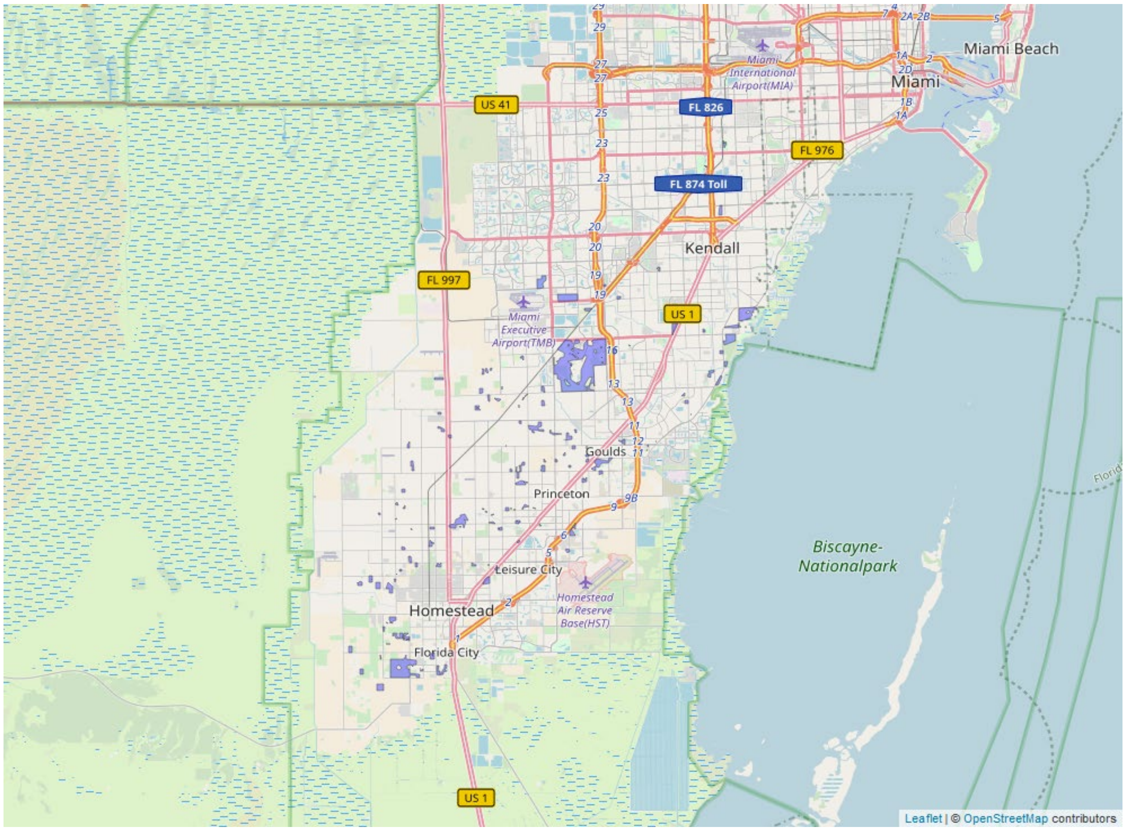

Figure 54. Range map of Miami tiger beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9965.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/4/2022

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: Yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Miami tiger beetle is an endemic of the pine rockland ecosystem in Miami-Dade County, Florida. The Miami tiger beetle likely historically occurred throughout pine rockland habitat on the Miami Rock Ridge, although its historical range is not completely known. Available information is limited based on a single historical observation prior to the species' rediscovery in 2007 in the Richmond Heights area of south Miami, Florida, known as the Richmond Pine Rocklands. The Richmond Pine Rocklands is a mixture of publicly and privately owned lands that retain the largest area of contiguous pine rockland habitat within the urbanized areas of Miami-Dade County and outside of the boundaries of Everglades National Park (USFWS 2016).

The Miami tiger beetle feeds on small arthropod prey, especially ants (USFWS 2022). They occur in two locations within pine rockland habitat in Miami-Dade County. The Richmond population occurs on four contiguous parcels within the Richmond Pine Rocklands: (1) Zoo Miami Pine Rockland Preserve (293 ha; 723 ac), (2) Larry and Penny Thompson Park (121 ha; 300 ac), (3) U.S. Coast Guard property (96 ha; 237 ac), and (4) University of Miami's Center for Southeastern Tropical Advanced Remote Sensing property (31 ha; 76 ac). A second population was identified in September 2015 at the Nixon Smiley Pineland Preserve in Miami-Dade County. Based on historical records, current occurrences, and habitat needs of the species, the current range of the species is considered to be any pine rockland habitat (natural or disturbed) within the Miami Rock Ridge (USFWS 2016).

The Miami tiger beetle appears to have only limited dispersal abilities and is likely to be a weak flier. Miami tiger beetles within the four contiguous occupied parcels in the Richmond population probably represent a single population as they are within close proximity to each other and have connecting patches of habitat with few or no barriers between parcels. Information regarding Miami tiger beetles at the pineland preserve is limited, but beetles are within approximately 5.0 km (3.1 mi) of the Richmond population. The site is separated from the Richmond population by urban development that likely represents a significant barrier to dispersal. Miami tiger beetles at the Nixon Smiley Pineland Preserve are currently considered a second population, known as the Nixon Smiley population. The Richmond population occurs within an approximate 2 km^2 (494 ac) block, but currently much of the habitat is overgrown with vegetation, leaving few remaining open patches the beetles need. Survey data documented a decline in the number of open habitat patches, and less than 10% of the mostly pine rockland habitat within this area supported the species at that time (USFWS 2016).

As discussed in the 2016 5-Year Review, pesticides used in and around pine rockland habitat are a potential threat to the Miami tiger beetle through direct exposure to adults and larvae, secondary exposure from insect prey, overall reduction in availability of adult and larval prey, or any combination of these factors. The use of pesticides for agriculture and mosquito control presents potential risks to nontarget insects, especially imperiled insects. Multiple studies suggest negative effects of insecticides on several tiger beetle species, although impacts from pesticides do not appear to be well studied in tiger beetles. Efforts to control mosquitoes and other insect pests in Florida have increased as human activity and population size have increased. To control mosquito populations, organophosphate (naled) and pyrethroid (permethrin) adulticides are applied by mosquito control districts throughout south Florida, including Miami-Dade County. The use of such pesticides (applied using both aerial and ground-based methods) for mosquito control presents a potential risk to the Miami tiger beetle, and this risk may increase with the spread of any mosquito-borne disease, such as the Zika virus, as current guidelines to incorporate no-spray buffers around butterfly critical habitat are not necessarily adhered to if there is a public health concern. However, based on Miami-Dade Mosquito Control's implementation of spray buffers, mosquito control pesticides were not considered a major threat for the Miami tiger beetle at the time of listing (USFWS 2016).

Information on Miami tiger beetle population sizes, trends, and demography are limited because survey data are inconsistent, and some sites are difficult to access. Habitat loss, degradation, and fragmentation of the pine rockland ecosystem have significantly reduced the range of the species, leaving just two known discontinuous populations remaining. The species likely has limited ability to rescue extirpated populations due to its limited dispersal ability. The remaining populations are small and appear to occupy relatively small habitat patches, which make the populations vulnerable to local extinction from normal fluctuations in population size, genetic problems from small population size, or environmental catastrophes. The threat of habitat loss is continuing from development, inadequate habitat management resulting in vegetation encroachment, and environmental effects resulting from climatic change. The fragmented nature of Miami-Dade County's remaining pine rockland habitat and the influx of development around them may preclude the ability to conduct prescribed burns or other beneficial management actions that are needed to maintain habitat required by the species. Due to the restricted range, small population size, few populations, and relative isolation, collection is a significant threat and could potentially occur at any time. Additionally, the existing regulatory mechanisms do not provide adequate protection for the species (USFWS 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate 100% of the species' range overlaps with methomyl use sites or is likely to be exposed through off-site transport in the action area (Table 73). Approximately 19.1% of the species' range overlaps with methomyl use sites and 85.9% of the range that occurs off-field is likely to be exposed to spray drift or runoff. Other orchards and vegetables and ground fruit are the most prevalent within the species' range, with 50.8% and 31.8% overlap, respectively. However, overlap with other use sites may also contribute to the overall exposure of the species, as shown in Table 73 below.

Usage

Past usage data indicate that up to 83.7% of the species' range has been treated with methomyl annually. Usage data indicates that methomyl applications to other orchards account for the highest past usage, with up to 50.8% of the species' range treated from these crops alone. In addition, up to 31.8% of the range has likely been treated from vegetables and ground fruit usage. However, usage on other crop types may also contribute to the overall exposure of the species, as shown in Table 73 below.

Table 73. Overlap and annual usage data for the Miami tiger beetle. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	0	0	0	0	0
Citrus	NA	NA	NA	NA	NA	NA
Corn[61]	0	0.7	0.7	0	0	0
Cotton	0	0	0	0	0	0
Other Grains	0	21.7	21.7	0	1.1	1.1
Other Orchards	19.1	31.7	50.8	19.1	31.7	50.8
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0	31.8	31.8	0	31.8	31.8
Wheat	NA	NA	NA	NA	NA	NA
Total[62]	**19.1**	**85.9**	**100**	**19.1**	**64.6**	**83.7**

Additional Exposure Considerations

The Miami tiger beetle is found exclusively in bare or sparsely vegetated sandy areas in pine rockland habitat. In Florida, pine rocklands are found along the Miami Rock Ridge, within the Florida Keys, and Big Cypress National Preserve. The breeding season is from May-October

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[61] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

[62] Total overlap is capped at 100%.

when females oviposit (lay eggs) in open sandy patches. The eggs hatch, apparently after sufficient soil wetting, and then the first instar larvae digs a burrow at the site of oviposition. Adults emerge in May and June and will mate, oviposit, and produce larvae that can develop and emerge as a second cohort of adults in late July and August as the earlier cohort of adults are dying off. Larvae from these later active adults develop through fall and winter and emerge as adults the following May (USFWS 2016).

Exposure Summary

There is a high degree of overlap between off-site exposure areas and the species' range, with 85.9% overlap between off-site areas and the species' range. Past usage data suggests that up to 64.6% of the species' range is likely to be exposed to methomyl through spray drift annually, which represents a high extent of usage. Additionally, given that methomyl use likely coincides with periods of high larval and adult activity, we determined that the species has a high exposure ranking.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We expect that exposure to methomyl will result in adverse effects to some of the prey items for this beetle, such as ants and other small arthropods.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die, as will prey items this beetle consumes.

Overall Toxicity: High

Effects of the Action Summary

The Miami tiger beetle has a high exposure ranking. We expect the entire range is likely to be exposed to methomyl and past usage data indicate that up to 83.7% of the range has been treated annually in the past. Additionally, we anticipate that the timing of most methomyl applications will coincide with periods of peak activity. As such, we anticipate a large number of individuals are likely to experience exposure. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given this high level of toxicity, coupled with the high potential exposure, we anticipate a large number of individuals are likely to die. Therefore, we determine the overall risk of adverse effects to the species is high.

