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.

Vulnerability

For the insect species that we or EPA determined are "likely to be adversely affected" by the proposed action, we considered several factors for each species to determine the current vulnerability of that species to additional stressors. This effort allows us to consider whether a species' current condition is stable, moving toward recovery, or moving toward 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 status 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. We obtained the information to create the vulnerability summary from the Status of the Species accounts (Appendix B), the 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, medium, 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 carbaryl through direct contact with sprayed chemical in the air or through residues on foliage and other surfaces. Exposure can occur on use sites as well as off-field through spray drift and runoff. Carbaryl 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.

Exposure to Agricultural Uses

We characterize the expected level of exposure using overlaps between the species' ranges and agricultural land uses where carbaryl is registered for use (i.e., overlap data; including a 30-m off-site transport area adjacent to use sites), past carbaryl usage data (when available; the amount and location where carbaryl has been used in the past), any species-specific considerations such as life history information (e.g., habitat preferences, dispersal behavior), and existing protections or conservation actions (e.g., existing label measures, conservation measures from the action agency). Species with greater than 10% overlap between their range and agricultural carbaryl 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 carbaryl use sites, we considered past carbaryl usage data within a species' range to determine how much of a species' range we expect to be treated with carbaryl 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 biological opinion. Species that data indicate will have a large portion of their range (>10%) treated with carbaryl each year are assigned a high usage score. Species with 5-10% total usage are assigned a medium usage score, and species with less than 5% total usage are assigned a low usage score. Agricultural uses of carbaryl in the state of Hawai‘i are no longer registered; however, agricultural uses are still registered for other island territories.

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 large 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. Past usage data for carbaryl is not available for species located on Pacific or Caribbean islands, including Commonwealth of the Northern Mariana Islands, Guam, American Sāmoa, U.S. Virgin

Islands, and Puerto Rico. Thus, in the absence of any additional exposure considerations for these species, our ranking is based on total overlap of carbaryl use sites for species that occur in these areas. For all species, where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate.

Exposure to Non-Agricultural Uses

Carbaryl has several registered non-agricultural uses, including use sites within developed, open space developed, nurseries, rangeland, managed forests, and rights of way Use Data Layers (UDLs). Rights of way includes roadsides, and we refer to roadsides when applicable. In many cases, data provided by EPA indicate low to high levels of overlap between species' ranges and non-agricultural UDLs. However, UDLs for non-agricultural uses tend to be less defined than those for agricultural UDLs and may not accurately represent the actual footprint of these use sites on the landscape. As such, we assess exposure of species to non-agricultural uses of carbaryl in a qualitative manner, considering the life history of species, methods of application, carbaryl usage, and any existing conservation measures to reduce drift and runoff or otherwise limit exposure to species. To facilitate this analysis, for every species in this Appendix, we reviewed species' documents (e.g., 5-Year Reviews, recovery plans, listing rules) to determine if the species and their prey could occur on non-agricultural carbaryl use sites (i.e., managed forests, rights of way, developed, open space developed, nurseries, or rangelands) and the manner in which they may rely on these sites.

For most species, we anticipate that non-agricultural uses will not meaningfully add to the overall level of anticipated exposure considered in our analysis of agricultural uses and discuss each use in more detail in the *Overall Considerations for the Opinion* section of this Opinion. Briefly, we expect listed species are generally unlikely to be exposed to non-agricultural uses of carbaryl due to low levels of past usage and/or existing mitigation measures that are protective of listed species. Usage data summarized by the EPA indicate that all non-agricultural UDLs have very low levels of past usage (at most 2.5% treatable areas treated with carbaryl annually). Some use patterns, like rights of way, are particularly low usage areas, with less than 500 lbs of carbaryl applied nationally each year.

Additionally, based on application information, we anticipate carbaryl use in these UDLs are largely restricted to small treatment areas that are treated infrequently over long periods of time. Use patterns like forestry, rangeland, or rights of way may even be geographically restricted as available past usage data indicate carbaryl usage is only in certain areas of the country, such as the western conterminous United States. Available usage data from the U.S. Forest Service indicate that, over a five year period (from 2016-2020), the Forest Service treated 322 acres of forests in California and 557 acres of forests across three Forest Service Regions (covering North Dakota, Montana, South Dakota, Idaho, Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada), with the majority of applications taking place in small areas (less than 1 acre in size). Similarly, usage data from the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) show limited past carbaryl usage as well. From 2019-2023, APHIS

treated 92,309 acres of rangeland in seven states (Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming) and 25 counties. While this represents a large area overall, when distributed across the areas within the seven states where usage occurs, we anticipate only a small percentage of any species' range is likely to be treated for these use patterns. Additionally, all but one of these applications were made using carbaryl bait, which we expect has a much lower risk profile as bait applications are not likely to cause off target exposures as there is no spray drift or contact exposure likely to occur.

Additionally, there are several existing conservation and mitigation measures for non-agricultural uses of carbaryl that will reduce the likelihood of exposure to listed species. For example, from the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the extent of area that can be treated on many use sites within the developed, open space developed, and nurseries UDLs. Similarly, we anticipate all rangeland applications of carbaryl will be carried out in association with USDA APHIS as part of their grasshopper and Mormon cricket suppression program (USFWS 2024), which includes many conservation measures that are meant to protect listed species from exposure. Examples of measures include a reduced agent area treatment strategy that minimizes the amount of pesticide applied within a treatment block, allowance of only one application per year, reduced application rates, minimized treatment area size within 500 feet and 1,000 feet from listed species ranges for ground and aerial applications, respectively, and extended application buffers when applications are made near the listed species' habitat (e.g., up to 750 feet for some ground applications and up to a mile for some aerial applications).

To assess the likelihood of exposure to non-agricultural uses of carbaryl, we conducted a habitat assessment for each listed species, incorporating available information regarding habitat preferences, known occurrences, relevant life history traits or behaviors, as well as relevant available usage data (summarized in the above sections). For species whose habitat is known or presumed to occur in or adjacent to non-agricultural use sites, we consider, individually and qualitatively, the extent and manner of non-agricultural carbaryl usage within the species' range to generally determine whether a small, moderate, or large number of individuals are likely to be exposed and the expected level of adverse effects from non-agricultural exposure of carbaryl.

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

[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

to carbaryl 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 carbaryl and experience adverse effects.

We consider estimated concentrations of carbaryl 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 carbaryl can vary greatly depending on where exposure takes place. For instance, exposures on or near 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 carbaryl 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 carbaryl exposure for some taxa groups, we expect insects will die from carbaryl exposure before sublethal effects would occur.

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 carbaryl exposure. In contrast, species that rely on other arthropods for food resources may experience high levels of indirect adverse effects as carbaryl exposure will likely reduce the abundance and availability of prey.

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 carbaryl 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.

Conservation Measures

As part of the 2022 proposed interim decision for carbaryl, the technical registrants committed to a number of conservation measures for the protection of listed species, including a 48-hour rain restriction and mandatory 25-foot and 150-foot application buffers from aquatic habitats for all

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.

outdoor ground and aerial applications, respectively. We anticipate these measures will contribute to the protection of listed insect species by reducing the amount of carbaryl residue that is transported off use sites and into the habitat of listed species.

Additionally, an existing letter of concurrence issued by the Service to USDA APHIS regarding carbaryl use in their rangeland grasshopper and Mormon cricket suppression program requires the implementation of numerous conservation measures for the protection of listed species. The USDA APHIS biological assessment considered grasshopper and Mormon cricket program activities in states where their program is active, which include the implementation of conservation measures, and as a surrogate for usage in states where no programs exist greatly reducing the likelihood of exposure to the species from rangeland uses of carbaryl. Insect mitigations from the USDA-APHIS grasshopper and Mormon cricket consultation are species-specific, and we include details where applicable below. Specific buffers apply for the following species that fall in the action area for the USDA-APHIS consultation: American burying beetle, Carson wandering skipper, Dakota skipper, Franklin's bumblebee, Pawnee montane skipper, Poweshiek skipperling, and valley elderberry longhorn beetle. For the remaining insects in this biological opinion that are outside of the action area for the grasshopper and Mormon cricket program, we anticipate there is a low likelihood of the need to apply these program measures as grasshopper and Mormon cricket populations do not reach the level where they would need to be suppressed in these areas. However, we anticipate the standard aquatic habitat buffers (500-foot buffer for aerial sprays, 200-foot buffer for ground sprays, and a 50-foot buffer for bait application) and other mitigation measures outlined in the USDA APHIS biological assessment would be applied if there were a need to use carbaryl applications for this reason within the remaining insect species' habitats.

Summary of Insect Conclusions

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of 49 of the 59 insect species in this Appendix. For the other 10 species in this Appendix, we expect the registration of carbaryl, as proposed, is likely to jeopardize the continued existence of the species in the wild, and we provide additional information about these species below. Species that had the same or very similar rationales for their conclusion were grouped together, below, 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 with rationales that did not fit in a group, or warranted additional discussion, have a separate rationale.

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) for all species, including those species in the grouped analyses, are included in Appendices B and E. Species with rationales that did not fit in a group, or warranted a separate rationale, have an individual discussion. To be clear, we conducted a species-specific analysis for each species as part of this formal consultation (considering the status of the species, environmental baseline, cumulative effects, and effects of the action, for each species, as explained further in Appendices B and E); our process and analysis for each species remained the same, regardless of the format of the discussion presented below (i.e., a grouped or individual discussion).

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 low exposure (informed by low overlap with agriculture)

The species in Table 1 are grouped together as they have low concern of adverse effects due to low exposure as informed by low overlap between the species' range and agricultural land uses where carbaryl is registered for use. While we present some specific information about the species in Table 1 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Insect species with low exposure, informed by low overlap with agriculture

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Ambrysus amargosus	Ash Meadows naucorid	High	Low	High	0.6	No Jeopardy
Anaea troglodyta floridalis	Florida leafwing butterfly	High	Low	High	3.5	No Jeopardy
Atlantea tulita	Puerto Rican harlequin butterfly	High	Low	High	0.5	No Jeopardy
Boloria acrocnema	Uncompahgre fritillary butterfly	Medium	Low	High	0.1	No Jeopardy
Callophrys mossii bayensis	San Bruno elfin butterfly	High	Low	High	1.9	No Jeopardy
Dinacoma caseyi	Casey's June beetle	High	Low	High	0.5	No Jeopardy
Euchloe ausonides insulanus	Island marble butterfly	High	Low	High	1.4	No Jeopardy
Euphilotes battoides allyni	El Segundo blue butterfly	High	Low	High	0.4	No Jeopardy
Euphydryas editha quino (=E. e. wrighti)	Quino checkerspot butterfly	High	Low	High	3.3	No Jeopardy
Glaucopsyche lygdamus palosverdesensis	Palos Verdes blue butterfly	High	Low	High	1.5	No Jeopardy
Heraclides aristodemus ponceanus	Schaus swallowtail butterfly	High	Low	High	0.1	No Jeopardy

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Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Hesperia leonardus montana	Pawnee montane skipper	High	Low	High	0.4	No Jeopardy
Hypolimnas octocula marianensis	Mariana eight-spot butterfly	High	Low	High	1.6	No Jeopardy
Icaricia (Plebejus) shasta charlestonensis	Mount Charleston blue butterfly	High	Low	High	0.6	No Jeopardy
Icaricia icarioides missionensis	Mission blue butterfly	High	Low	High	1.8	No Jeopardy
Ischnura luta	Rota blue damselfly	High	Low	High	0.4	No Jeopardy
Lednia tumana	Meltwater lednian stonefly	High	Low	High	0.2	No Jeopardy
Lycaeides argyrognomon lotis	Lotis blue butterfly	High	Low	High	0.8	No Jeopardy
Lycaena hermes	Hermes copper butterfly	High	Low	High	0.7	No Jeopardy
Polyphylla barbata	Mount Hermon June beetle	High	Low	High	1.7	No Jeopardy
Pyrgus ruralis lagunae	Laguna Mountains skipper	High	Low	High	0.3	No Jeopardy
Rhaphiomidas terminatus abdominalis	Delhi Sands flower-loving fly	High	Low	High	1.4	No Jeopardy
Speyeria zerene behrensii	Behren's silverspot butterfly	High	Low	High	2.1	No Jeopardy
Speyeria zerene hippolyta	Oregon silverspot butterfly	High	Low	High	0.9	No Jeopardy
Speyeria zerene myrtleae	Myrtle's silverspot butterfly	High	Low	High	4.4	No Jeopardy

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Trimerotropis infantilis	Zayante band-winged grasshopper	High	Low	High	1.7	No Jeopardy
Vagrans egistina	Mariana wandering butterfly	High	Low	High	1.4	No Jeopardy
Zapada glacier	Western glacier stonefly	High	Low	High	0.9	No Jeopardy

All the species listed in the table above have a high vulnerability ranking, indicating that they may not be able to withstand additional stressors in their environment, including mortality of individuals from carbaryl exposure. Additionally, the Florida leafwing butterfly, the Puerto Rican harlequin butterfly, Schauss swallowtail butterfly, Pawnee montane skipper, Mission blue butterfly, Behren's silverspot butterfly, and the Mariana wandering butterfly all have pesticides listed as a specific threat to the species, indicating that they may be particularly vulnerable to adverse effects resulting from carbaryl exposure. All the species listed above have a high toxicity ranking as available data suggests that any individuals exposed to carbaryl, even at low exposure concentrations, are likely to die.

However, while these species are highly vulnerable, individuals are likely to die if exposed, and pesticides are noted as a threat to some of the species in this group, we anticipate, at most, a very small number of individuals are likely to be exposed to carbaryl. All the species in this group have low extent of overlap between agricultural use sites and their ranges (including associated off-site transport areas). Furthermore, the total agricultural overlap metric we use for agriculture is a conservative estimate of exposure as it does not fully account for redundancy between use site layers, assumes exposure is occurring in all possible overlapping areas, and does not consider information on past carbaryl usage. As such, we expect that exposure of these species to carbaryl will occur in an even smaller portion of the species' ranges. Thus, while these species' vulnerability and toxicity rankings may vary from medium to high, we have high confidence that no more than small numbers of individuals of these species are likely to be exposed to carbaryl from agricultural usage, and exposure will be limited to small portions of the species ranges.

While we expect that some of these species may occur on non-agricultural use sites, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl. Of the species listed in Table 1, we expect that the Casey's June beetle, Hermes copper butterfly, and Zayante band-winged grasshopper, among others, may travel through, forage, and potentially breed in non-agricultural areas within developed, open space developed, managed forests, rights of way, and rangeland use sites. However, we anticipate, at most, low levels of exposure from these uses. This is corroborated by mandatory pesticide usage reporting data collected by the

state of California, which indicates that a maximum of just 0, 0.02, and 0.03% of the ranges of the Casey's June beetle, Hermes copper butterfly, and Zayante band-winged grasshoppers, respectively, were treated with carbaryl annually from 2013-2022. While this reporting includes all agricultural usage, it is also inclusive of certain non-agricultural uses, such as those performed by professional commercial applicators. While these data no not capture all non-agricultural usage, such as residential applications by consumers, given our broad understanding of carbaryl usage, general information on non-agricultural use practices, and existing conservation measures we expect limited exposure from these uses of carbaryl. Additionally, the most recent 5-year reviews for the Casey's June beetle and Zayante band-winged grasshopper indicate that pesticides are unlikely to act as stressors for these species.

In summary, while all the species in this group have high vulnerability and toxicity rankings, we expect these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of total agricultural overlap and low exposure resulting from non-agricultural uses. While pesticides are noted as a threat to many of the species in this group, adverse effects from carbaryl exposure are anticipated to be limited to the loss of, at most, small numbers of individuals in localized areas. 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 expected to appreciably reduce the likelihood of survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of these insects.

Note: The Oregon silverspot butterfly has a non-essential experimental population (EXPN Entity ID: 11398).

Species with low exposure (informed by low past usage from USDA Census of Agriculture)

The species in Table 2 are grouped together because we expect low exposure (% range treated) confirmed by low levels of past insecticide usage within their ranges, as informed by USDA's Census of Agriculture (CoA). While we present some specific information about the species in **Table 2** below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Insects with low exposure, informed by low past usage (from USDA's Census of Agriculture (CoA)).

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Brychius hungerfordi	Hungerford's crawling water beetle	High	Low	High	1.0	No Jeopardy
Cyclargus (=Hemiargus) thomasi bethunebakeri	Miami blue butterfly	High	Low	High	1.4	No Jeopardy
Ellipsoptera puritana	Puritan tiger beetle	High	Low	High	3.5	No Jeopardy
Euphydryas editha taylori	Taylor's (=whulge) checkerspot	High	Low	High	2.0	No Jeopardy
Habroscelimorpha dorsalis dorsalis	Northeastern beach tiger beetle	High	Low	High	4.1	No Jeopardy
Hemileuca maia menyanthevora	Bog buck moth	High	Low	High	2.9	No Jeopardy
Heterelmis comalensis	Comal Springs riffle beetle	High	Low	High	2.4	No Jeopardy
Neonympha mitchellii francisci	Saint Francis' satyr butterfly	High	Low	High	2.6	No Jeopardy
Nicrophorus americanus	American burying beetle	High	Low	High	3.3	No Jeopardy
Pseudocopaeodes eunus obscurus	Carson wandering skipper	High	Low	High	2.3	No Jeopardy

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Strymon acis bartrami	Bartram's scrub-hairstreak butterfly	High	Low	High	4.6	No Jeopardy
Stygoparnus comalensis	Comal Springs dryopid beetle	High	Low	High	2.4	No Jeopardy

All the species listed in Table 2 have high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including mortality of individuals from carbaryl exposure. Additionally, pesticides have been specifically noted as a threat to the Hungerford's crawling water beetle, Miami blue butterfly, and the Bartram's scrub-hairstreak butterfly, indicating that these species may be particularly vulnerable to carbaryl exposure. All the species listed above have a high toxicity ranking as available data suggests that any individuals exposed to carbaryl, even at low exposure concentrations, are likely to die.

While species in Table 2 are highly vulnerable, individuals are likely to die if exposed, and pesticides are noted as a threat, we anticipate only a small number of individuals are likely to be exposed to carbaryl from agricultural uses given the low insecticide usage in the past across their ranges. Low CoA usage indicates that very little insecticide usage (of any type) occurred in agricultural crops in the past in the counties where these species' ranges occur. Given that this reporting broadly includes all insecticide usage on agriculture, we consider CoA data to be conservative estimates of carbaryl usage that indicate very little of the species' ranges are likely to be treated. As such, we anticipate no more than a small number of individuals are likely to be exposed to carbaryl through agricultural uses.

While we expect that some of these species may occur on non-agricultural use sites, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl. Of the species listed in Table 2, we expect that the American burying beetle and the Taylor's checkerspot in particular may be exposed to carbaryl from non-agricultural use within managed forests, developed, open space developed, rangeland, and rights of way use sites. However, we anticipate, at most, low levels of exposure from these uses. This is corroborated by considering additional factors, including unique life history traits and existing management actions. The American burying beetle spends significant portions of its life buried underground where we do not anticipate individuals are likely to be exposed to pesticide applications, and the Service does not have any information to suggest that pesticides have contributed to population extirpation or species declines. While there may be significant overlap with rangeland use sites in particular, we expect individuals are not likely to experience any exposure to carbaryl from rangeland uses as USDA APHIS is required to implement existing conservation measures for carbaryl, including a 200-ft. ground and 1000-ft. aerial buffer from the beetle's range for carbaryl bait applications. Similarly, the Service does not currently consider pesticides as a concern for the Taylor's checkerspot butterfly. Pesticide use within occupied areas is almost entirely done to manage and

restore habitat and it is done in ways designed to minimize impact to Taylor's checkerspot individuals. Therefore, we expect a few, if any, individuals to die as a result of these non-agricultural uses of carbaryl under the proposed action.

In summary, while the species listed in the table above are highly vulnerable and individuals are likely to experience high levels of adverse effects if exposed, we expect all these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of general insecticide usage within these species' ranges and low exposure resulting from non-agricultural uses. While pesticides are noted as a threat to many of the species in this group, adverse effects from carbaryl exposure are anticipated to be limited to the loss of, at most, small numbers of individuals in localized areas. As such, we expect the overall risk of adverse effects to these species 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 expected to result in the death of more than small numbers of individuals and is not expected to appreciably reduce the likelihood of survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of these insect species.

Note: The American burying beetle has a non-essential experimental population (EXPN Entity ID: 10161).

Species with low exposure (informed by low past usage from California Department of Pesticide Regulation Pesticide Use Reporting data)

The species in Table 3 are grouped together because they occur completely within California and have low exposure confirmed by low levels of past carbaryl usage within their ranges (% range treated), as informed by the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data. While we present some specific information about the species in **Table 3** below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Insects with low exposure informed by low past usage from California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Apodemia mormo langei	Lange's metalmark butterfly	High	Low	High	0.6	No Jeopardy
Cicindela ohlone	Ohlone tiger beetle	High	Low	High	0.6	No Jeopardy
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	High	Low	High	0.6	No Jeopardy
Elaphrus viridis	Delta green ground beetle	High	Low	High	0	No Jeopardy
Euphilotes enoptes smithi	Smith's blue butterfly	High	Low	High	0	No Jeopardy
Euphydryas editha bayensis	Bay checkerspot butterfly	High	Low	High	0.1	No Jeopardy
Euproserpinus euterpe	Kern primrose sphinx moth	High	Low	High	0	No Jeopardy
Speyeria callippe callippe	Callippe silverspot butterfly	High	Low	High	0	No Jeopardy

All the species in Table 3 have high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including mortality of individuals from carbaryl exposure. Additionally, pesticides have been specifically noted as a threat to the Lange's metalmark butterfly, Callippe silverspot butterfly, Kern primrose sphinx moth, Valley elderberry longhorn beetle, and Bay checkerspot butterfly, indicating that these species may be

particularly vulnerable to carbaryl exposure. All the species listed above have a high toxicity ranking as available data suggests that any individuals exposed to carbaryl, even at low exposure concentrations, are likely to die.

While species in Table 3 are highly vulnerable and individuals are likely to die if exposed, we anticipate only a small number of individuals are likely to be exposed to carbaryl from agricultural use given that CalPUR data indicate low usage within their ranges. While these species have relatively higher percent overlap between agricultural uses and their ranges, CalPUR carbaryl usage data indicates that very little carbaryl has been used within the sections where these species' ranges occur from 2013-2022. Given that this usage reporting is mandated by the state of California and that these data are provided regularly at a relatively high spatial resolution, we have high confidence that only a small percent of the species' ranges is likely to be exposed to carbaryl.

While we expect that some of these species may occur on non-agricultural use sites, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl. Of the species listed in Table 3, we expect that the Smith's blue butterfly, Delta green ground beetle, and Ohlone tiger beetle may occur in non-agricultural use sites within managed forests, developed, open space developed, rangeland, and rights of way use sites. However, we anticipate, at most, low levels of exposure from these uses. While CalPUR data include all agricultural usage, it is also inclusive of certain non-agricultural uses, such as those performed by professional commercial applicators. While these data no not capture all non-agricultural usage, such as residential applications by consumers, given our broad understanding of carbaryl usage, general information on non-agricultural use practices, and existing conservation measures we expect limited exposure from these uses of carbaryl. As such, we anticipate no more than small numbers of individuals of these species will be exposed and die from non-agricultural uses of carbaryl.

In summary, while the species listed in the table above are highly vulnerable and individuals are likely to experience high levels of adverse effects if exposed, we expect all of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of carbaryl usage within these species' ranges as indicated by mandated reporting data from the state of California and low exposure resulting from non-agricultural uses. While pesticides are noted as a threat to many of the species in this group, adverse effects from carbaryl exposure are anticipated to be limited to the loss of, at most, small numbers of individuals in localized areas. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of these species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of these insect species.

Species with Individual Integration and Synthesis Summaries

For the species in Table 4, our preliminary exposure and toxicity rankings indicate that the proposed action may result 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 4. Insects with high adverse effects anticipated from the proposed action.