Preliminary Conclusion

The Miami tiger beetle is listed as endangered and is a narrow endemic species that exists in two disjunct population clusters in Miami-Dade County, Florida. We do not believe the beetles are able to disperse between these two populations due to their limited dispersal ability and the urban development that serves as a barrier. If individuals are lost from one population due to methomyl exposure, the species cannot recover by gaining individuals from a nearby population. In the 2016 status review, we mention that this species is threatened by agricultural pesticides. Threats persist for the species from development, vegetation encroachment, and climate change.

The species range occurs in close proximity to methomyl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range. Additionally, methomyl exposure and resultant mortality is likely throughout some of the most critical time periods in the Miami tiger beetle's life cycle, between May-October. Due to the fragmented and isolated nature of habitat and populations, in addition to low numbers of individuals and declining trends, the species is unlikely to regain most individuals lost due to methomyl exposure. We expected a large number of individuals would experience exposure and die.

Final Conclusion (with Species-Specific Conservation Measures)

Because of the effects described in our preliminary conclusion above (Preliminary Conclusion), EPA and the applicant agreed to incorporate the following measures as part of the action. Within the Pesticide Use Limitation Area (PULA) for the Miami tiger beetle:

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for Miami tiger beetle by >95%. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*

The PULA for the Miami tiger beetle will be developed as described in the Description of the Proposed Action section of the main Opinion and Appendix A-1. EPA is currently considering public comments received on the Draft Insecticide Strategy. If additional mitigation options become available during finalization of the Insecticide Strategy or in the future, this might warrant re-initiation to incorporate those measures into the action (i.e., additional options and mitigations for end users). In that case, EPA will provide documentation that these measures provide equivalent conservation for listed species, including reduction in off-site transport. Upon confirmation by the Service, those options will be added to the acceptable mitigations listed for end users of methomyl.

After incorporating these conservation measures, we expect pathways of exposure will be greatly limited over the course of the action. Therefore, we expect impacts to be low, a small number of individuals will be adversely affected, and effects will not likely reduce the reproduction, numbers, and distribution of the species. After adding the effects of the action (including the species-specific conservation measures) and cumulative effects to the environmental baseline and in light of the status of the species, we do not anticipate the registration of methomyl will appreciably reduce the survival and recovery of the Miami tiger beetle in the wild.

References

U.S. Fish and Wildlife Service. 2022. Miami Tiger Beetle (*Cicindelidia floridana*), 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 18 pp.

U.S. Fish and Wildlife Service. 2016. Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Miami Tiger Beetle (*Cicindelidia floridana*). Federal Register 81(193):68985-69007.

Integration and Synthesis Summary: Dehli Sands flower-loving fly

Scientific Name:	Common Name:	Entity ID:
Rhaphiomidas terminatus abdominalis	Delhi Sands flower loving-fly	452

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed Action to the species, we determined that there is a low overlap and usage within the species' range (Figure 58), indicating a low extent of exposure, and that most exposed individuals are likely to die. While the toxicity is high, we do not expect many individuals are likely to be exposed. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Delhi Sands flower-loving fly. We discuss our rationale for the species in the sections below.

Species range

Last updated: 7/01/2021; Wherever found; *States within the range:* CA

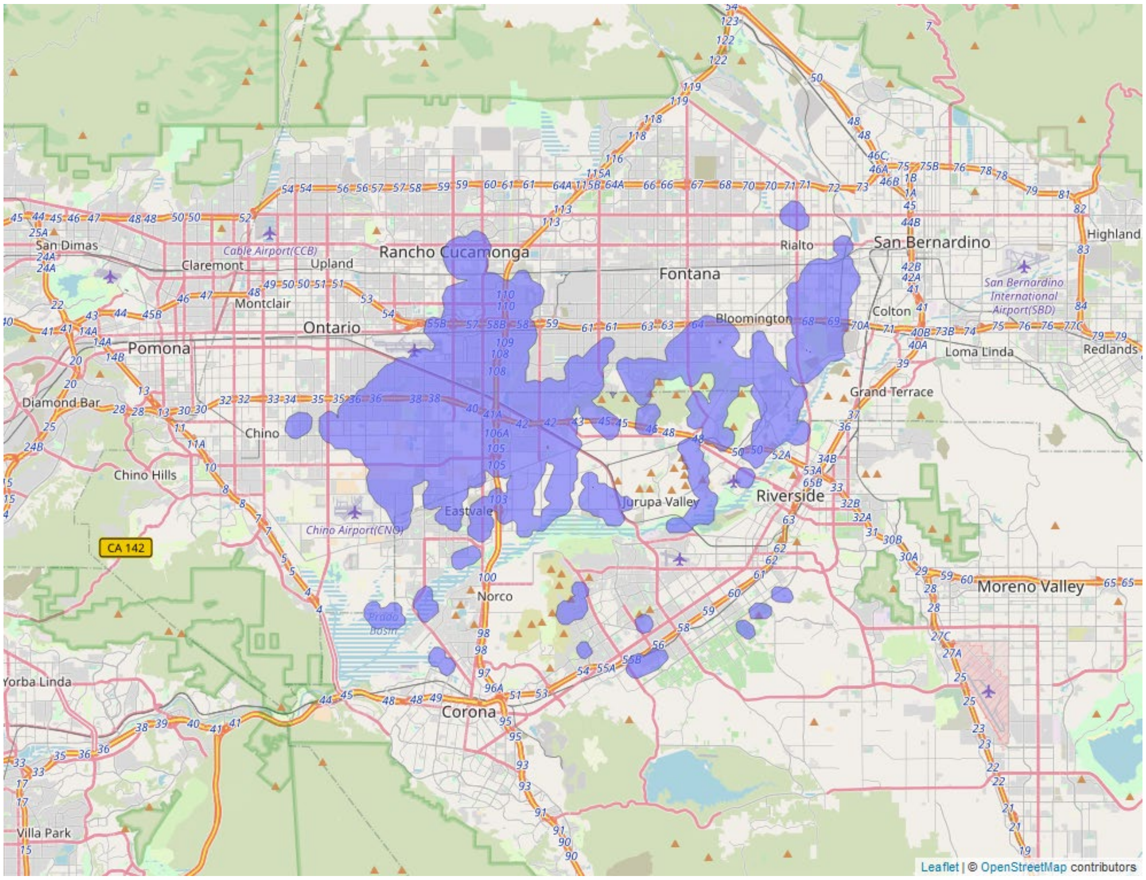

Figure 55. Range map of Delhi Sands flower-loving fly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1540.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in status

Date of most recently completed 5-Year Review: 8/31/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: No

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Delhi Sands flower-loving fly is only known from Riverside and San Bernardino Counties, with most occupied Delhi Sands flower-loving fly habitat located within a limited area of southwestern San Bernardino County. They occur in arid, sandy habitats like dune systems of inland desert valleys, rivers, deltas, and beach strands. They also occur in moderately disturbed areas such as abandoned vineyards or grazing lands (USFWS 2021). Only the adult stage occurs above-ground when adults emerge to breed during the summer months. When the species was listed in 1993, we estimated that between 140 and 285 ha of known occupied Delhi Sands flower-loving fly habitat existed at five locations. By 1997, we estimated that 485 ha of suitable habitat (both occupied and unoccupied) and several hundred acres of restorable habitat remained. The recovery plan stated that 12 known occupied sites encompassing about 180 ha of suitable habitat were known as of the spring of 1997 (USFWS 1997). As of 2021, the species was known in three recovery units: the Ontario unit, Jurupa unit, and Colton unit. Some areas where the species is found are conserved or managed, but many are not protected (USFWS 2021). Since listing, populations discovered in disturbed areas appeared small and we did not believe they will persist without substantial habitat restoration and management. We estimate that approximately 1,144 ha of potential habitat remain, 365 ha of which are occupied. Accurate population size estimates of historical viable populations are unknown for the Delhi Sands flower-loving fly, and habitat block samples from the 2000s included only 0-25 individuals (USFWS 2008).

The final rule listing the Delhi Sands flower-loving fly identified habitat loss and degradation as major threats. A small percentage (about 10%) of remaining habitat has been conserved, though most of this habitat is not actively managed. While significant efforts have been made to conserve occupied Delhi Sands flower-loving fly habitat, only the Jurupa Hills conservation area is likely of sufficient size and quality to potentially sustain a stable population through time. We mentioned our expectation that the 61-ha Vulcan Conservation Bank will be effectively managed to protect a relatively large block of Delhi Sands flower-loving fly habitat once all the conservation credits are sold, but the status of this Conservation Bank is unknown and additional lands surrounding the Conservation Bank are needed to ensure the long-term conservation of the largest remaining block of Delhi Sands flower-loving fly habitat. Other conserved areas are likely too small and isolated to provide adequate protection to existing populations without protection of additional surrounding lands and adequate land management. Despite the progress that has been made to protect lands occupied by the Delhi Sands flower-loving fly, habitat destruction in association with residential and commercial development continues to be the primary threat to the subspecies. Secondary threats include habitat degradation from weed abatement, activities for fire control, trash dumping, off-road vehicle use, small population size, and isolation due to habitat fragmentation. Isolation due to habitat fragmentation is likely to increase in the future as a consequence of continued habitat loss (USFWS 2008, 2019, 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect up to 1% of the species range will overlap with methomyl use sites or is likely to be exposed through off-site transport in the action area. Only 0.1% of the species' range overlaps with methomyl use sites while 0.8% of the range occurs off-field but may still be exposed to spray drift or runoff (Table 74).

Table 74. Overlap for the Delhi Sands flower-loving fly. Where specific crops are not registered for methomyl use in a state where the species is found, columns are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	0.1	0.6	0.8
Citrus	0	0	0
Corn	0	0	0
Cotton	0	0	0
Other Grains	<0.1	0.1	0.1
Other Orchards[63]	<0.1	<0.1	<0.1
Other Row Crops	<0.1	<0.1	<0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	<0.1	0.1	0.1
Wheat	NA	NA	NA
Total	**0.1**	**0.8**	**1**

Usage

Mandatory pesticide usage reporting data gathered by the state of California indicates that very little insecticides are used within the Delhi Sands flower-loving fly's range; between 2012-2021,

[63] We expect 'other orchards' and 'citrus' use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

only 2.6% of the species' range was treated with insecticides of any kind, and no methomyl use within the range was recorded in that same time period (Table 75). Given that this usage data collected by the state of California is mandatory and is geographically specific to agricultural sections, we have high confidence that there is low methomyl usage within the species' range.

Table 75. Pesticide usage data within the range of the Delhi Sands flower-loving fly collected by the California Department of Pesticide Regulation. The data presented in this table are from 2012-2021.

% range treated with all pesticides	% range treated with all insecticides	% range treated with methomyl
4.8	2.6	0

Additional exposure considerations
The Delhi Sands flower-loving fly prefers arid, sandy areas and is restricted to Delhi sands soil type for feeding. We do not anticipate agricultural areas are likely to occur on these soil types. However, the species is known to travel through agricultural areas (such as abandoned vineyards), pasture, and developed lands for feeding and dispersal (USFWS 2008; Geary Hund, pers. comm. USFWS species co-occurrence Ask to Field 2016). As such, while we do not anticipate individuals are likely to be exposed to methomyl in their preferred habitat, we cannot rule out the possibility of exposure during dispersal events and feeding activity.
The fly-bait methomyl use is limited to applications around livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters. The fly baits can be used as a perimeter scatter bait, placed in bait stations (hung at least 4 feet high), or mixed with water to form a paste which can be brushed onto walls, windowsills, and support beams of outdoor livestock houses. While the fly-bait does contain a fly specific pheromone, muscamone, the foot print for this use is limited in scope and not likely a significant exposure pathway of methomyl (see BE Appendix 4-5). Because the Delhi Sands flower-loving fly is associated with arid, sandy habitats as described above and is generally found in areas containing Delhi fine sands soil type within Riverside and San Bernardino Counties, with most occupied habitat located within a limited area of southwestern San Bernardino County (USFWS 2021), we do not anticipate it will be found in the vicinity of where the methomyl ,fly-bait will be applied.

Exposure Summary

Only a small portion of the species' range occurs either on methomyl use sites or in adjacent areas that are likely to experience exposure through off-field transport, such as spray drift or runoff. We don't expect the fly-bait applications for methomyl will be used within the vicinity of the preferred habitat (arid, sandy habitats, including dune systems of inland desert valleys, rivers, deltas, and beach strands with specific Delhi sand fine soils) for the Delhi sand flower-loving fly. Thus, exposure from this methomyl use type is not anticipated. Mandatory pesticide reporting data collected by the state of California indicate low insecticide usage within the species' range in recent years, with no methomyl usage reported in the same period. While past usage data indicate a low probability of an individual being exposed to methomyl, changes in pesticide usage patterns in the future may result in exposure of individuals, particularly as the species is known to occasionally feed on and disperse through agricultural areas. However, we expect that, at most, very few individuals will likely experience exposure given the low extent of overlap of use sites and spray drift areas within the species' range.

Overall Exposure: Low

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to methomyl will result in adverse effects to plants, including any species that the species is reliant on for food or habitat, such as flowering plants that provide nectar for adults or host plants that provide shelter and food for larvae.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Delhi Sands flower-loving fly has a low exposure ranking as overlap between methomyl use sites and adjacent spray drift areas and the species' range is low. Additionally, mandatory pesticide usage data collected by the state of California indicate very little insecticides were used within the species' range from 2012-2021, with no methomyl usage reported in the same period (which will include the fly-bait application as well). The Delhi Sands flowering-loving fly has a high toxicity ranking as available toxicity data suggests that insects are likely to die with any exposure to methomyl. While it is possible that methomyl usage patterns may change in the future, which may result in the exposure and mortality of a very small number of individuals, we do not expect this is likely to occur.

Conclusion

The Delhi Sands flower-loving fly is listed as endangered, and only a remaining habitat fragments are occupied across their restricted range limited to Riverside and San Bernardino Counties, California. They occur in three recovery units. We do not have recent population estimates, but they appeared to be small in the mid-2000s and trends were indiscernible.

Residential and commercial development remains the greatest threat to the species. Thus, we have determined that the species has a high vulnerability.

Because the Delhi sands soil type is a key habitat resource and they are not likely to be agricultural areas, we expect overlap or adjacency with agricultural fields or fly-bait application areas such as livestock animal and poultry premises, commercial structures, and enclosed commercial dumpsters will be very limited. Overlap between the Delhi Sands flower-loving fly's range with methomyl use sites is only 0.1% and potential spray drift areas (up to 90m) is 0.8%, indicating that only a very few individuals are likely to be exposed. In addition, past insecticide usage in the species' range is low (2.6%) confirmed by reporting mandated by the state of California, and no methomyl has been used in the species' range across the most recent years of data available. Thus, we expect very little exposure will likely occur.

In summary, we expect minimal exposure to methomyl on-field or through spray drift will occur for the Delhi Sands flower-loving fly, and impacts are expected to be highly localized and affect only a very few individuals, at most, over the duration of the proposed action. While the species is highly vulnerable, we do not expect the adverse effects from the proposed action will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Delhi Sands flower-loving fly.

References

U.S. Fish and Wildlife Service. 2021. Delhi Sands Flower-loving Fly (*Rhaphiomidas terminatus abdominalis*) 5-Year Review: Summary and Evaluation. Carlsbad, California. 7 pp

U.S. Fish and Wildlife Service. 2019. Recovery Plan for Delhi Sands Flower-loving Fly (*Rhaphiomidas terminatus abdominalis*). Carlsbad, California. 18 pp

U.S. Fish and Wildlife Service. 2008. Delhi Sands Flower-loving Fly (*Rhaphiomidas terminatus abdominalis*) 5-Year Review: Summary and Evaluation. Carlsbad, California. 29 pp

U.S. Fish and Wildlife Service. 1997. Final Recovery Plan for the Delhi Sands Flower-loving Fly. Portland, Oregon 51 pp

Integration and Synthesis Summary: Sacramento Mountains checkerspot butterfly

Scientific Name:	Common Name:	Entity ID:
Euphydryas anicia cloudcrofti	Sacramento Mountains checkerspot butterfly	1260

Species Overview

In our review of the current status of the species, as well as the environmental baseline, and cumulative effects for the action area, the Service determined that the species' vulnerability is high Our evaluation of the effects of the proposed action on the species indicates a low extent of exposure due to the low overlap of the action area with the species' range and low past usage of methomyl within the species' range (Figure 59). Most exposed individuals are likely to die due to the high toxicity of methomyl to insects. Given that exposure is low, the risk of adverse effects to the species is also low. As such, we expect only a small number of individuals are likely to die from exposure to methomyl. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Sacramento Mountains checkerspot butterfly. We discuss our rationale for this conclusion in the sections below.

Species range

Based on range map dated: 3/3/2022; Wherever found; *States within the range:* NM

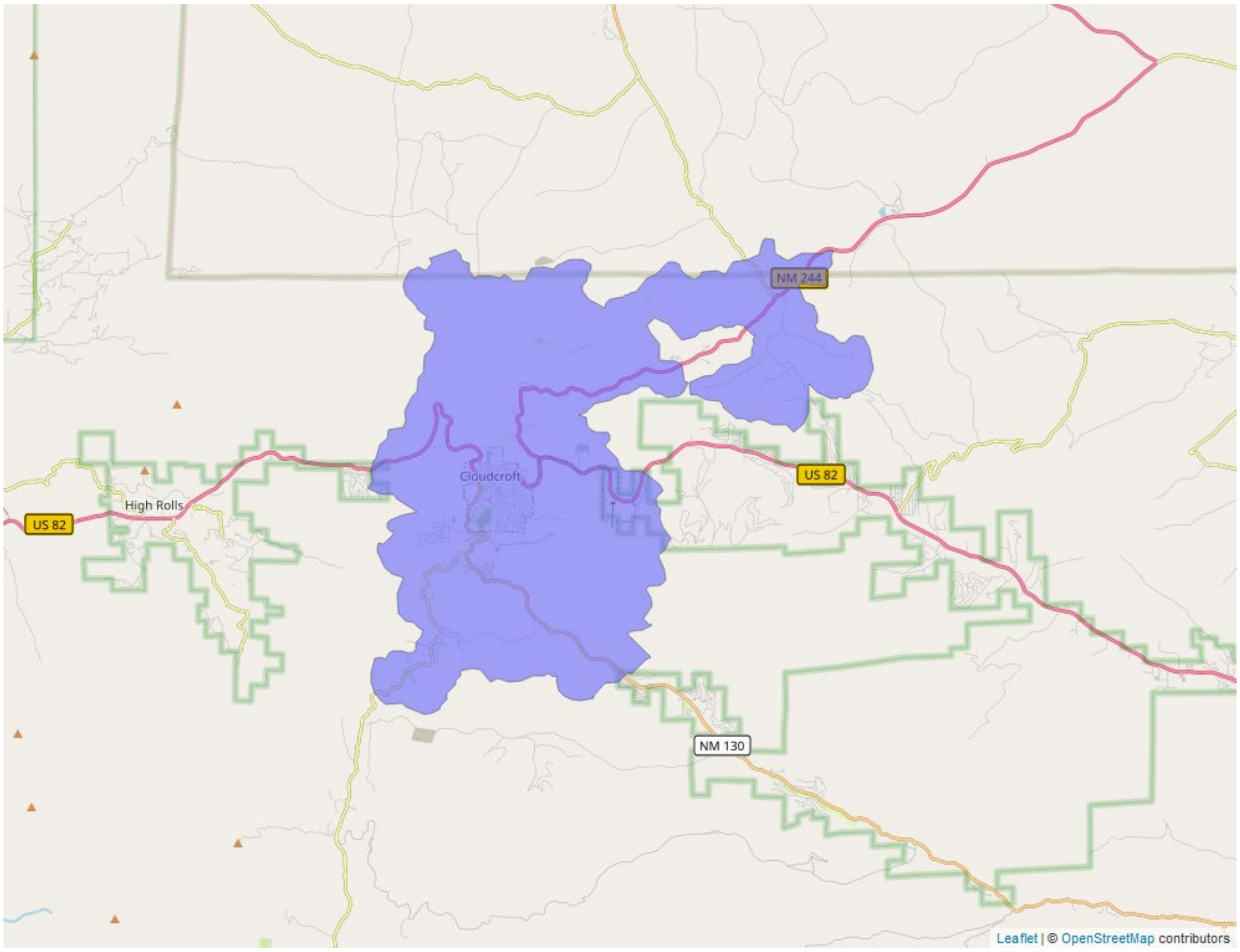

Figure 56. Range map of Sacramento Mountains checkerspot butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1546.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of Status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Date of most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Declining population(s) - one or more populations declining

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Sacramento Mountains checkerspot butterfly is found in the Sacramento Mountains in south-central New Mexico. They inhabit high-altitude meadows in the upper montane and subalpine zones between 2,380-2,750 meters in elevation. Trees, spruce (*Picea* spp.), fir (*Pseudotuga* spp. and *Abies* spp.), and pine (*Pinus* spp.), usually occur along meadow peripheries. Suitable habitat is usually cool and wet, supporting diverse and robust plant life. Remnant colonies are found in extremely small areas, less than a few acres each, across only a few square kilometers of suitable habitat.