Scientific Name	Common Name	Determination
Lycaeides melissa samuelis	Karner blue butterfly	Jeopardy
Neonympha mitchellii mitchellii	Mitchell's satyr Butterfly	Jeopardy
Somatochlora hineana	Hine's emerald dragonfly	Jeopardy
Icaricia icarioides fenderi	Fender's blue butterfly	Jeopardy
Speyeria nokomis nokomis	Silverspot	Jeopardy
Hesperia dacotae	Dakota Skipper	Jeopardy
Cicindela nevadica lincolniana	Salt Creek Tiger beetle	Jeopardy
Oarisma poweshiek	Poweshiek skipperling	Jeopardy
Bombus affinis	Rusty patched bumble bee	Jeopardy
Cicindelidia floridana	Miami tiger beetle	Jeopardy
Bombus franklini	Franklin’s bumble bee	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 and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 1) and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high and toxicity is high, we determine the risk of adverse effects to the species is high. We expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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

Based on range map dated: 07-11-2022; Wherever found; *States within the range:* IL, IN, MI, MN, NH, NY, OH, WI

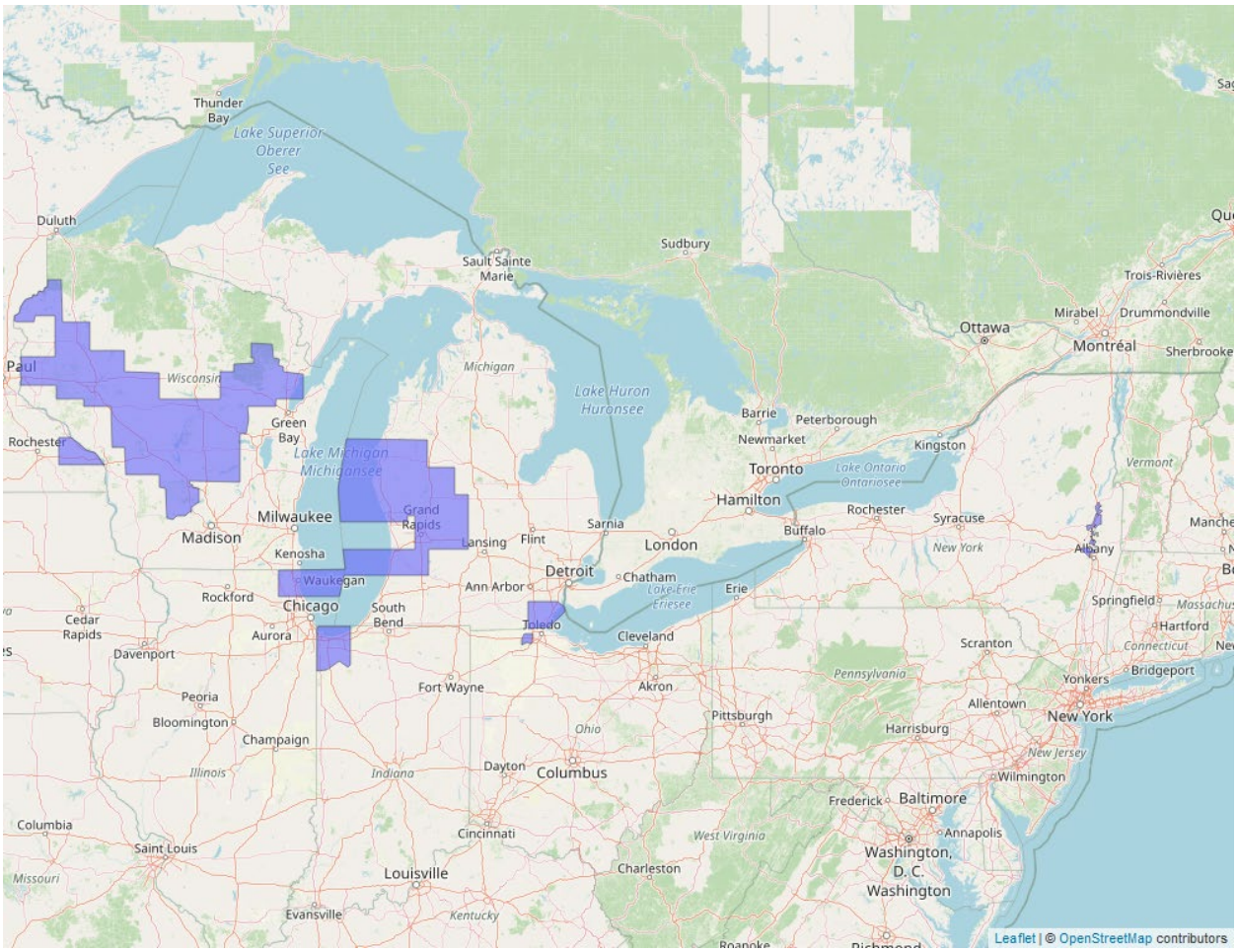

Figure 1. Range map of Karner blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6656.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status Review: 12/17/2019

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

Number of populations: Multiple populations (few)

Species trends: Declining population(s) – one of more populations 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 with Agricultural Use Sites

Data indicate that 46.1% of the species' range overlaps with agricultural use sites and 29.4% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 5). In total, there is approximately 75.5% overlap between the species' range and exposures associated with agricultural use sites for carbaryl.

Table 5. Agricultural use overlap and annual usage data (% Range Treated) for the Karner blue butterfly.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	11.3	9.1	20.4	1.9	1.6	3.5
Citrus	0	0	0	0	0	0
Corn	25.2	9.1	34.3	4.6	1.4	6
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	3.6	4.5	8.1	2.3	2.7	5
Other Grains	2.3	3.5	5.8	<0.1	<0.1	<0.1

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Orchards[2]	0.6	0.9	1.5	0.5	0.8	1.3
Other Row Crops	0.1	0.1	0.2	0.1	<0.1	0.1
Soybeans[3]	17.7	8.4	26.1	3.8	1.5	5.3
Vegetables and Ground Fruit	3.2	2	5.2	1.4	1.1	2.5
Total	**46.1**	**29.4**	**75.5**	**10.8**	**7.6**	**18.4**

Usage

Past usage data indicate that up to 18.4% of the species' range has been treated with carbaryl annually from agricultural uses.

Additional Exposure Considerations

The Karner blue butterfly is not known to occur on agricultural use sites. As such, while there is overlap between the species' range and agricultural use sites, we do not anticipate any individuals are likely to be exposed directly on agricultural use sites. Thus, we only consider exposure that occurs off-site as relevant to the species. The total overlap with off-site agricultural areas is 29.4% and up to 7.6% of the range is likely to be treated annually.

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

[2] 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.

[3] 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.

Non-agricultural Uses

We do not anticipate the Karner blue butterfly will occur in developed, open space developed, nurseries, or rangeland areas. The Karner blue butterfly is known to frequent roadsides and forests in search of nectar, indicating that exposure to carbaryl through forestry and rights of way uses may occur. However, we anticipate there is a low likelihood of exposure to the species through these non-agricultural uses given these areas are either not likely to be treated with carbaryl or do not represent preferred habitat for the species. The species' host plant, the wild lupine, typically occurs in open habitat with high levels of sun exposure, indicating that there is a low likelihood of their occurrence in managed forests, which suggests that the Karner blue butterfly is not likely to spend significant time within managed forests. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the species. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage in the range, and that if usage did occur, exposure to Karner blue butterfly would be minimal. Similarly, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within one species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the Karner blue butterfly's range for rights of way uses. Thus, while the Karner blue butterfly may occur in rights of way use sites due to its host plant's affinity for these areas, we do not anticipate more than minimal exposure to carbaryl in these use sites is likely to occur. As such, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Exposure Summary

While we do not anticipate individuals will occur on agricultural use sites, there is a high extent of overlap between off-field adjacent areas and the species' range (29.4% off-field overlap). Based on past usage data, we expect a medium level of agricultural usage within the species' range (up to 7.6% range treated annually). Given that the extent of overlap is high and expected usage is medium, we expect a large number of individuals are likely to experience exposure from the proposed action.

Based on the species' life history, we anticipate individuals may occasionally occur in non-agricultural use sites, including managed forests and rights of way. However, based on the habitat preference of the species' host plant and the low likelihood of usage within forests and rights of way within the range of the Karner blue butterfly, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 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 carbaryl exposure.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl from spray drift up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

While individuals are not likely to occur on agricultural use sites, there is a high level of off-field overlap (29.4% overlap) and a medium level of past usage (up to 7.6% range treated annually), indicating a large number of individuals are likely to be exposed from agricultural uses. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die from agricultural exposure, and the overall risk of adverse effects to the Karner blue butterfly is high. Based on available usage data, we anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl even though they may occur on managed forests and rights of way. We anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl.

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 cluster due to carbaryl exposure, the species cannot recover by gaining individuals from the other population cluster. 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 overlaps with many carbaryl use sites, including agricultural, managed forest, and some developed sites. We anticipate exposure will occur from drift from agricultural use sites in a large portion of the range (29.4%), and the species is known to frequent roadsides, and forests in search of nectar/pollen. Because we expect low usage on non-agricultural use sites based on past usage data for carbaryl, we anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl. From agricultural uses, carbaryl exposure and resultant mortality is likely during some of the most critical time periods in the Karner blue butterfly's life cycle. 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 carbaryl exposure.

We anticipate that exposure to carbaryl will occur through spray drift throughout a large portion of the species range, including during a vulnerable period in the species' life cycle. Therefore, we expect impacts to be high and a large number of individuals to be adversely affected over the project duration that will likely reduce the reproduction, numbers and distribution of the species. Considering the high vulnerability of the species, high level of exposure, and large number of individuals of this species likely to die across a large portion of its range, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Karner blue butterfly.

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: 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, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 2) and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high and toxicity is high, we determine the risk of adverse effects to the species is high. We expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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: 02-24-2021; Wherever found; *States within the range:* AL, IN, MI, MS, OH, VA

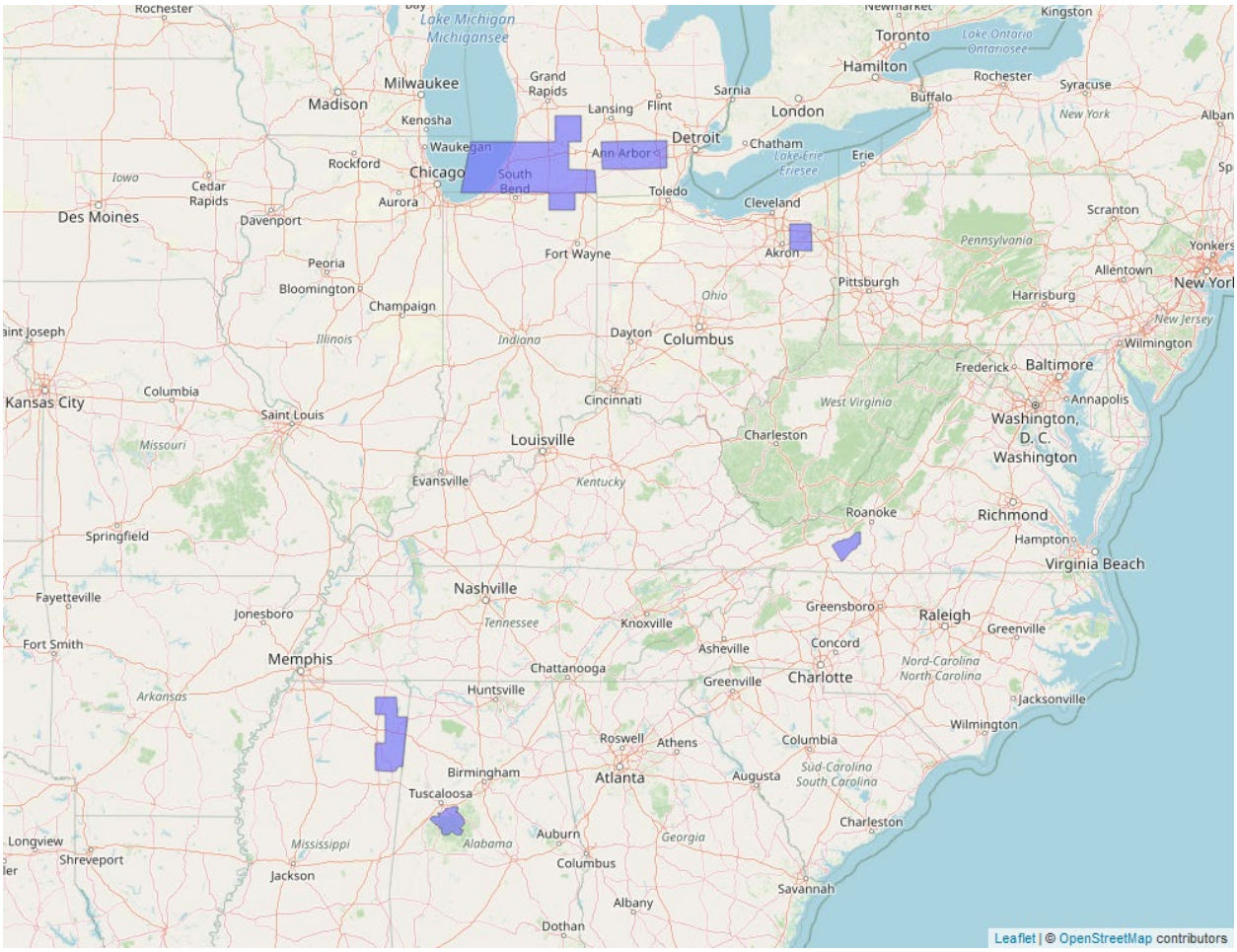

Figure 2. Range map of Mitchell's satyr butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8062.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status 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 for 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 with Agricultural Use Sites

Data indicate that 37.7% of the species' range overlaps with agricultural use sites and 27.5% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 6). In total, there is approximately 65.1% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 6. Agricultural use overlap and annual usage data (% Range Treated) for the Mitchell's satyr butterfly.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	4.9	5.7	10.6	1.1	1.4	2.5
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	23.2	8.3	31.5	5.9	2.5	8.4
Grapes	0.6	1	1.6	0.2	0.3	0.5
Other Crops	4.6	6.1	10.7	4.6	6	10.6
Other Grains	1.1	2.3	3.4	<0.1	0.1	0.1
Other Orchards[4]	1	1.6	2.6	1	1.6	2.6
Other Row Crops	0.2	0.1	0.3	0.1	0.1	0.2
Soybeans[5]	23.3	9	32.3	6.5	3	9.5
Vegetables and Ground Fruit	2.6	2.6	5.2	2.6	2.6	5.2
Total	**37.7**	**27.5**	**65.1**	**16**	**14.8**	**30.8**

[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.

Usage

Past usage data indicate that up to 30.8% of the species' range has been treated with carbaryl annually from agricultural uses.

Additional Exposure Considerations

The Mitchell's satyr butterfly known habitats are peatlands, but they may occur in habitats from prairie/bog fens to sedge meadow/swamps. During the flight period, which generally lasts only two weeks in the spring, the butterflies mate, lay eggs, and die. Under laboratory conditions, larvae feed 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.

Non-agricultural Uses

Based on its life history, we do not anticipate the Mitchell's satyr butterfly will occur in developed, open space developed, nurseries, or rights of way areas use sites. While the Mitchell's satyr butterfly can occur in managed forests and rangeland use sites, we do not anticipate the species will likely spend significant time in these areas as it is a peatland habitat specialist. Additionally, available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the Mitchell's satyr butterfly. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage in the range, and that if usage did occur, exposure to the Mitchell's satyr butterfly would be minimal. Similarly, available usage information indicates that no carbaryl has been used in rangelands within the states containing the species' range. As such, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conservation Measures

While there has been no reported usage of carbaryl for rangeland uses from 2014-2018 in the states where the Mitchell's satyr butterfly's range occurs, we expect any rangeland uses that may occur in the future will be carried out through the USDA APHIS grasshopper and Mormon cricket suppression program. Carbaryl applications made through or in association with this program are required to implement conservation measures for the protection of listed species, including standard ground and aerial buffers (500-ft. for ground applications and 1,000-ft. for aerial applications), reduced application rates, and reduced number of applications made per year. We expect these measures will be sufficiently protective of the Mitchell's satyr butterfly to any potential future rangeland uses of carbaryl.

Exposure Summary

There is a high extent of overlap between agricultural use sites and the species' range (65.1% total overlap including off-site transport). Past usage data indicate a high level of usage within the species' range (up to 30.8% range treated annually). Additionally, we anticipate the timing of agricultural applications of carbaryl will likely coincide 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 from agricultural use of carbaryl.

Based on the low likelihood of usage within forests and rangelands within the range of the Mitchell's satyr butterfly and existing conservation measure requirements for rangeland applications of carbaryl, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that exposure to carbaryl will result in adverse effects to plants, including any plant species that the Mitchell's satyr butterfly 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 carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (65.1% total overlap) and a high level of past usage (up to 30.8% range

treated annually), indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die. As such, the overall risk of adverse effects to the Mitchell's satyr butterfly is high. Based on available usage data and existing conservation measures, we anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl. Therefore, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

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 65.1% of the Mitchell's satyr butterfly's range overlaps with agricultural use sites in the action area. Past usage data indicate that up to 30.8% of the species' range will be treated annually. Suitable fen habitat for the species occurs in close proximity or adjacent to agricultural 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 is significant for a rare species of limited distribution and ability to disperse, declining populations, and ongoing threats. Because Mitchell's satyr's preferred habitat is peatland fens, with only uncommon visits to managed forests and rangeland areas, we expect the likelihood of carbaryl exposure in non-agricultural use sites to be low.

We anticipate that exposure to carbaryl will occur from spray drift throughout a large portion of the species range, including during a vulnerable period in the species' life cycle. Therefore, we expect impacts to be high and an unknown, but significant number of individuals to die. Considering the high vulnerability, high level of exposure, and significant number of individuals of this species likely to die, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Mitchell's satyr butterfly.

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 (*Neonympha mitchellii mitchellii*) Recovery Plan. Ft. Snelling, Minnesota. 81 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, the Service has determined that the species’ vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species’ range (Figure 3) and high past usage of carbaryl within the species’ range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high and toxicity is high, we determine the risk of adverse effects to the species is high. We expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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: 01-25-2023; Wherever found; *States within the range:* IL, MI, MO, WI

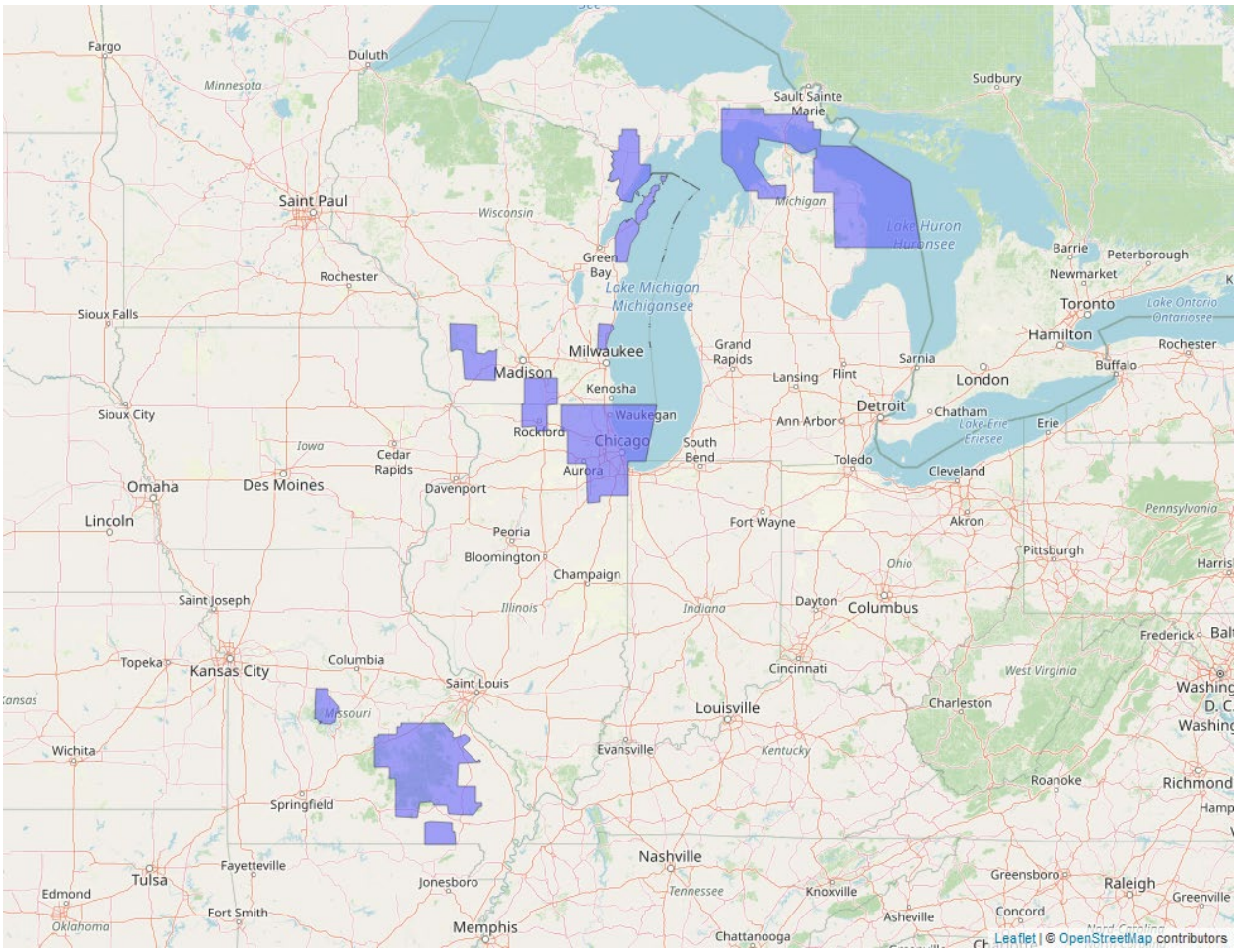

Figure 3. Range map of Hine's emerald dragonfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/7877.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status 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 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 with Agricultural Use Sites

Data indicate that 23.1% of the species' range overlaps with agricultural use sites and 12.2% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 7). In total, there is approximately 35.3% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 7. Agricultural use overlap and annual usage data (% Range Treated) for the Hine's emerald dragonfly.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	4	3.5	7.5	1.5	1.3	2.8
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn[6]	14.9	4.3	19.2	5.8	1.9	7.7
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.4	2.2	4.6	2.1	2	4.1

[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 and total percent treated range.

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Grains	1.1	1.5	2.6	<0.1	0.1	0.1
Other Orchards[7]	0.2	0.2	0.4	0.2	0.2	0.4
Other Row Crops	<0.1	0.1	0.1	<0.1	0.1	0.1
Soybeans	13.1	4.1	17.2	5.8	1.9	7.7
Vegetables and Ground Fruit	0.5	0.4	0.9	0.5	0.4	0.9
Total	**23.1**	**12.2**	**35.3**	**10.1**	**5.9**	**16**

Usage

Past usage data indicate that up to 16% of the species' range has been treated with carbaryl annually from agricultural uses.

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

[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 and total percent treated range.

Non-agricultural uses

The Hine's emerald dragonfly is not likely to occur on developed, nurseries, managed forests, or rangeland carbaryl use sites. While the Hine's emerald dragonfly breeds and spends its larval stages in aquatic habitats, it is known to use rights of way and golf courses as flight corridors, indicating that exposure to carbaryl through these non-agricultural uses may occur. However, we anticipate there is a low likelihood of exposure to the species through these non-agricultural uses because they typically occur in spring-fed wetlands, wet meadows, and marshes, and likely only occur in rights of way and golf courses for short periods of time. Additionally, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within the species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is spread across the national landscape, with sporadic treatments likely to occur within the dragonfly's range for rights of way uses. Thus, we anticipate low levels of exposure to Hine's emerald dragonflies through rights of way uses of carbaryl are likely to occur. Similarly, available usage data indicate only low levels of past carbaryl usage in open space developed areas within the Hine's emerald dragonfly's range, with, at most, up to 2.4% of the species' range likely to be treated each year. Given that this usage includes usage in other open space developed areas in addition to golf courses (i.e., areas that the species does not occupy), we anticipate an even lower level of past usage of carbaryl within its range is likely. As such, we expect exposure to carbaryl through usage on golf courses to be minimal. In summary, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conservation Measures

There are a number of conservation measures included in the 2022 proposed interim decision for carbaryl and the 2024 NMFS biological opinion on carbaryl that will help reduce the level of exposure to the Hine's emerald dragonfly. Measures of particular importance to the dragonfly include a 48 hour rain restriction and mandatory application buffers to water bodies (25-ft for ground applications, 150-ft for aerial applications). We expect these measures will reduce the concentration of carbaryl entering aquatic habitats.