Its life cycle is synchronized with the development of host and nectar plants; their host plant is New Mexico beardtongue (*Penstemon neomexicanus*) and preferred nectar plant is the orange sneezeweed (*Helenium hoopesii*). Each life stage has different microhabitat, resources, and seasonal specializations different from the other life stages. Their flight season lasts from mid-June to late-August. Adult movements have been observed between 460-890 meters, and their dispersal rate is very low (i.e., zero adults moved between canyons during a 2003 study). They used to exist as a metapopulation, but extant locations are separated by a matrix of dense conifer forest, and it is unlikely that the butterfly disperses through these unsuitable habitats. Population densities are extremely low, and we assume populations are small. Between 2000-2020, abundance and area occupied have declined, and it is only found in two meadows on the Lincoln National Forest as of 2022 (USFWS 2022).

Primary threats to the species include altered wildfire regimes (e.g., fire suppression), climate change, incompatible grazing, invasive plant species, and recreation. Catastrophic wildfires and effects of climate change could be devastating to the butterfly and its habitat. Threats that we expect to have a small impact on overall species viability include collection, disease, predation, parasites, insecticides, human development, and wild ungulate grazing. In 2007, the U.S. Forest Service treated areas affected by looper moths (*Nepytia janetae*) with an insecticide *Bacillus thuringiensis var. kurstaki* (Btk) that produces a toxin that will kill moths and butterflies that are exposed. To minimize risks to the butterfly, the Forest Service applied Btk during months when the butterfly was inactive. Some habitat loss due to development has occurred, and future loss to development could occur from roads, powerlines, and other Forest Service infrastructure and maintenance activities. Elk preferentially forage the butterfly's host plant, New Mexico beardtongue, potentially causing a reduction in available host plants and incidental consumption of larvae by the elk (USFWS 2022).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate no use sites occur within the species' range (Table 79). Approximately 2.2% of the range occurs in off-field areas that are likely to be exposed to spray drift or runoff.

Usage

Past usage data indicate that up to 2.2% of the species' range has been treated with methomyl annually.

Table 76. Overlap and annual usage data for the Sacramento Mountains checkerspot butterfly. Where specific crops are not registered for methomyl use in a state where the species is found, rows are designated as NA (not applicable).

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Alfalfa	0	1	1	0	1	1
Citrus	0	0	0	0	0	0
Corn[64]	0	0.2	0.2	0	0.2	0.2
Cotton	0	0.2	0.2	0	0.2	0.2
Other Grains	0	0.2	0.2	0	0.2	0.2
Other Orchards	0	0.6	0.6	0	0.6	0.6
Other Row Crops	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	0	0	0	0	0	0

[64] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

Use Layer	On-field Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (Off-field)	Total % Range Treated
Wheat	0	0	0	0	0	0
Total[65]	**0**	**2.2**	**2.2**	**0**	**2.2**	**2.2**

Additional exposure considerations

As mentioned above, the Sacramento Mountains checkerspot butterfly is a habitat specialist and is only found in a small area in two meadows on the Lincoln National Forest near the small town of Cloudcroft, New Mexico. The Sacramento Mountains checkerspot butterfly inhabits high-altitude meadows in the upper-montane and subalpine zone at elevations between 2,380 and 2,750 meters (7,800 and 9,000 feet) (USFWS 2022). The Sacramento Mountains checkerspot butterfly appears to have a stronger affinity for the highest elevation areas in its range, gentle or angled slopes, and south-eastern aspect orientations. Their lifecycle is closely tied to trees such as spruce (*Picea spp*.), fir (*Pseudotuga* spp. and *Abies* spp.), and pine (*Pinus* spp.), that usually occur along meadow peripheries and steep slopes where their host plant, New Mexico beardtongue is found. Adults also prefer to nectar on orange sneezeweed (*Helenium (Hymenoxys) hoopesii*). While each life stage has different microhabitat, resources, and seasonal specializations different from the other life stages, their dispersal rate is very low (i.e., zero adults moved between canyons during a 2003 study). Their flight season lasts from mid-June to late-August and they are not likely to be found in or near agricultural areas.

Exposure Summary

There is a low degree of overlap between off-site exposure areas and the species' range, with 2.2% overlap between off-site areas and the species' range. Past usage data suggests that up to 2.2% of the species' range is likely to be exposed to methomyl through spray drift annually, which represents a low extent of usage.

Overall Exposure: Low

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[65] Total overlap is capped at 100%.

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to methomyl on-field or from concentrations in spray drift up to 90 meters off-field will result in mortality of any individuals exposed.

Indirect Effects

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Toxicity Summary

Given the high sensitivity of insects to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Sacramento Mountains checkerspot butterfly has a low exposure ranking. Only 2.2% of the range overlaps with spray drift areas and past usage data indicate that up to 2.2% of the range has been treated annually in the past. As such, we anticipate a small number of individuals are likely to experience exposure. The species has a high toxicity ranking as available data indicates insect species are highly sensitive to methomyl and that any individuals exposed are likely to die. Given this high level of toxicity, coupled with the low potential exposure, we anticipate a moderate number of individuals are likely to die. However, because this butterfly is only found in very specialized habitats, at high elevations within a National Forest where very little if any agriculture if found, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Sacramento Mountains checkerspot butterfly has a high vulnerability based on its endangered status, limited distribution, and declining trend and we anticipate exposure of individuals of the species to methomyl will result in mortality. However, we anticipate a very low extent of usage will occur within the species range annually based on past usage data. The species range does not occur near methomyl use sites as there is very little overlap between use sites and the species' range (2.2%). Only a small portion of the species' range overlaps with spray drift areas (2.2%). While individuals exposed to methomyl will likely die, we anticipate very few individuals will be exposed given the low extent of overlap and past usage. Therefore, we expect impacts to be low and a small number of individuals will be adversely affected. We do not anticipate this effect to individuals will reduce the reproduction, numbers and distribution of the species. We also anticipate similar levels of usage in the future given the species' high altitude habitat, gentle or angled slopes, and south-eastern aspect orientations. Their lifecycle is closely tied to trees such as spruce (*Picea spp*.), fir (*Pseudotuga* spp. and *Abies* spp.), and pine

(*Pinus* spp.), that usually occur along meadow peripheries and steep slopes where their host plant, New Mexico beardtongue is found. Their preferred habitats are generally removed from agricultural activities. Thus, the likelihood of exposure to methomyl is low.

We anticipate that a very small number of individuals will be affected over the duration of the proposed action (exposure through agricultural uses and spray drift resulting in the loss of a very small number of individuals). While the species has a limited range and declining populations, it has limited overlap with agricultural use sites and we expect the risk to the species is low. We do not expect species-level effects to occur. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Sacramento Mountains checkerspot butterfly in the wild.

References

U.S. Fish and Wildlife Service. 2022. Current Condition Assessment Report for the Sacramento Mountains Checkerspot Butterfly (*Euphydryas anicia cloudcrofti*). Version 1.2. Albuquerque, New Mexico. 43 pp.

Completely Aquatic Insects

Integration and Synthesis Summary: Hungerford's crawling water beetle

Scientific Name:	Common Name:	Entity ID:
Brychius hungerfordi	Hungerford's crawling water beetle	441

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is medium overlap of the action area with the species' range (Figure 55). There is low past usage of methomyl within the species' range, corroborated by low past usage of any insecticides, indicating a low extent of exposure. Most exposed individuals are likely to die and experience low levels of indirect effects. Given that exposure is low and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to die from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hungerford's crawling water beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 6/7/2022; Wherever found; *States within the range:* MI

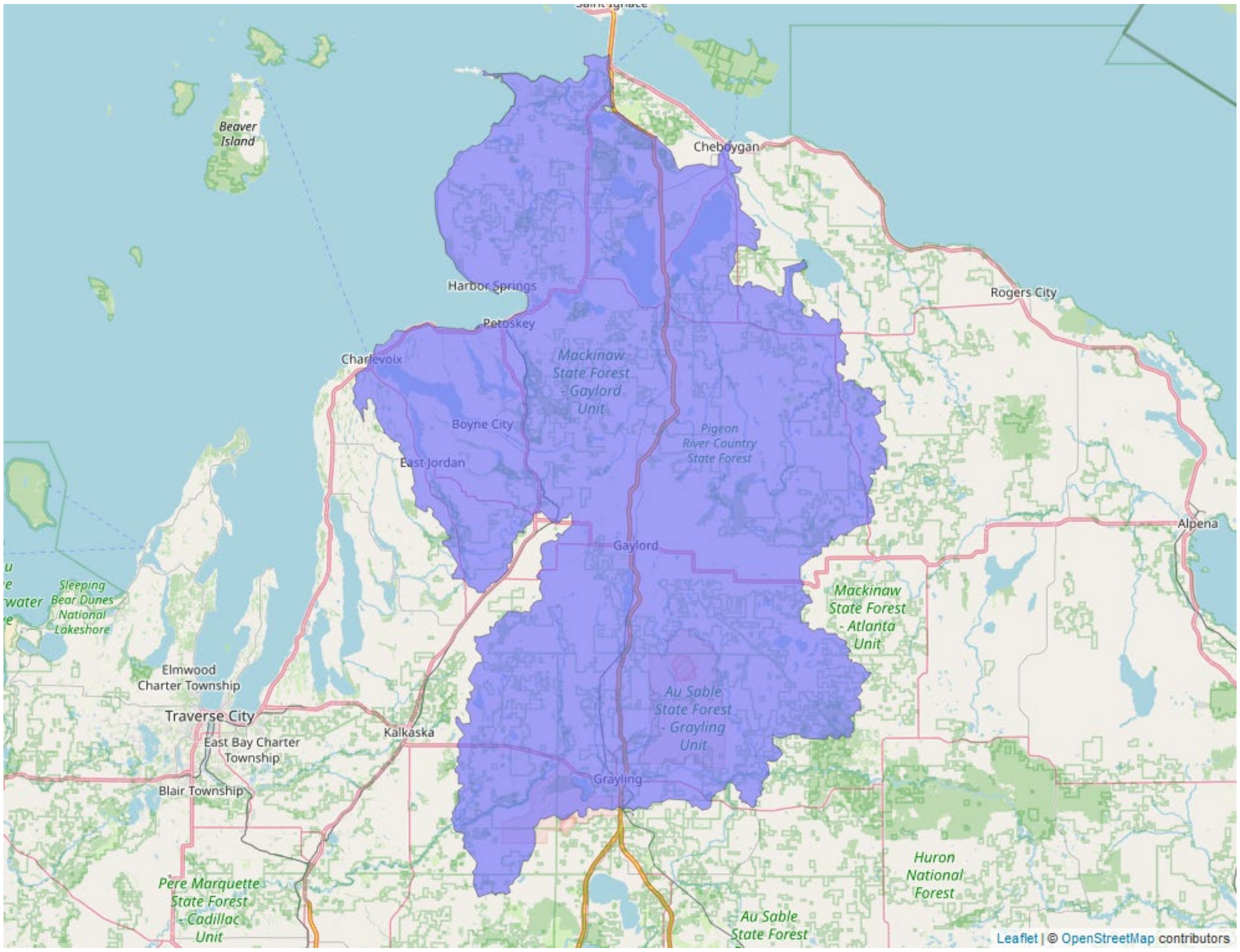

Figure 57. Range map of Hungerford's crawling water beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6123.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: No change in Status

Most recently completed 5-Year Review: 3/30/2021

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: NA

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Although the dietary requirements for Hungerford's crawling water beetle are not fully understood, Spirogyra, lithophilic diatoms or Cocconeis are the most likely food sources for Hungerford's crawling water beetle adults. There are eleven streams range-wide with known populations of Hungerford's crawling water beetle. Throughout the recognized range, we have very limited information on the abundance, population trends, and demographic features of this species. Observations of Hungerford's crawling water beetle in the East Branch of Maple River suggest that they may have two generations per year, with adults emerging in early spring (May) and a second brood of adults emerging late in the season (August). Emergence of adults in the spring from overwintering larvae is likely not synchronous, occurring over a period of weeks, dictated somewhat by local temperature conditions. In addition, some adult beetles survive over the winter, even beneath ice cover. Thus, the timing and magnitude of peak population numbers undoubtedly changes from year to year, with the magnitude controlled somewhat by local climatic conditions and survivability of old adults (USFWS 2012). Populations are found downstream from culverts, beaver and natural debris dams, and human-made impoundments. Streamflow variability, exposure of river edges to air, and presence of algae are important for suitable habitat (USFWS 2021).