Exposure Summary

There is a high degree of overlap with carbaryl agricultural use sites and the species' range (35.3% total overlap) within the action area. Past usage data suggests a high level of usage within the species' range (up to 16% of range treated). Given that both the extent of overlap is high and the expected usage is high, we expect a large number of individuals are likely to experience exposure from the proposed action from agricultural use.

Based on the short amount of time Hines emerald dragonflies are anticipated to occur in golf courses and rights of way, and the low extent of carbaryl usage anticipated for these use sites

within the species' range, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Aquatic Phase and Terrestrial Phase Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 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. We expect carbaryl use will result in a decrease in the availability of insect prey species as insects have been demonstrated to be sensitive to carbaryl 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 carbaryl at estimated environmental concentrations (both in terrestrial and aquatic habitats), we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites 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

There is a high level of overlap of the Hine's emerald dragonfly range with carbaryl agricultural use sites and their associated areas of off-site transport (35.3% total overlap), as well as a high level of past usage (up to 16% range treated annually), indicating a large number of individuals are likely to be exposed. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die if exposed. As such, the overall risk of adverse effects to the Hine's emerald dragonfly is high. Based on available usage data and the short length of time Hine's emerald dragonflies are expected to be on use sites, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conclusion

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). The Hine's emerald dragonfly has a high vulnerability based on its status, distribution, and trends. While many of the species' occupied sites are conserved and actively managed, fragmentation and ongoing loss of habitat remain as significant barriers to recovery. The risk to the species posed by labeled agricultural uses of carbaryl across the range is high as overlap with the species range on use sites is approximately 35%. We anticipated that up to 16% of the species range is likely to be treated with carbaryl based on past usage data. Therefore, the likelihood of exposure to carbaryl is high based on agricultural use site overlap and from usage estimates. Because Hine's emerald dragonfly's preferred habitat is wetlands and they are only believed to fly through or over golf courses and some other developed areas, we expect the likelihood of carbaryl exposure in non-agricultural use sites to be low.

We anticipate that a large number of individuals will 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). Given the species' limited range and declining populations and its overlap with agricultural use sites lead us to expect species-level effects will 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Hine's emerald dragonfly.

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: 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, the Service has determined that the species’ vulnerability is low. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species’ range (Figure 4) and high past usage of carbaryl within the species’ range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high and toxicity is high, we determine the risk of adverse effects to the species is high. We expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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

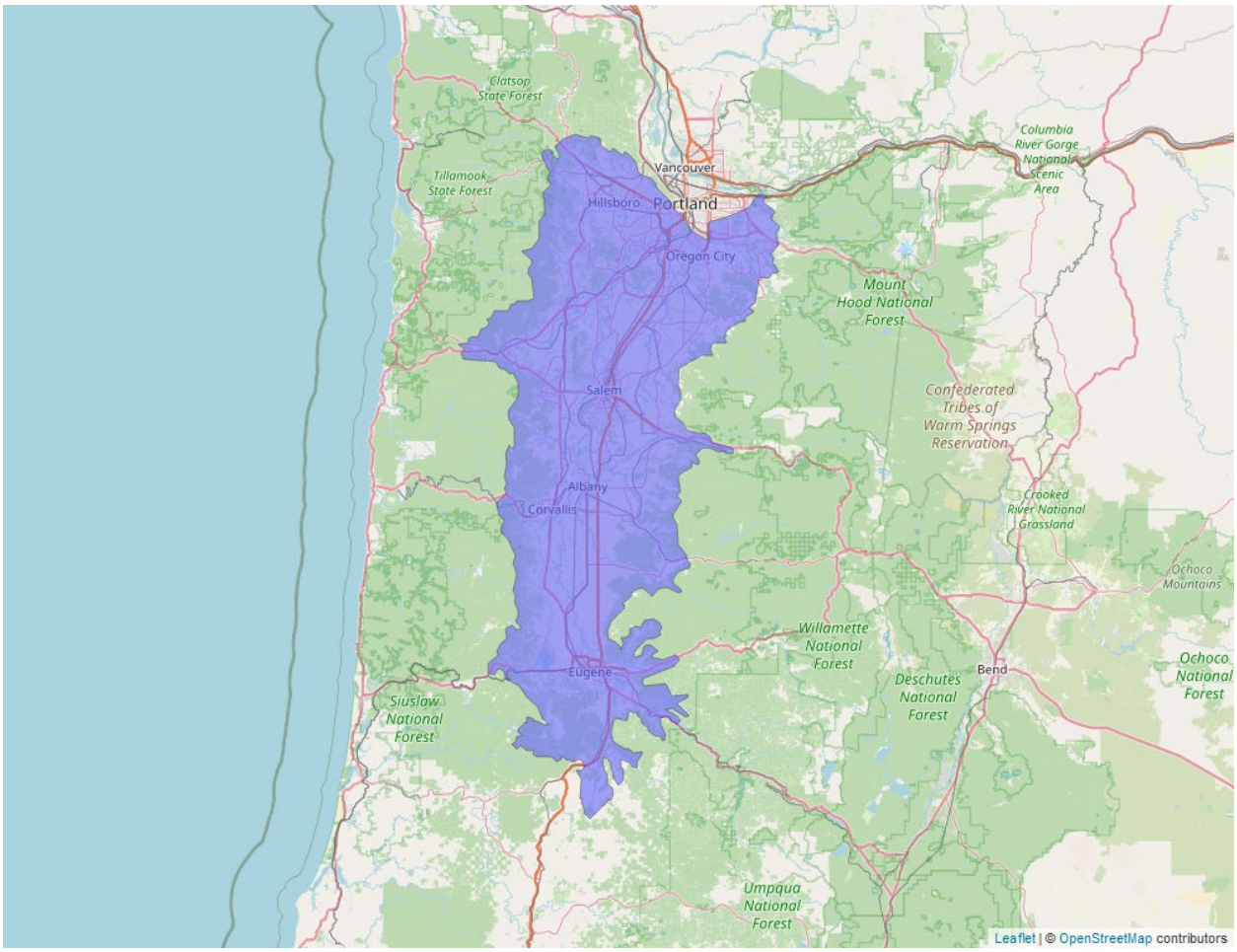

Figure 4. Range map of Fender's blue butterfly (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6659.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: Downlist to Threatened; Reclassified 1/12/23

Most recently completed 5-Year Status Review: 03/06/2019

Distribution: Species/Populations neither constrained nor 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 with Agricultural Use Sites

Data indicate that 35.8% of the species' range overlaps with agricultural use sites and 22.5% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 8). In total, there is approximately 58.3% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 8. Agricultural use overlap and annual usage data (% Range Treated) for the Fender's blue butterfly.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	0.3	0.5	0.8	0.3	0.5	0.8
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn[8]	1.7	1.5	3.2	0.4	0.4	0.8

[8] 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.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Grapes	1.3	1.4	2.7	0.5	0.4	0.9
Other Crops	22.4	7.8	30.2	22.4	7.8	30.2
Other Grains	0.7	1.1	1.8	<0.1	<0.1	<0.1
Other Orchards[9]	5.6	6.9	12.5	1.9	2.3	4.2
Other Row Crops	0.7	0.9	1.6	<0.1	0.1	0.1
Soybeans	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vegetables and Ground Fruit	4.4	3.8	8.2	1.2	1	2.2
Total	**35.8**	**22.5**	**58.3**	**26.2**	**12.1**	**38.3**

Usage

Past usage data indicate that up to 38.3% of the species' range has been treated with carbaryl annually from agricultural uses.

Additional Exposure Considerations

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

[9] 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.

(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 carbaryl 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.

Non-agricultural Uses

We do not anticipate individuals are likely to occur in managed forests, developed, open space developed, nurseries, rights of way, or rangeland use sites. Therefore, we anticipate no adverse effects from non-agricultural uses of carbaryl. **Exposure Summary**

There is a high degree of overlap with carbaryl agricultural use sites and associated areas of off-site transport and the species' range (58.3% total overlap). Past usage data suggests a high level of usage within the species' range (up to 38.3% range treated). Given that the extent of overlap is high and that expected usage is high, we expect a large number of individuals are likely to experience exposure from the proposed action.

We do not expect Fender's blue butterflies to occur on non-agricultural carbaryl use sites. Therefore, we anticipate no exposure or adverse effects to the species from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed at all life stages.

Indirect Effects

We do not expect that carbaryl use will result in any indirect adverse effects to individuals as we do not anticipate carbaryl is likely to reduce the abundance and availability of necessary food resources to support individuals.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (58.3% total overlap) and a high level of past usage (up to 38.3% range treated annually), suggesting that a large number of individuals are likely to be exposed over the duration of the proposed action. We expect insect species are highly sensitive to carbaryl exposure, indicating that a large number of individuals are likely to die. As such, we expect the overall risk of adverse effects to the Fender's blue butterfly is high.

We do not expect Fender's blue butterflies to occur on non-agricultural carbaryl use sites, so we anticipate no individuals will be exposed or adversely affected from non-agricultural uses of carbaryl.

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 carbaryl to the species is anticipated to be high due to high overlaps of the species range with agricultural use sites, high anticipated usage on agricultural sites, 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 carbaryl exposure will likely be at risk of the same outcome (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, reducing the likelihood that their use of other sites will compensate for the loss of butterflies exposed to carbaryl. 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. 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Fender's blue butterfly.

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: Silverspot

Scientific Name:	Common Name:	Entity ID:
Speyeria nokomis nokomis	Silverspot	1324

Species Overview

In reviewing the status of the species, the environmental baseline and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 5), and low past usage of carbaryl within the species' range, indicating a medium extent of exposure. Most exposed individuals are likely to die. Given that exposure is medium and toxicity is high, we determine the risk of adverse effects to the species is high. We expect a moderate 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the silverspot. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 04-04-2023; Wherever found; *States within the range:* CO, NM, UT

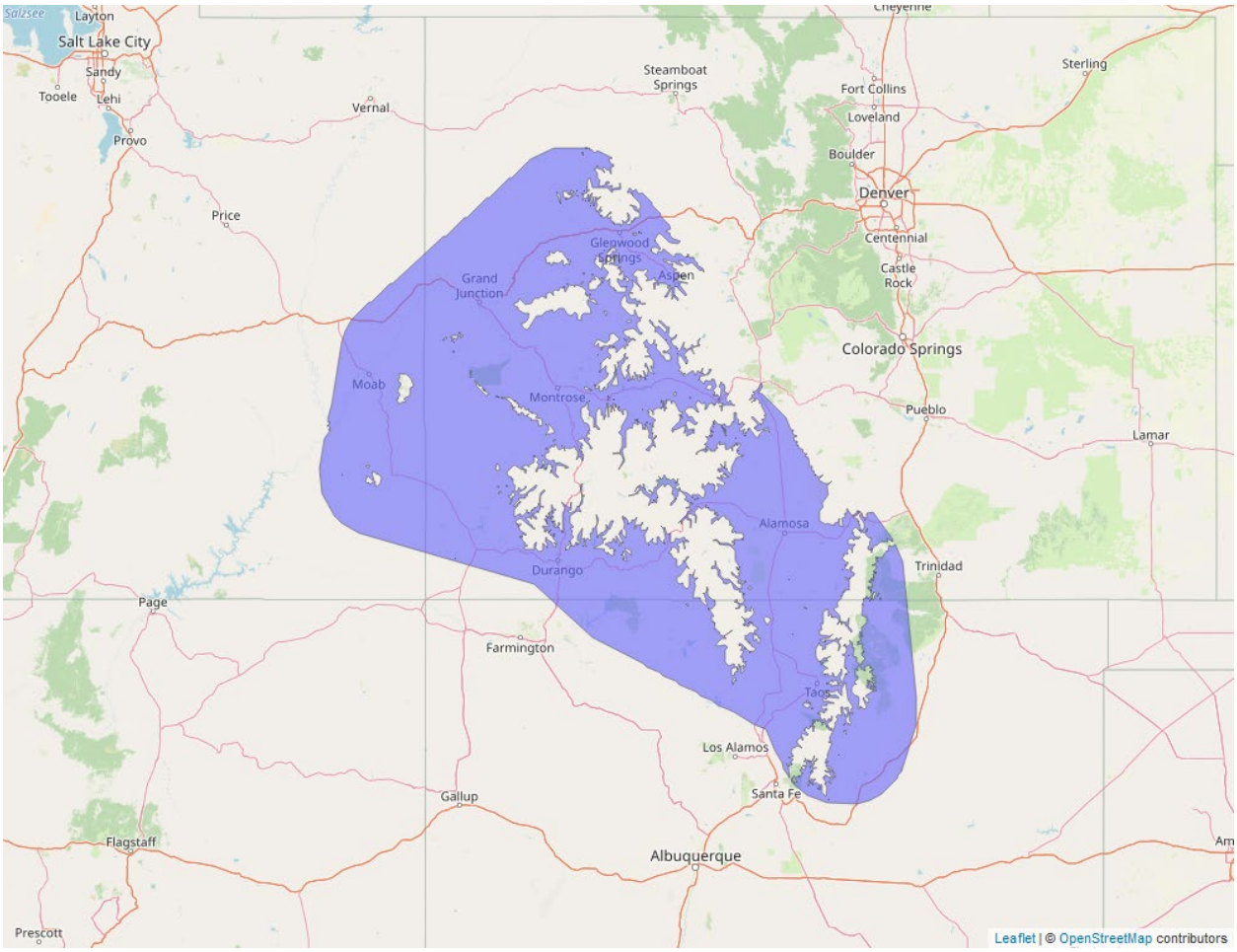

Figure 5. Range map of silverspot (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2813.