Threats to this species include stream modification, road work, and certain types of fish management activities. Recent road culvert projects and sea lamprey control actions appear to indicate that conservation measures can be implemented to reduce adverse effects to Hungerford's crawling water beetle, with little impact to their populations. Monitoring at some of these project sites is on-going and may provide additional insight on the magnitude and management of these threats. No information is available to assess the threat of logging and climate change may be a threat to Hungerford's crawling water beetles. Due to its apparent dependence on various stream characteristics, such as water temperature and flow rate, substrate composition of gravel and cobble, and the presence of Dichotomosiphon algae, alteration of stream habitat from climate change may significantly change the distribution and persistence of Hungerford's crawling water beetle in certain streams. Climate change may cause some streams to become unsuitable for Hungerford's crawling water beetle while others develop suitable habitat; however, the geographic isolation of Hungerford's crawling water beetle populations and its uncertain dispersal capabilities may affect its ability to find and colonize new streams. At this time, the greatest challenge to ensuring recovery of this species remains the lack of information on ecology and natural history. Stream modification is thought to be the primary threat to the species and may include physical destruction of the stream habitat and degradation of water quality. Specific threats may include beaver control, beaver activity, stream pollution, stream-side logging, channelization, bank stabilization, dredging, and impoundment. Road work and culvert removal or bridge construction may impact Hungerford's crawling water beetle. In-stream projects, such as culvert removal projects, may result in considerable disturbance downstream. In some cases, these projects may have short-term adverse effects but may have overall benefits through reduction of erosion and sedimentation in the stream. Logging in the riparian zone represents another possible threat to habitat; it can cause significant modification of habitat and increase erosion and the sediment load into the stream. Other alterations of stream habitat that may result in destruction of suitable Hungerford's crawling water beetle habitat include dredging for stream bed modification and channelization (USFWS 2006, 2012).

Other threats are also assumed to impact the species. For example, the use of lampricides to control sea lamprey is a potential concern for Hungerford's crawling water beetle. Sea lamprey larvae live in certain Great Lakes tributaries before transforming into parasitic adults that migrate to the Great Lakes. Lampricides are chemicals used to reduce populations of sea lamprey to levels that lessen the impact to Great Lakes fish. The Carp Lake River and unoccupied portions of the Maple River have been treated with the lampricides 3- trifluoromethyl-4-nitrophenol (TFM) and 2'5-dichloro-4'-nitrosalicylanilide (niclosamide). Human disturbance within the stream may be a threat to Hungerford's crawling water beetle. Areas of a stream where there are high levels of disturbance caused by fishing and recreation are not likely to be suitable for B. hungerfordi. Human activity could result in habitat disturbance as one walks through the stream or inadvertent crushing of individuals by stepping on them. Although this is a potential threat, there are no known occupied sites with excessive human disturbance due to fishing or recreation. Certain types of fish management activities also may pose a threat to the species (USFWS 1994), although other forms of fish management may be beneficial. Specifically, fish management activities that result in creation, maintenance, or enhancement of suitable Hungerford's crawling water beetle habitat may be beneficial to the species. Conversely, activities that result in the elimination of suitable Hungerford's crawling water beetle habitat may pose a threat. For example, removal of a dam or culvert (e.g., to allow fish passage) immediately upstream of a known site may, in some cases, eliminate suitable Hungerford's crawling water beetle habitat (as discussed above). Some actions may have contemporaneous positive and negative impacts that must be weighed carefully (USFWS 2006, 2012).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We do not expect listed aquatic insects' species will occur on-field, and thus expect exposure will only result from off-field transport via spray drift or runoff. Given that the ranges for listed aquatic species are generally delineated using the relevant HUC 12 watersheds, we anticipate that all residues that leave use sites will be collected in the waterbodies within the species range where individuals occur regardless of how residues leave treated sites or where in the range they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that listed aquatic species are likely to experience. We expect up to 6.9% of the species' range will contain use sites (Table 76).

Usage

Past usage data indicate that up to 1.8% of the species' range has been treated with methomyl annually. Use layers with the highest usage include vegetables and ground fruit (0.6%) and other orchards (0.5%).

Table 77. Overlap and usage data for the Hungerford's crawling water beetle.

Use Layer	Use Site Overlap (% range)	% Range Treated (On-field)
Alfalfa	3.5	0.5
Citrus	NA	NA
Corn[66]	1.3	0.1
Cotton	<0.1	<0.1
Other Grains	1.1	0.1
Other Orchards	0.5	0.5
Other Row Crops	<0.1	<0.1
Soybeans	0.5	<0.1
Vegetables and Ground Fruit	0.6	0.6
Wheat	NA	NA
Total	**6.9**	**1.8**

Additional Exposure Considerations

Reproduction in haliplids usually occurs in the spring and early summer. Mating has been observed in June for *B. hungerfordi* and *B. hornii*, but optimal breeding activity for *B. hungerfordi* may begin in early to mid-July and continue into early August.

In general, *B. hungerfordi* is found in areas of streams characterized by moderate to fast stream flow, good stream aeration, inorganic substrate, and alkaline water conditions (USFWS 2006, 2012).

A jeopardy determination was made for this species in the draft methomyl biological opinion. Results from the 2017 Census of Agriculture, which reports general insecticide usage including methomyl usage, indicates that very low levels of any insecticide were used within the counties where the Hungerford's crawling water beetle range occurs (i.e., up to 0.59% the species' range received treatment of any insecticide, potentially including methomyl). Because methomyl is only one of many insecticides included in the Census of Agriculture, likely even less than 0.59% of the species' range has been treated with methomyl in the past. Because Census of Agriculture data is collected at a more geographically specific scale then other usage data, we expect this to

[66] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

be a more accurate indicator of insecticide usage within the range. As such, we expect a low likelihood of methomyl usage and low extent of exposure of *B. hungerfordi* from the action.

Exposure Summary

While there is a medium extent of overlap between the species' range and methomyl use sites and areas likely exposed through off-site transport (6.9% overlap), past usage data indicates only a small portion of the species' range is likely to be treated with methomyl (up to 1.8% annually). Data from the USDA Census of Agriculture corroborates this low level of usage as only 0.59% of the species' range has been treated with any insecticide in recent years. Given the conservative nature of the Census of Agriculture data, we have high confidence that individuals have a low likelihood of exposure to methomyl. As such, we anticipate only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites. This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. However, despite the incorporation of the rain restriction mitigation, toxicity remains high for this species.

Aquatic habitat buffers: The methomyl label also has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet, of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for aquatic invertebrates, we expect that exposure to methomyl from runoff or spray drift deposition will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that methomyl exposure will result in adverse effects to aquatic plants, including the types of algae that provide food and shelter for the species.

Toxicity Summary

Given the high sensitivity of aquatic invertebrates to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

Hungerford's crawling water beetle has a low exposure ranking. We anticipate only a small portion of the range is likely to be treated with methomyl as past usage data is low (up to 1.8% annually). Additional data from USDA's Census of Agriculture corroborates our expectation of low methomyl usage as very little insecticide usage (including methomyl) has been reported in the counties where the species' range occurs (up to 0.59% of the species' range). As such, we expect only a small number of individuals will experience exposure throughout the duration of the proposed action. Given that insects are highly sensitive to methomyl at aquatic estimated environmental concentrations and are likely to die, we determined the overall toxicity for the species is high. While toxicity is high, we expect the Hungerford's crawling water beetle is at low risk of adverse effects from the proposed action as few individuals are likely to experience exposure, indicating that only a small number of individuals will die throughout the duration of the proposed action.

Conclusion

The Hungerford's crawling water beetle is listed as endangered and is known to exist in small, isolated populations within Michigan. The Hungerford's crawling water beetle relies on specific stream conditions, including moderate to fast stream flow, good stream aeration, inorganic substrate, and alkaline water conditions. Methomyl exposure through runoff or spray drift deposition would disrupt these conditions, leading to lethal outcomes for the species. The species' reproductive cycle, with mating observed from June to early August, coincides with the timing of methomyl applications and increases the risk of exposure during critical periods of the beetle's life cycle. The fragmented and isolated nature of the beetle's habitat, combined with the species' ecological traits and high sensitivity to methomyl, poses a significant thread to the species.

Our analysis indicates a moderate overlap of 6.9% between the action area and the species' range, suggesting a medium methomyl exposure level. Past usage data shows up to 1.8% of the species' range has been treated with methomyl annually, and additional data from USDA's Census of Agriculture further supports our expectation that a very small area of the species' range will experience exposure to methomyl (i.e., insecticide usage, including methomyl, has been reported in 0.59% of the species' range). Aquatic invertebrates, including the Hungerford's crawling water beetle, are highly sensitive to this pesticide. Even though methomyl is highly toxic to the Hungerford's crawling water beetle, we expect a low level of risk to the species because we anticipate only a small number of individuals will die from the proposed action.

In summary, we expect a small number of individuals will die from methomyl exposure because of the low past methomyl usage in the species' range (1.8% of the range treated) and even lower past insecticide usage (0.59% of the species range). We do not expect significant mortality or species-level effects to occur from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Hungerford's crawling water beetle.

References

U.S. Fish and Wildlife Service. 2021. Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) 5-Year Review: Summary and Evaluation. East Lansing, Michigan. 15 pp.