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Threatened

Most recent 5-Year Status Review recommendation: N/A

Most recently completed 5-Year Status 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 silverspot butterfly is found in east-central Utah through western and south-central Colorado and into north-central New Mexico at elevations between 5,200-8,300 feet in mountain valleys or near the base of mountains in floodplains. They require moist habitats in mostly open meadows with a variety of herbaceous and woody vegetation. Eggs are laid on or near northern bog violet (*Viola nephrophylla*), which larvae exclusively feed on. Bog violet only grows in wet meadows supported by springs, streams, and near-surface groundwater, which are further supported by meltwater from mountain snowpack. Light interspersion of willow (*Salix* spp.) and other trees or shrubs in the meadows appear beneficial for egg laying. Within the species' range, five colonies across four populations have been extirpated. As of 2023, there were 21 colonies grouped into ten populations considered extant, six of which have very low or low resiliency.

Threats to the species include habitat loss and fragmentation; livestock grazing; human-caused hydrologic alteration; and genetic isolation. Habitat loss and fragmentation occurs from development (e.g., golf courses and housing), agricultural conversion, and livestock grazing. Mowing for native hay, grazing, and burning can be compatible and beneficial for *Speyeria nokomis nokomis* if implemented properly. Additional minor threats include exotic plant invasions, climate events, effects of climate change, disease, desiccation of larvae, predation, collection, prescribed burning or wildfire, and pesticides. Insecticides, herbicides, and fungicides may impact silverspots or its habitat. As of 2023, we are not aware that mortality of the butterfly, bog violet, or native nectar sources have occurred from pesticide use nor that pesticide use has reduced the viability of the species (USFWS 2023).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap with Agricultural Use Sites

Data indicate that 7.3% of the species' range overlaps with agricultural use sites and 4.3% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 9). In total, there is approximately 11.6% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 9. Agricultural use overlap and annual usage data (% Range Treated) for the silverspot.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	3.4	1.9	5.3	0.3	0.2	0.5
Citrus	0	0	0	0	0	0
Corn[10]	0.3	0.2	0.5	0.3	0.2	0.5
Grapes	<0.1	0.1	0.1	<0.1	<0.1	<0.1
Other Crops	1.6	1.1	2.7	1.6	1.1	2.7
Other Grains	1.1	0.7	1.8	0.2	0.1	0.3
Other Orchards[11]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vegetables and Ground Fruit	0.9	0.4	1.3	0.1	<0.1	0.1
Total	**7.3**	**4.3**	**11.6**	**2.4**	**1.7**	**4.1**

Usage

Past usage data indicate that up to 4.1% of the species' range has been treated with carbaryl annually from agricultural uses.

Additional Exposure Considerations

Populations of *Speyeria nokomis nokomis* are known to occur at elevations between 5,200 and 8,300 feet. The butterfly requires moist habitats in mostly open meadows with a variety of herbaceous and woody vegetation. *Speyeria nokomis nokomis* eggs are laid on or near the bog

[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.

[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.

violet (*Viola nephrophylla/V. sororia* var. *affinis*), which the larvae feed on exclusively. A variety of flowering plants provide adult nectar sources. In the range of *Speyeria nokomis nokomis*, there is more haying and grazing than cropland and a variety of orchards also occur near riparian areas within the species' range. . The butterflies can easily move at least one mile and, if multiple colonies of the silverspot butterfly occur relatively close to each other in a drainage, they may move between all colonies every 1–5 years. However, regular genetic interchange may not occur if the distance between colonies is greater than 5–10 miles, and all known populations are a minimum of 24.5 miles apart (USFWS 2024).

Silverspots lay eggs in mid-September, and they hatch after 10-18 days, usually in early October. The first instar larvae seek shelter for winter diapause, which lasts approximately 225 days. In mid-May, when fresh violets are present, larvae emerge from winter diapause and feed on the violets until mid-July. Mature larvae form a chrysalis and pupate for 17 days, and adult butterflies emerge from late July to mid-August (USFWS 2024).

Non-agricultural Uses

We do not anticipate silverspots are reliant on non-agricultural use sites of carbaryl, such as managed forests, rights of way, developed, open space developed, or nurseries. They occur at elevations between 5,200-8,300 feet and rely heavily on their larval host plant, bog violet (*Viola nephrophylla/V. sororia* var. *affinis*). The bog violet and silverspot require moist habitats in mostly open meadows. Silverspots can travel over a mile while nectaring, but they usually stay close to their habitat and bog violet. While rangeland use sites occur within the species' range, available past usage data indicate that carbaryl has only been used for rangeland applications within the Utah portion of the species' range. Furthermore, this usage data indicates that only a very small portion of rangeland sites within Utah have been treated (at most less than 1% of rangeland acres). As such, we anticipate there is a low likelihood of exposure to the species through rangeland and other non-agricultural uses. In summary, we anticipate no more than small numbers of individuals are likely to be exposed through non-agricultural uses of carbaryl.

Conservation Measures

We expect rangeland uses of carbaryl will be through the USDA APHIS grasshopper and Mormon cricket suppression program. Carbaryl applications made through this program are required to implement conservation measures for the protection of listed species, including standard ground and aerial buffers (500-ft. for ground applications and 1,000-ft. for aerial applications), reduced application rates, and reduced number of applications made per year. We expect these measures will be sufficiently protective of the silverspot to rangeland uses of carbaryl.

Exposure Summary

There is a high degree of overlap with carbaryl agricultural use sites and associated off-site areas and the species' range (11.6% total overlap) within the action area. Past usage data suggests a

low level of usage within the species' range (up to 4.1% range treated annually). Given that the extent of overlap is high but the expected usage is low, we expect a moderate number of individuals are likely to experience exposure from the proposed action.

Based on low reliance on non-agricultural use sites, low usage on rangeland within the range of the silverspot, and existing conservation measures, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: Medium

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that carbaryl use will result in any indirect adverse effects to individuals as we do not anticipate carbaryl is likely to reduce the abundance and availability of necessary food resources to support individuals at all life stages.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (11.6% total overlap) and a low level of past usage (up to 4.1% range treated annually), indicating a moderate number of individuals are likely to be exposed over the duration of the proposed action. Because we expect insect species are highly sensitive to carbaryl, the overall risk of adverse effects to the silverspot butterfly is high.

Based on available usage data and existing conservation measures from the use of carbaryl in rangelands based on the USDA-APHIS grasshopper and Mormon cricket suppression program,

we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conclusion

The silverspot butterfly is a threatened species that inhabits moist habitats in open meadows at elevations between 5,200-8,300 ft. in mountain valleys of Colorado, Utah, and New Mexico. They rely on a larval host plant, bog violet, which only grows in wet meadows supported by springs and streams fed by snowpack meltwater. There are 21 colonies across ten populations after extirpation of five colonies; six remaining colonies have low resiliency. Threats persist from habitat loss and fragmentation, hydrologic alteration, and genetic isolation. Use of insecticides is listed as a minor threat to the species in the 2023 Species Status Assessment.

Agricultural carbaryl use sites overlap 11.6% of the species range, 7.3% of which is on-field. A small portion of the range (4.1%) has been treated annually with carbaryl in the past. The species range occurs near carbaryl use sites and the species can travel at least a mile, thus we anticipate exposure will occur in a moderate portion of the range. Agricultural carbaryl exposure and resultant mortality is likely throughout some of the most critical time periods in the butterfly's life cycle, from May through October. Because known populations are separated by more than their dispersal distance, the species is unlikely to recolonize areas lost due to carbaryl exposure. After considering the conservation measures mentioned above for carbaryl use in rangeland, we expect exposure from agricultural uses of carbaryl to drive our level of concern for the silverspot butterfly, and we anticipate that no more than a small number of individuals will be exposed through these uses.

We expect impacts to silverspot to be high and the moderate number of individuals adversely affected will likely reduce the reproduction, numbers, and distribution of the species. Considering the high vulnerability of the species, medium level of exposure, moderate number of individual butterflies likely to die, and the likelihood that extirpated colonies will not be recolonized, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the silverspot butterfly.

References

U.S. Fish and Wildlife Service. 2024. Recovery Outline for Silverspot Butterfly (*Speyeria nokomis nokomis*). Denver, Colorado. 14 pp.

U.S. Fish and Wildlife Service. 2023. Species Status Assessment Report for *Speyeria nokomis nokomis*. Version 1.1. Grand Junction, Colorado. 81 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, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 6), and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high, we determine the risk of adverse effects to the species is high. As such, we expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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

Based on range map dated: 04-06-2023; Wherever found; *States within the range:* MN, ND, SD