U.S. Fish and Wildlife Service. 2012. Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) 5-Year Review: Summary and Evaluation. East Lansing, Michigan. 19 pp.

U.S. Fish and Wildlife Service. 2006. Hungerford's Crawling Water Beetle (*Brychius hungerfordi*) Recovery Plan. Fort Snelling, Minnesota. 91 pp.

Integration and Synthesis Summary: Comal Springs riffle beetle

Scientific Name:	**Common Name:**	**Entity ID:**
Heterelmis comalensis	Comal Springs riffle beetle	453

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is medium overlap of the action area with the species' range (Figure 56). There is low past usage of methomyl within the species' range, corroborated by low past usage of any insecticides, indicating a low extent of exposure. Most exposed individuals are likely to die and experience low levels of indirect effects. Given that exposure is low and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be die from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Comal Springs riffle beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 5/6/2021; Wherever found; *States within the range:* TX

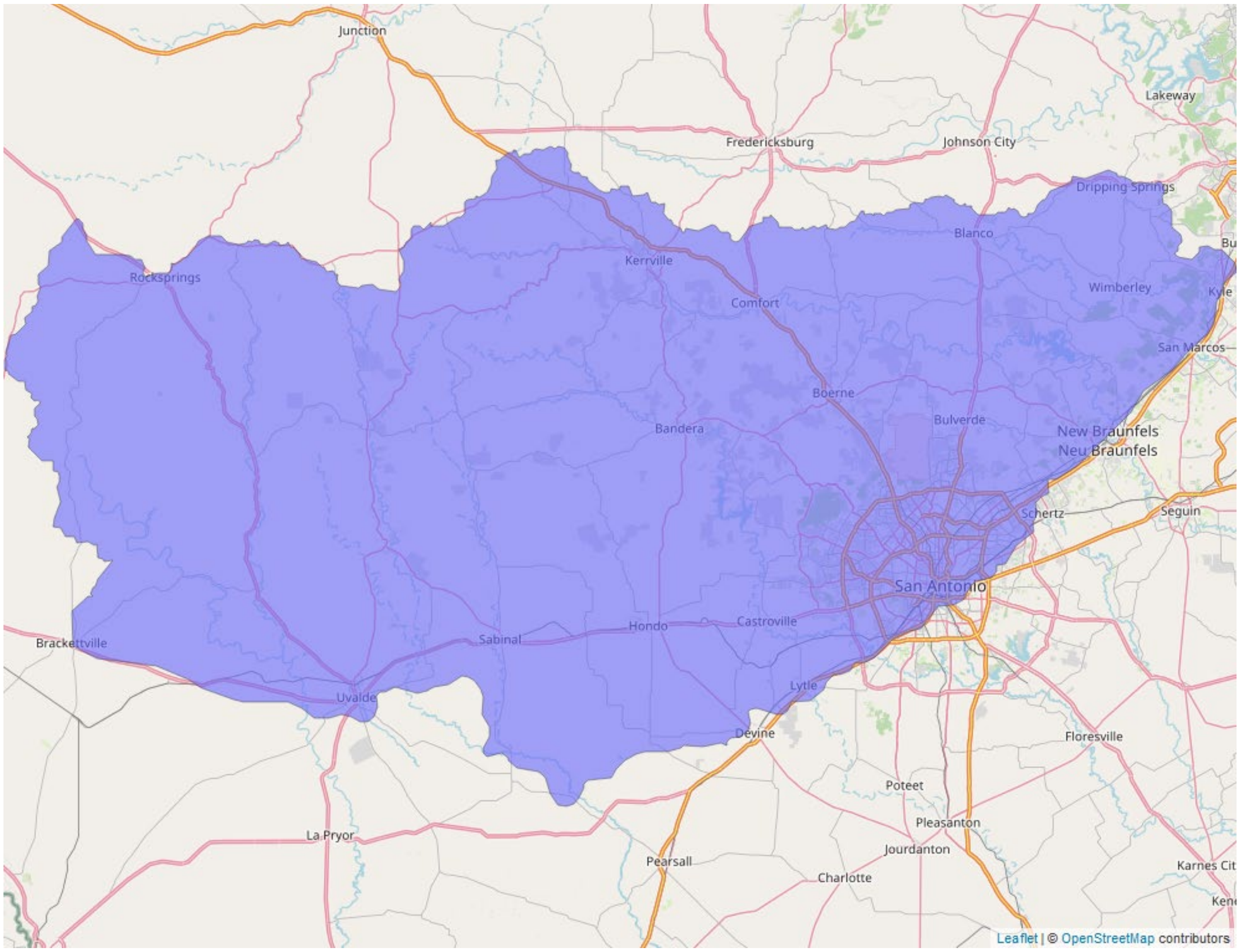

Figure 58. Range map of Comal Springs riffle beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3403.Range map of Comal Springs riffle beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3403.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Multiple populations (few)

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Comal Springs riffle beetle is a small, aquatic beetle known from Comal Springs and San Marcos Springs in Texas. They are not a subterranean species; they occur in gravel substrate and shallow riffles in spring runs. We do not believe they can fly, though other closely-related species can fly (USFWS 1997).

The main threat to the habitat of Comal Springs riffle beetles is reduction or loss of water of adequate quantity and quality, due primarily to human water withdrawal from the San Antonio segment of the Edwards Aquifer (Balcones Fault Zone) and other activities. Total withdrawal from the San Antonio region of the Edwards Aquifer increased after 1934, when the total well discharge was 101,900 ac-ft. Human population increases result in increased demand for water from the aquifer. Water in the Edwards Aquifer flows from west to east or northeast and withdrawal or contamination of water in the western part of the aquifer can have a direct effect on the quantity and quality of water flowing toward the springs and at the spring openings. Prior to wells being drilled into the aquifer, almost all the water entering the aquifer eventually exited at springs.

In addition to a loss of water, a decrease in the water level in the aquifer could lead to decreased water quality at the springs. The Balcones Fault Zone is bounded on the south and east by a “bad water” interface across which the groundwater quality abruptly deteriorates to greater than 1,000 mg/L total dissolved solids. Crossing the bad water interface, groundwater goes from fresh to saline or brackish. Lowered water levels resulting from groundwater pumping and/or decreased recharge may result in deterioration of water quality in the freshwater section of the aquifer through movement of the bad water interface. The Comal and San Marcos Springs are less than 305 and 62 m, respectively, from the bad water interface. Although the data are inconclusive at present, even a small movement of the water may negatively impact the species. Other possible effects of reduced spring flow exist. These include changes in the chemical composition of the water in the aquifer and at the springs, a decrease in current velocity and corresponding increase in siltation, and an increase in temperature and temperature fluctuations in the aquatic habitat.

Another threat to the species’ habitat is groundwater contamination. Pollutants of concern include, but are not limited to, those associated with human sewage (particularly septic tanks), leaking underground storage tanks, animal/feedlot waste, agricultural chemicals (especially insecticides, herbicides, and fertilizers) and urban runoff (including pesticides, fertilizers, and detergents). Pipeline, highway, and railway transportation of hydrocarbons and other potentially harmful materials in the Edwards Aquifer recharge zone and its watershed, with the attendant possibility of accidents, present a particular risk to water quality in Comal and San Marcos Springs. Comal and San Marcos Springs are both located in urbanized areas. Hueco Springs is located alongside River Road, which is heavily traveled for recreation on the Guadalupe River, and may be susceptible to road runoff and spills related to traffic. Fern Bank Springs is in a relatively remote, rural location and its principal vulnerability is probably to contaminants associated with leaking septic tanks, animal/feedlot wastes, and agricultural chemicals. Of the counties containing portions of the San Antonio segment of the Edwards Aquifer, the potential for acute, catastrophic contamination of the aquifer is greatest in Bexar, Hays, and Comal Counties because of the greater level of urbanization compared to the western counties. Although spill or contamination events that could affect water quality do happen to the west of Bexar County, dilution and the time required for the water to reach the springs may lessen the threat from that area. As aquifer levels decrease, dilution of contaminants moving through the aquifer may also decrease. The Texas Water Commission reported that in 1988 within the San Antonio segment of the Edwards Aquifer, Bexar, Hays, and Comal Counties had the greatest number of land-based oil and chemical spills in central Texas that affected surface and/or groundwater with 28, 6, and 4 spills, respectively. In 1989, the Texas Water Commission used the assessment tool DRASTIC to classify aquifers statewide according to their pollution potential. The Edwards Aquifer (Balcones Fault Zone—Austin and San Antonio Region) was ranked among the highest in pollution potential of all major Texas aquifers. The project's objective was to identify areas sensitive to groundwater pollution from a contaminated land surface based on the hydrogeologic setting. The area of particular concern was the Edwards Aquifer recharge zone and its watershed. The effect of natural droughts in south central Texas will increase in severity due to the large increase in human groundwater withdrawals.

The species' limited habitat is likely to be lost through low flow during minor or severe drought. At present, competition is not known to be a significant threat to these species. However, two exotic snail species, *Thiara granifera* and *Thiara tuberculata*, are common in the spring runs and, as grazers, may compete for food. Another exotic species, the giant ramshorn snail (*Marisa cornuarietis*), is present in two of the spring runs and may colonize the other runs at low flow levels. Marisa can have a tremendous impact on vegetation, that in turn may affect the habitat for surface-dwelling grazers like the riffle beetle (USFWS 1997).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We do not expect listed aquatic insects will occur on-field, and thus expect exposure will only result from off-field transport via spray drift or runoff. Given that the ranges for listed aquatic species are generally delineated using the relevant HUC 12 watersheds, we anticipate that all residues that leave use sites will be collected in the waterbodies within the species range where individuals occur regardless of how residues leave treated sites or where in the range they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that listed aquatic species are likely to experience. We expect up to 7.3% of the species range will contain use sites (Table 77).

Usage

Past usage data indicate that up to 0.6% of the species' range has been treated with methomyl annually (Table 77). Use layers with the highest usage include other gains (0.2%), and others with 0.1% usage include corn, cotton, other orchards, and vegetables and ground fruit.

Table 78. Overlap and usage data for the Comal Springs riffle beetle.

Use Layer	Use Site Overlap (% range)	% Range Treated (On-field)
Alfalfa	<0.1	<0.1
Citrus	NA	NA
Corn[67]	2.4	0.1
Cotton	1.2	0.1
Other Grains	3.4	0.2
Other Orchards	<0.1	0.1
Other Row Crops	<0.1	<0.1
Soybeans	<0.1	<0.1
Vegetables and Ground Fruit	0.1	0.1
Wheat	NA	NA
Total	**7.3**	**0.6**

Additional Exposure Considerations

This species is a detritivore. Larvae have been collected with adults in the gravel substrate of the spring headwaters and not on submerged wood as is typical of most *Heterelmis* species (Brown and Barr 1988). The Comal Springs riffle beetle is not a subterranean species. It occurs in the gravel substrate and shallow riffles in spring runs (USFWS 1997).

A jeopardy determination was made for this species in the draft methomyl biological opinion. Results from the 2017 Census of Agriculture, which reports general insecticide usage including methomyl usage, indicates that very low levels of any insecticide were used within the counties where the Comal Springs riffle beetle range occurs (i.e., up to 2.2% of the counties where the species' range occurs received treatment of any insecticide, potentially including methomyl). Because methomyl is only one of many insecticides included in the Census of Agriculture, likely even less than 2.2% of the species' range has been treated with methomyl in the past. In addition,

[67]We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

because Census of Agriculture data is collected at a more geographically specific scale then other usage data, we expect this to be a more accurate indicator of insecticide usage within the range. As such, we expect a low likelihood of methomyl usage and low extent of exposure of Comal Springs riffle beetle from the action.

Exposure Summary

While there is a medium extent of overlap between the species' range and methomyl use sites and areas likely exposed through off-site transport (7.3% overlap), past usage data indicates only a small portion of the species' range is likely to be treated with methomyl (up to 0.6% annually). Data from the USDA Census of Agriculture corroborates this low level of usage as only 2.2% of the species range has been treated with any insecticide in recent years. Given the conservative nature of the Census of Agriculture data, we have high confidence that individuals have a low likelihood of exposure to methomyl. As such, we anticipate only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites. This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. However, despite the incorporation of the rain restriction mitigation, toxicity remains high for this species.

Aquatic habitat buffers: The methomyl label also has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet, of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds".

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for aquatic invertebrates, we expect that exposure to methomyl from runoff or spray drift deposition will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that methomyl exposure will result in adverse effects to organic matter, known as aufwuchs or biofilm, this beetle feeds on from the roots and wood in streams where this beetle is found, and that also provide shelter for the species.

Toxicity Summary

Given the high sensitivity of aquatic invertebrates to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Comal Springs riffle beetle has a medium exposure ranking. However, we anticipate only a small portion of the range is likely to be treated with methomyl as past usage data is low (up to 0.6% annually). Additional data from USDA's Census of Agriculture corroborates our expectation of low methomyl usage as very little insecticides (including methomyl) has been reported in the counties where the species' range occurs (up to 2.2% of the species' range). As such, we expect only a small number of individuals will experience exposure throughout the duration of the proposed action. Given that insects are highly sensitive to methomyl at aquatic estimated environmental concentrations and are likely to die, we determined the overall toxicity for the species is high. Even though toxicity is high, we expect the Comal Springs riffle beetle is at low risk of adverse effects from the proposed action as few individuals are likely to experience exposure, indicating that only a small number of individuals will die throughout the duration of the proposed action.

Conclusion

The Comal Springs riffle beetle is listed as endangered and is known to exist in small, isolated populations within Texas. The Comal Springs riffle beetle relies on specific stream conditions, including gravel substrates and shallow riffles in spring runs with high water quality. The primary threat to the habitat of the Comal Springs riffle beetle is the reduction or loss of water of adequate quantity and quality due to human activities, including water withdrawals from the Edwards Aquifer. Threats are compounded by potential groundwater contamination from urban runoff, agricultural chemicals, and other pollutants. The beetle's habitat in the spring headwaters is particularly vulnerable to changes in water quality, temperature, and flow rates, which can be exacerbated by drought and increased water withdrawals. Methomyl exposure through runoff or spray drift deposition will likely disrupt these conditions, leading to lethal outcomes for the beetle. We do not anticipate indirect effects on the beetle's food resources, such as aufwuchs or biofilm..

Our analysis indicates a moderate overlap of 7.3% between the action area and the species' range, suggesting a medium methomyl exposure level. Past usage data shows that up to 0.6% of the species' range has been treated with methomyl annually, and additional data from USDA's Census of Agriculture further supports our expectation that a very small area of the species' range will experience exposure to methomyl (i.e., insecticides (including methomyl) have been reported in 2.2% of the species' range). Aquatic invertebrates, including the Comal Springs riffle beetle, are highly sensitive to this pesticide. Even though methomyl is highly toxic to the Comal Springs riffle beetle, we expect a low level of risk to the species because we anticipate a small number of individuals will die from the proposed action.

In summary, we expect a small number of individuals will die from methomyl exposure because of the low past methomyl usage in the species' range (0.6%) and low past insecticide usage in the counties where the species occurs (2.2%). We do not expect significant mortality or species-level effects to occur from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Comal Springs riffle beetle.

References

U.S. Fish and Wildlife Service. 1997. Endangered and Threatened Wildlife and Plants; Final Rule to List Three Aquatic Invertebrates in Comal and Hays Counties, TX, as Endangered. Federal Register 62(243): 66295-66304.

Integration and Synthesis Summary: Comal Springs dryopid beetle

Scientific Name:	**Common Name:**	**Entity ID:**
Stygoparnus comalensis	Comal Springs dryopid beetle	454

Species Overview

In reviewing the status of the species, the environmental baseline, and cumulative effects for the action area, we determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determined there is medium overlap of the action area with the species' range (Figure 57). There is low past usage of methomyl within the species' range, corroborated by low past usage of any insecticides, indicating a low extent of exposure. Most exposed individuals are likely to die and experience low levels of indirect effects. Given that exposure is low and the level of indirect effects is low, we determined the risk of adverse effects to the species is low. As such, we expect a small number of individuals are likely to be die from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Comal Springs dryopid beetle. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 5/6/2021; Wherever found; *States within the range:* TX

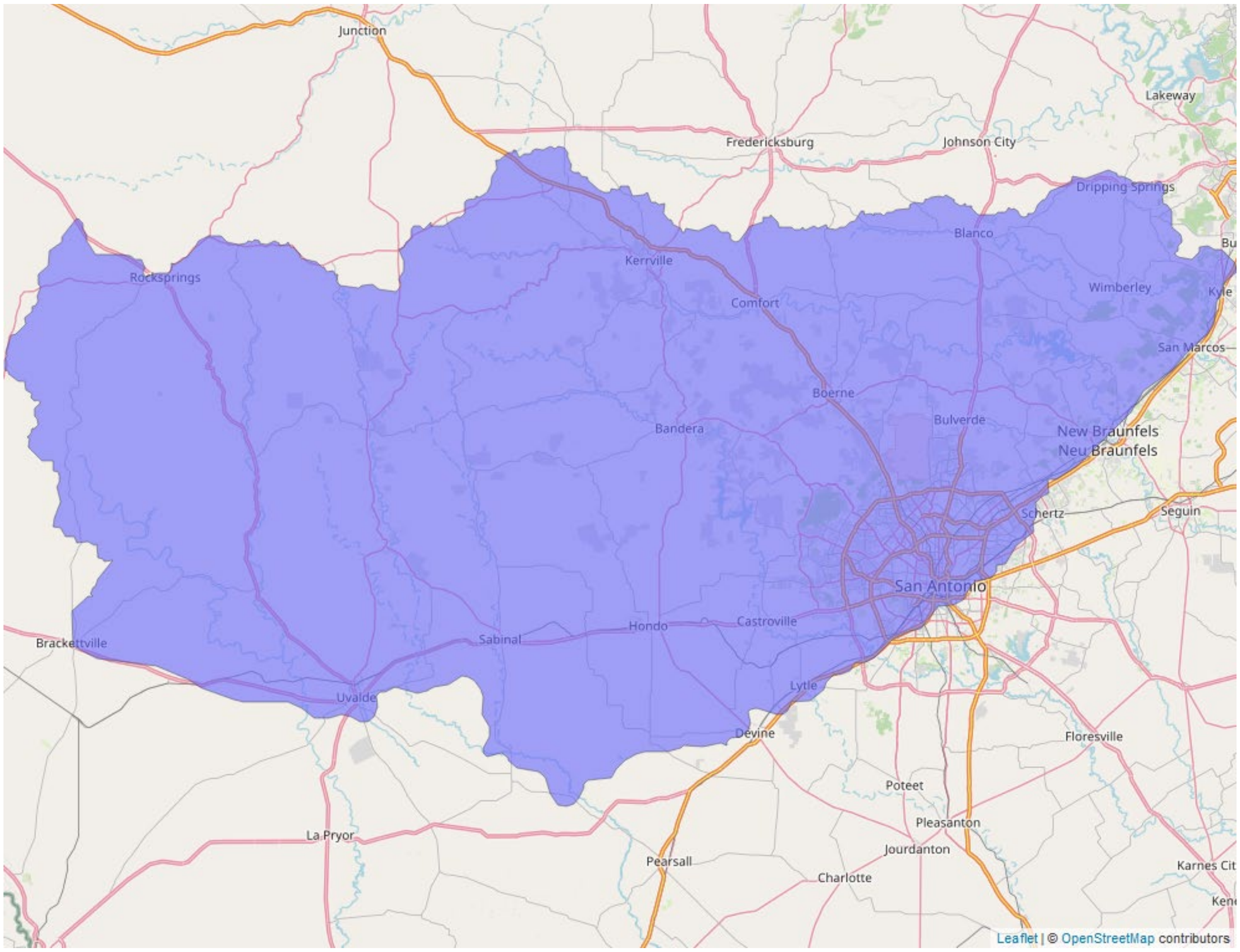

Figure 59. Range map of Comal Springs dryopid beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7175.

Vulnerability

As mentioned above, vulnerability considers the present condition of the species to determine its vulnerability to additional stressors. Here, in making our jeopardy determination, vulnerability of the species is a function not only of its status, but also the environmental baseline and cumulative effects, as summarized below.

Summary of status

Listing status: Endangered

Most recent 5-Year Review recommendation: N/A

Most recently completed 5-Year Review: N/A

Distribution: Small, endemic, constrained, and/or isolated population(s)

Number of populations: Population size/location(s) unknown

Species trends: Unknown population trends

Pesticides noted in Service documents as a threat to the species: yes

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Comal Springs dryopid beetle is a subterranean aquatic beetle found in Comal Springs and Fern Bank Springs in Texas. Larvae are presumed to be associated with air-filled voids inside the spring orifices because all other known dryopid beetle larvae are terrestrial. Comal Springs cryopid beetles do not swim and may have a smaller range in the aquifer than other species of aquatic invertebrates (USFWS 1997).

The main threat to species' habitat is a reduction or loss of water of adequate quantity and quality, due primarily to human water withdrawal from the San Antonio segment of the Edwards Aquifer (Balcones Fault Zone) and other activities. Total withdrawal from the San Antonio region of the Edwards Aquifer increased after 1934, when the total well discharge was 101,900 ac-ft. Human population increases result in increased demand for water from the aquifer. Water in the Edwards Aquifer flows from west to east or northeast and withdrawal or contamination of water in the western part of the aquifer can have a direct effect on the quantity and quality of water flowing toward the springs and at the spring openings. Prior to wells being drilled into the aquifer, almost all the water entering the aquifer eventually exited at springs.