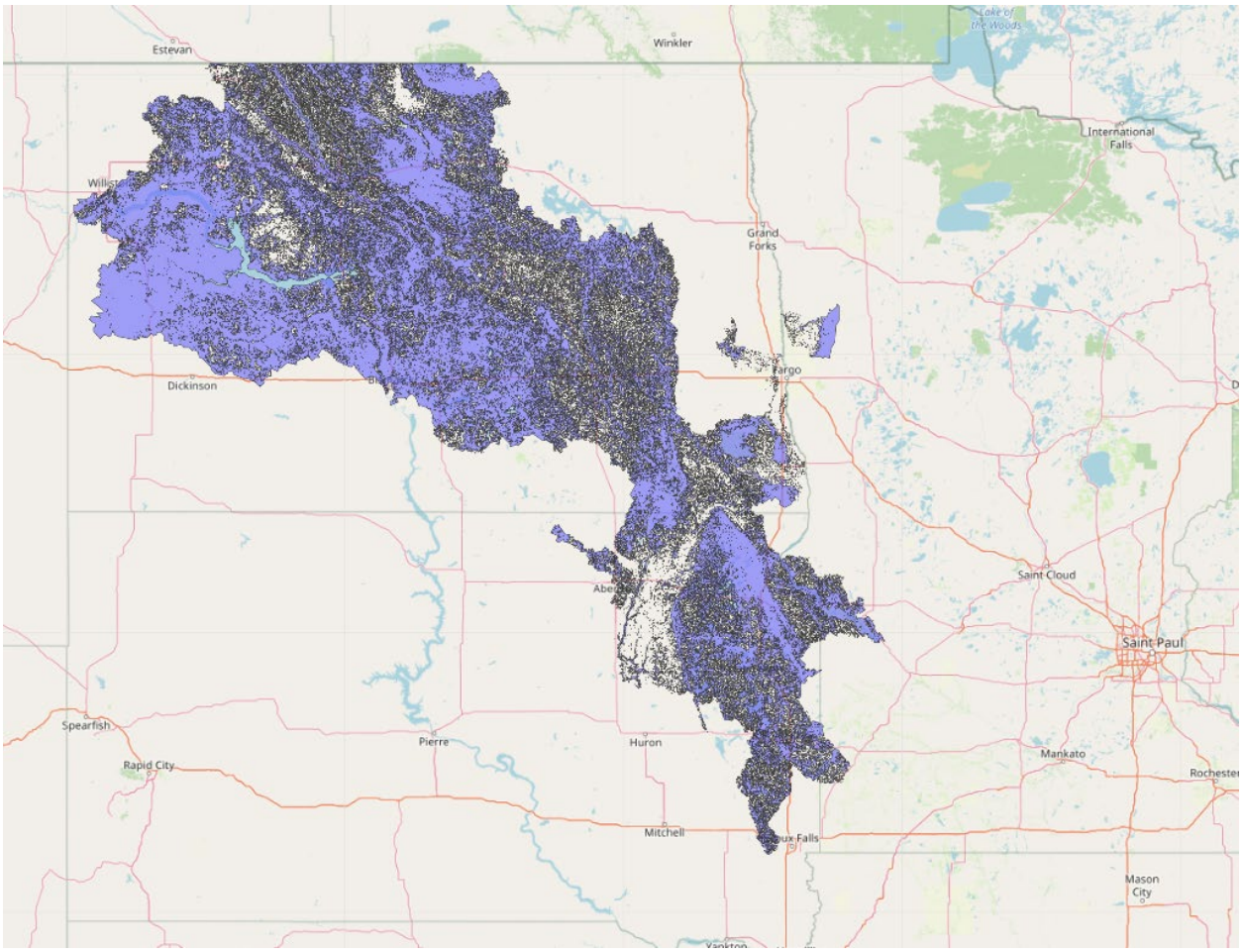

Figure 6. Range map of Dakota skipper (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1028.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Threatened

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

Most recently completed 5-Year Status 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 two 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 with Agricultural Use Sites

Data indicate that 59% of the species' range overlaps with agricultural use sites and 30.1% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 10). In total, there is approximately 89.1% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 10. Agricultural use overlap and annual usage data (% Range Treated) for the Dakota skipper.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	4	4.9	8.9	0.5	0.7	1.2
Citrus[12]	0	0	0	0	0	0
Corn	18.7	7.1	25.8	3.9	1.2	5.1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	10.6	7.6	18.2	2.7	2.1	4.8
Other Grains	10.7	5.8	16.5	0.3	0.2	0.5

[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.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Other Orchards	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Row Crops	2.1	1.4	3.5	0.5	0.3	0.8
Soybeans[13]	28.2	8.2	36.4	4.7	1.2	5.9
Vegetables and Ground Fruit	3.4	2.2	5.6	0.5	0.4	0.9
Total	**59**	**30.1**	**89.1**	**9.2**	**4.8**	**14.1**

Usage

Past usage data indicate that up to 14.1% of the species' range has been treated with carbaryl annually from agricultural uses.

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 carbaryl applications are likely to coincide with these periods of peak adult and larval activity, indicating that exposure is likely throughout its life cycle.

Non-agricultural Uses

We do not anticipate the Dakota skipper will occur in managed forests, nurseries, developed, and open space developed use sites. The Dakota skipper may occur in rangeland and rights of way use sites (particularly highways and railroads), indicating that some exposure to non-agricultural uses of carbaryl may occur. However, we anticipate there is a low likelihood of exposure to the species through these non-agricultural uses as we expect low levels of usage in these particular use sites. Available usage data from USDA APHIS indicate that no carbaryl was used on rangelands from 2014 - 2018 within the states where the Dakota skipper's range occurs, indicating that there is a low likelihood of exposure to individuals through rangeland uses of

[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.

carbaryl. Similarly, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within one species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the Dakota skipper's range for rights of way uses. Thus, while the species may occur on rights of way use sites, we anticipate there is a low likelihood of individuals experiencing exposure to carbaryl in these sites. As such, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conservation Measures

While there has been no reported usage of carbaryl for rangeland uses from 2014-2018 in the states where the Dakota skipper's range occurs, we expect any rangeland uses that may occur in the future will be carried out through the USDA APHIS grasshopper and Mormon cricket suppression program. Carbaryl applications made through or in association with this program are required to implement conservation measures for the protection of listed species in general, including reduced application rates and reduced number of applications made per year. Additionally, USDA APHIS have agreed to additional measures designed to specifically protect the Dakota skipper, including the implementation of a 1-mile buffer for ultra-low volume aerial applications of carbaryl, a 750-ft. buffer for ground applications, and a 1-mile aerial and 750-ft. ground buffer for all bait applications for carbaryl for the Dakota skipper under this program. These measures greatly reduce the likelihood of exposure to the Dakota skipper from rangeland uses of carbaryl.

Exposure Summary

There is a high degree of overlap with carbaryl agricultural use sites and their associated areas of off-site transport and the species' range (89.1% total overlap). Past usage data suggests a high level of usage within the species' range (up to 14.1% range treated annually). Given that the extent of overlap is high and that expected usage is high, we expect a large number of individuals are likely to experience exposure from the proposed action.

Based on low levels of part usage and existing conservation measures, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that carbaryl use will result in any indirect adverse effects to individuals as we do not anticipate carbaryl is likely to reduce the abundance and availability of necessary food resources to support individuals at all life stages.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (89.1% total overlap) and a high level of past usage (up to 14.1% range treated annually), indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die. As such, the overall risk of adverse effects to the Dakota skipper is high.

Based on available usage data and existing conservation measures from the use of carbaryl in rangelands based on the USDA-APHIS grasshopper and Mormon cricket suppression program, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

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. The Dakota skipper may carry out its entire life cycle in pasture or haylands, and it is found on rights of way along highways and railroads. 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. Threats persist from habitat loss and degradation of native prairies, effects of small population sizes, loss of nectar sources (e.g. indeterminate herbicide use), and climate conditions like flooding and drought.

Agricultural carbaryl use sites overlap 89.1% of the species range, 59% of which is on-field. A large portion of the range (14.1%) has been treated annually with carbaryl in the past. The species range occurs near carbaryl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range. Agricultural carbaryl exposure and resultant mortality is likely throughout some of the most critical time periods in the skipper's life cycle, from spring through July. 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 carbaryl exposure. After considering the conservation measures mentioned above (e.g., rangeland buffers under the USDA APHIS grasshopper and Mormon cricket suppression program), we expect exposure from agricultural uses of carbaryl to drive our level of concern for the Dakota skipper, and we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

We expect impacts to Dakota skippers to be high and the large number of individuals adversely affected will likely reduce the reproduction, numbers, and distribution of the species. Considering the high vulnerability of the species, high level of exposure, and large number of individual skippers likely to die, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Dakota skipper.

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: 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 and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 7), and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die and are likely to experience high levels of indirect effects resulting from loss of prey species. Given that exposure is high and the level of indirect effects is high, we determine the risk of adverse effects to the species is high. As such, we expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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

Based on range map dated: 07-12-2022; Wherever found; *States within the range:* NE

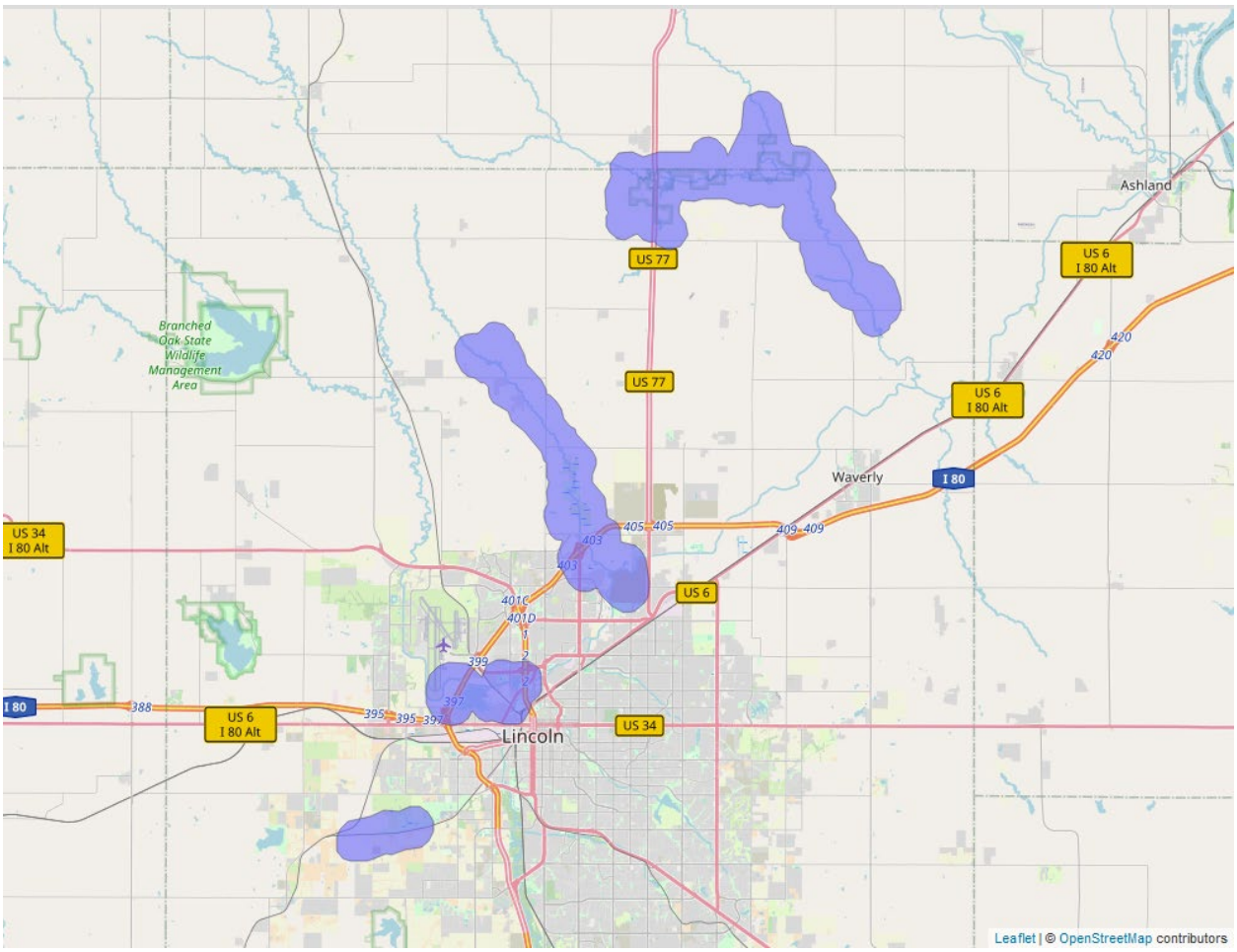

Figure 7. Range map of Salt Creek tiger beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/342.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status 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 Salt Creek tiger beetle. 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 with Agricultural Use Sites

Data indicate that 49.7% of the species' range overlaps with agricultural use sites and 15.3% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 11). In total, there is approximately 65% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 11. Agricultural use overlap and annual usage data (% Range Treated) for the Salt Creek tiger beetle.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	2.4	3.6	6	2.4	3.6	6
Citrus	0	0	0	0	0	0

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Corn[14]	46.1	9.2	55.3	46.1	9.2	55.3
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	0.5	1.2	1.7	0.5	1.2	1.7
Other Grains	0.5	0.9	1.4	0.5	0.9	1.4
Other Orchards[15]	0.2	0.1	0.3	0.2	0.1	0.3
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	46	9	55	46	9	55
Vegetables and Ground Fruit	0.1	0.1	0.2	0.1	0.1	0.2
Total	**49.7**	**15.3**	**65**	**49.7**	**15.3**	**65**

Usage

Past usage data indicate that up to 65% of the species' range has been treated with carbaryl annually from agricultural uses.

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 two years. Larvae are sedentary predators, catching prey that passes nearby. 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.

[14] 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.

[15] 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.

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). Given that these are not areas where we anticipate carbaryl will be directly applied, we only consider off-site exposure in our assessment, indicating that total overlap with agricultural areas is 15.3% and up to 15.3% of the range is likely to be treated annually.