In addition to a loss of water, a decrease in the water level in the aquifer could lead to decreased water quality at the springs. The Balcones Fault Zone is bounded on the south and east by a "bad water" interface across which the groundwater quality abruptly deteriorates to greater than 1,000 mg/L total dissolved solids. Crossing the bad water interface, groundwater goes from fresh to saline or brackish. Lowered water levels resulting from groundwater pumping and/or decreased recharge may result in deterioration of water quality in the freshwater section of the aquifer through movement of the bad water interface. The Comal and San Marcos Springs are less than 305 and 62 m, respectively, from the bad water interface. Although the data are inconclusive at present, even a small movement of the water may negatively impact the species. Other possible effects of reduced spring flow exist. These include changes in the chemical composition of the water in the aquifer and at the springs, a decrease in current velocity and corresponding increase in siltation, and an increase in temperature and temperature fluctuations in the aquatic habitat.

Another threat to the habitat of this species is the potential for groundwater contamination. Pollutants of concern include, but are not limited to, those associated with human sewage (particularly septic tanks), leaking underground storage tanks, animal/feedlot waste, agricultural chemicals (especially insecticides, herbicides, and fertilizers) and urban runoff (including pesticides, fertilizers, and detergents). Pipeline, highway, and railway transportation of hydrocarbons and other potentially harmful materials in the Edwards Aquifer recharge zone and its watershed, with the attendant possibility of accidents, present a particular risk to water quality in Comal and San Marcos Springs. Comal and San Marcos Springs are both located in urbanized areas. Hueco Springs is located alongside River Road, which is heavily traveled for recreation on the Guadalupe River, and may be susceptible to road runoff and spills related to traffic. Fern Bank Springs is in a relatively remote, rural location and its principal vulnerability is probably to contaminants associated with leaking septic tanks, animal/feedlot wastes, and agricultural chemicals. Of the counties containing portions of the San Antonio segment of the Edwards Aquifer, the potential for acute, catastrophic contamination of the aquifer is greatest in Bexar, Hays, and Comal Counties because of the greater level of urbanization compared to the western counties. Although spill or contamination events that could affect water quality do happen to the west of Bexar County, dilution and the time required for the water to reach the springs may lessen the threat from that area. As aquifer levels decrease, however, dilution of contaminants moving through the aquifer may also decrease. The Texas Water Commission reported that in 1988, within the San Antonio segment of the Edwards Aquifer, Bexar, Hays, and Comal Counties had the greatest number of land-based oil and chemical spills in central Texas that affected surface and/or groundwater with 28, 6, and 4 spills, respectively. In 1989, the Texas Water Commission used the assessment tool DRASTIC to classify aquifers statewide according to their pollution potential. The Edwards Aquifer (Balcones Fault Zone—Austin and San Antonio Regions) was ranked among the highest in pollution potential of all major Texas aquifers. The project's objective was to identify areas sensitive to groundwater pollution from a contaminated land surface based on the hydrogeologic setting. The area of particular concern was the Edwards Aquifer recharge zone and its watershed. The effect of natural droughts in south central Texas will increase in severity due to the large increase in human groundwater withdrawals.

This species' limited habitat is likely to be lost through low flow during minor or severe drought. At present, competition is not known to be a significant threat to this species. However, two exotic snail species, *Thiara granifera* and *Thiara tuberculata*, are common in the spring runs and, as grazers, may compete for food. Another exotic species, the giant ramshorn snail (*Marisa cornuarietis*), is present in two of the spring runs and may colonize the other runs at low flow levels (USFWS 1997).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We do not expect listed aquatic insects will occur on-field, and thus expect exposure will only result from off-field transport via spray drift or runoff. Given that the ranges for listed aquatic species are generally delineated using the relevant HUC 12 watersheds, we anticipate that all residues that leave use sites will be collected in the waterbodies within the species range where individuals occur regardless of how residues leave treated sites or where in the range they are deposited. As such, we do not extend overlap metrics off-field as this will not functionally change the expected exposures that listed aquatic species are likely to experience. We expect up to 7.3% of the species range will contain use sites.

Usage

Past usage data indicate that up to 0.6% of the species' range has been treated with methomyl annually (Table 78). Use layers with the highest usage include other grains (0.2%), and those use layers with the same percentage at 0.1% are vegetables and ground fruit, other orchards, cotton, and corn.

Table 79. Overlap and usage data for the Comal Springs riffle beetle.

Use Layer	Use Site Overlap (% range)	% Range Treated (On-field)
Alfalfa	<0.1	<0.1
Citrus	NA	NA
Corn[68]	2.4	0.1
Cotton	1.2	0.1
Other Grains	3.4	0.2
Other Orchards	<0.1	0.1
Other Row Crops	<0.1	<0.1
Soybeans	<0.1	<0.1
Vegetables and Ground Fruit	0.1	0.1
Wheat	NA	NA
Total	**7.3**	**0.6**

Additional Exposure Considerations

Although specific food requirements of this species are unknown, potential food sources include detritus (decomposed plant materials), leaf litter, and decaying roots.

The Comal Springs dryopid beetle is a spring adapted, aquatic species dependent on high-quality, unpolluted groundwater that has low levels of salinity and turbidity. The species is generally associated with water that has adequate levels of dissolved oxygen for respiration (USFWS 1997).

A jeopardy determination was made for this species in the draft methomyl biological opinion. Results from the 2017 Census of Agriculture, which reports general insecticide usage including methomyl usage, indicates that very low levels of any insecticide were used within the counties where the Comal Springs dryopid beetle range occurs (i.e., up to 2.2% of the species' range received treatment of any insecticide, potentially including methomyl). Because methomyl is only one of many insecticides included in the Census of Agriculture, likely even less than 2.2% of the species' range has been treated with methomyl in the past. In addition, because Census of Agriculture data is collected at a more geographically specific scale then other usage data, we expect this to be a more accurate indicator of insecticide usage within the range. As such, we

[68] We expect corn and soybean use sites are highly redundant with each other and only use the higher of the two layers in our calculation of total percent overlap and total percent treated range.

expect a low likelihood of methomyl usage and low extent of exposure of Comal Springs dryopid beetle from the action.

Exposure Summary

While there is a medium extent of overlap between the species' range and methomyl use sites and areas likely exposed through off-site transport (7.3% overlap), past usage data indicates only a small portion of the species' range is likely to be treated with methomyl (up to 0.6% annually). Data from the USDA Census of Agriculture corroborates this low level of usage as only 2.2% of the species' range has been treated with any insecticide in recent years. Given the conservative nature of the Census of Agriculture data, we have high confidence that individuals have a low likelihood of exposure to methomyl. As such, we anticipate only a small number of individuals are likely to experience exposure from the proposed action.

Overall Exposure: Low

Conservation Measures

Rain restriction: The methomyl label has language designed to reduce the likelihood of pesticide runoff from use sites. This rain restriction language provides for a reduction in the concentration of methomyl in aquatic habitats by providing time for methomyl to degrade before runoff into aquatic habitats can occur, decreasing exposure and risk. However, despite the incorporation of the rain restriction mitigation, toxicity remains high for this species.

Aquatic habitat buffers: The methomyl label also has language to reduce the likelihood of pesticide spray drift from use sites specifically to nearby aquatic habitats. The label language states "Do not apply by ground equipment within 25 feet, or by air within 100 feet, of lakes, reservoirs, rivers, estuaries, commercial fish ponds and natural, permanent streams, marshes or natural, permanent ponds" for which vernal pools would be included.

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for aquatic invertebrates, we expect that exposure to methomyl from runoff or spray drift deposition will result in mortality of any individuals exposed.

Indirect Effects

The dietary items for the Comal Springs dryopid beetle are unknown but we expect that methomyl exposure will result in adverse effects to its food as they are most likely a predator of other aquatic invertebrates.

Toxicity Summary

Given the high sensitivity of aquatic invertebrates to methomyl at estimated environmental concentrations, we anticipate all individuals exposed to methomyl will die.

Overall Toxicity: High

Effects of the Action Summary

The Comal Springs dryopid beetle has a medium exposure ranking. A moderate portion of the species' range overlaps with the action area (7.3%). However, we anticipate only a small portion of the range is likely to be treated with methomyl as past usage data is low (up to 0.6% annually). Additional data from USDA's Census of Agriculture corroborates our expectation of low methomyl usage as very little insecticides (including methomyl) has been reported in the counties where the species' range occurs (up to 2.2% of the species range). As such, we expect only a small number of individuals will experience exposure throughout the duration of the proposed action. Given that insects are highly sensitive to methomyl at aquatic estimated environmental concentrations and are likely to die, we determined the overall toxicity for the species is high. While toxicity is high, we expect the Comal Springs dryopid beetle is at low risk of adverse effects from the proposed action as few individuals are likely to experience exposure, indicating that only a small number of individuals will die throughout the duration of the proposed action.

Conclusion

The Comal Springs dryopid beetle is listed as endangered and exists in small, endemic populations within Texas. The Comal Springs dryopid beetle relies on high-quality, unpolluted groundwater with low levels of salinity and turbidity. The primary threat to the habitat of the Comal Springs dryopid beetle is the reduction or loss of adequate water quantity and quality due to human activities, groundwater contamination from urban runoff and agricultural chemicals, and other pollutants. The beetle's habitat in the spring headwaters is also vulnerable to changes in water quality, temperature, and flow rates, which can be exacerbated by drought and increased water withdrawals. Threats are compounded by potential groundwater contamination from urban runoff, agricultural chemicals, and other pollutants. Methomyl exposure through runoff or spray drift deposition is likely to degrade these critical water conditions. In addition to the direct effects of methomyl exposure on the beetle, we also anticipate indirect effects due to potential impacts on its food resources, which likely include other aquatic invertebrates.

Our analysis indicates a moderate overlap of 7.3% between the action area and the species' range, suggesting a medium level of methomyl exposure. Past data show that up to 0.6% of the species' range has been treated with methomyl annually, and additional data from USDA's Census of Agriculture further supports our expectation that a very small area of the species' range will experience exposure to methomyl (i.e., insecticides (including methomyl) have been reported in 2.2% of the species' range). Aquatic invertebrates, including the Comal Springs dryopid beetle, are highly sensitive to methomyl. Even though methomyl is highly toxic to the Comal Springs dryopid beetle, we expect a low level of risk to the species because we anticipate only a small number of individuals will die from the proposed action.

In summary, we expect a small number of individuals will die from methomyl exposure because of the low past methomyl usage in the species' range (0.6%) and low past insecticide usage in the counties where the species occurs (2.2%). We do not expect significant mortality or species-level effects to occur from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not likely to appreciably reduce the survival and recovery of the species. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Comal Springs dryopid beetle.

References

U.S. Fish and Wildlife Service. 1997. Endangered and Threatened Wildlife and Plants; Final Rule to List Three Aquatic Invertebrates in Comal and Hays Counties, TX, as Endangered.