Non-agricultural Uses

We do not expect Salt Creek tiger beetles will occur on or near managed forests, nurseries, rangeland, or rights of way use sites. In contrast, the Salt Creek tiger beetle may occur in areas immediately adjacent to developed and open space developed use sites, indicating that some exposure to non-agricultural uses of carbaryl may occur. However, we anticipate there is a low likelihood of exposure to the species through these non-agricultural uses as these use sites do not represent the species' preferred habitat. The species spends a significant portion of its life cycle in burrows where they are protected from off-site transport of pesticides. Additionally, available usage data indicate that there is a low level of carbaryl usage in developed and open space developed areas (less than 2.5% of treatable acres are likely to be treated with carbaryl annually), indicating that there is a low likelihood of exposure to the species from these uses. Furthermore, we expect many carbaryl applications in developed areas will be limited to hand-held equipment that greatly limit the extent of off-site transport and non-target exposure, further reducing the likelihood that individuals will be exposed to carbaryl from developed uses. As such, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conservation Measures

There are a number of conservation measures included in the 2022 proposed interim decision for carbaryl and the 2024 NMFS biological opinion on carbaryl that will help reduce the level of exposure to the Salt Creek tiger beetle. Measures of particular importance to the beetle include a 48-hour rain restriction and mandatory application buffers to water bodies (25-ft for ground applications, 150-ft for aerial applications). We expect these measures are especially protective of the beetle as these measures reduce the amount of off-site transport to the aquatic habitats that the species lives alongside and would apply to all carbaryl uses, including open space developed and agricultural uses.

Exposure Summary

While we do not anticipate individuals are likely to be exposed on agricultural use sites of carbaryl, there is still a high degree of overlap between the action area and the species' range (15.3% off-field overlap) and a high level of past usage within the species' range (up to 15.3% range exposed annually). Given that the extent of overlap is high and that expected usage is high, we expect a large number of individuals are likely to experience exposure from the proposed action.

Based on limited occurrence in or adjacent to non-agricultural use sites of carbaryl, differences in application methods, low levels of usage, and existing mitigation measures on product labels, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We expect carbaryl exposure will reduce the abundance of prey species that the species relies on as food resources such as ants and other small arthropods. As such, we expect a high level of indirect adverse effect is likely to occur.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die. In addition, we expect carbaryl exposure will reduce the abundance of prey species that the species relies on as food resources such as ants and other small arthropods. As such, we expect a high level of indirect adverse effect is likely to occur.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (15.3% total overlap) and a high level of past usage (up to 15.3% range exposed annually), indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die as well as a reduction in prey species. As such, the overall risk of adverse effects to the Salt Creek tiger beetle is high. Based on available usage data and existing conservation measures, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conclusion

The Salt Creek tiger beetle is listed as endangered and has a very restricted range. Currently, the beetle is observed in the mudbanks of the Little Salt River and the salt mudflats of Lancaster County, Nebraska. Recent studies indicate that nearly all populations are stable or decreasing in size. 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 remains on the brink of extinction. Threats persist from flooding, habitat loss and fragmentation, and prey loss (e.g., insects).

Salt Creek tiger beetles are unlikely to occur on agricultural or non-agricultural carbaryl use sites, so we considered the 15.3% of the range off-field that is likely to be exposed through spray drift and runoff annually in our analysis. A large portion of the range (15.3%) has been exposed annually with carbaryl through off-field transport in the past from agricultural uses. Agricultural carbaryl exposure and resultant mortality is likely throughout some of the most critical time periods in the beetle's life cycle, between May-July. As discussed above, we expect exposure from agricultural uses of carbaryl to drive our level of concern for the Salt Creek tiger beetle. We anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl.

We expect impacts to Salt Creek tiger beetles to be high and the large number of individuals adversely affected will likely reduce the reproduction, numbers, and distribution of the species. Considering the high vulnerability of the species, high level of exposure, and large number of individual beetles likely to die, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Salt Creek tiger beetle.

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: Poweshiek skipperling

Scientific Name:	Common Name:	Entity ID:
Oarisma poweshiek	Poweshiek skipperling	10147

Species Overview

In reviewing the status of the species, the environmental baseline and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 8), and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high, we determine the risk of adverse effects to the species is high. As such, we expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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

Based on range map dated: 09-09-2022; Wherever found; *States within the range:* MI, WI

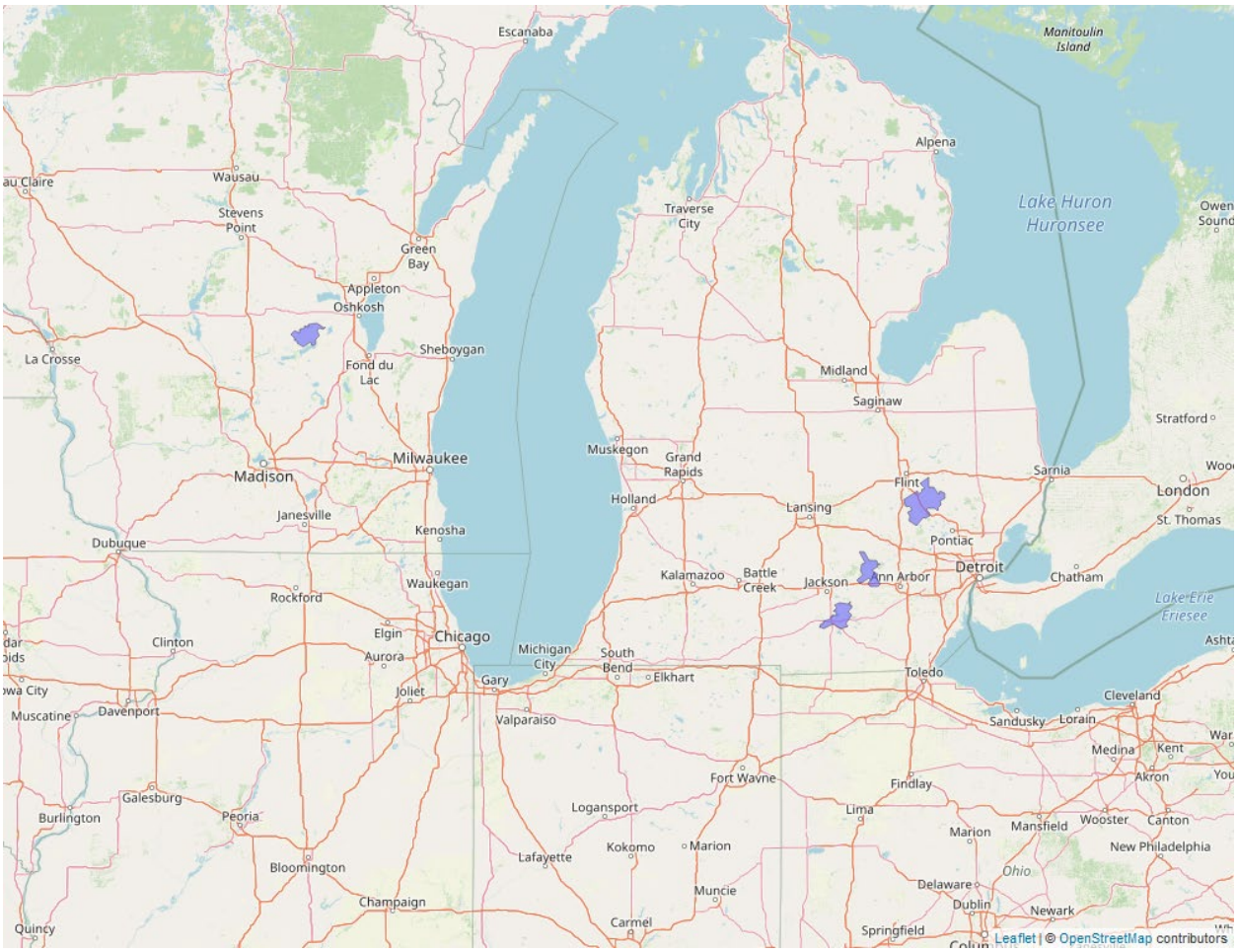

Figure 8. Range map of Poweshiek skipperling (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9161.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status 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. The Poweshiek skipperling was once a common prairie butterfly widely dispersed in portions of Manitoba, Canada and eight states, from Michigan to North Dakota. However, its range is substantially reduced, and it is restricted to small patches of fragmented native prairie remnants in portions of two states and Manitoba. The species is presumed extirpated from Illinois and Indiana, and the status of the species is unknown in four of the six states with records from the last 20 years. Survey data indicate that the Poweshiek skipperling has declined to zero or undetectable levels in approximately 96% of sites where it was historically recorded.

Between 1985 and 2003, researchers surveyed 10 or more sites across 7 years (excluding new sites in the first year); the average positive detection rate for those years is 71% across the range. Between 2004-2013, the percent of surveyed sites with positive detections for Poweshiek skipperling dropped to an average of 31% each year, with a low of 12% at sites surveyed in 2012 and 2013. Since listing, the number of populations has further declined. Out of 298 historically occupied sites, there are seven sites where the species is considered present (at the time of listing, 12 sites were considered occupied). Researchers found Poweshiek skipperlings ovipositing in Michigan on four plant species: *Muhlenbergia richardsonis* (muhly grass), *M. glomerata* (marsh muhly), *Carex sterilis* (dioecious sedge), and *Dasiphora fruticosa* (shrubby cinquefoil). In Manitoba, Poweshiek skipperlings were observed ovipositing and feeding on big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), prairie dropseed, and mat muhly grasses. They also moved among 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).

Primary threats to Poweshiek skipperling habitat include conversion, invasive species, secondary succession, and reduction in the diversity of native prairie plant communities 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 reduced its range and isolated many Poweshiek skipperling populations. 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 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 skipperlings or similar species. Landscape analyses of Michigan Poweshiek skipperling sites and the areas upwind revealed that unoccupied sites were surrounded by more agriculture (52%) than currently occupied sites (17%), 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 with Agricultural Use Sites

Data indicate that 27.3% of the species' range overlaps with agricultural use sites and 22.4% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 12). In total, there is approximately 49.7% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 12. Agricultural use overlap and annual usage data (% Range Treated) for the Poweshiek skipperling.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	5.7	6.4	12.1	5.7	6.4	12.1
Citrus	0	0	0	0	0	0
Corn[16]	14.7	6.5	21.2	14.7	6.5	21.2
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	5.3	6.8	12.1	5.3	6.8	12.1
Other Grains	0.5	1.5	2	0.5	1.5	2
Other Orchards[17]	0.5	0.4	0.9	0.5	0.4	0.9
Other Row Crops	0.1	0.1	0.2	0.1	0.1	0.2
Soybeans	13.2	6.8	20	13.2	6.8	20
Vegetables and Ground Fruit	0.6	0.7	1.3	0.6	0.7	1.3
Total	**27.3**	**22.4**	**49.7**	**27.3**	**22.4**	**49.7**

Usage

Past usage data indicate that up to 49.7% of the species' range has been treated with carbaryl annually from agricultural uses.

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

[16] 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.

[17] 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.

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 carbaryl throughout its entire life cycle if applications are made from Spring through September.

Non-agricultural Uses

The Poweshiek skipperling is not likely to occur in or near developed, open space developed, or nursery use sites as these areas are considered "impermeable" to the species. Similarly, we do not anticipate individuals are likely to occur on or near managed forest use sites because they do not represent preferred habitat for the species. While individuals may occur in rights of way and rangeland use sites, we anticipate there is a low likelihood of exposure to the species through these non-agricultural uses as they are not likely to contain the undisturbed high-quality prairie habitat required by Poweshiek skipperlings. Available usage data from USDA APHIS indicate that no carbaryl was used on rangelands from 2014 – 2018 within Michigan or Wisconsin, where the Poweshiek skipperling's range occurs, indicating that there is a low likelihood of exposure to individuals through rangeland uses of carbaryl. Similarly, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within one species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the Poweshiek skipperling's range for rights of way uses. Thus, while the species may occur in rights of way use sites, we anticipate there is only a low likelihood of individuals experiencing exposure to carbaryl in these sites. As such, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conservation Measures

While there has been no reported usage of carbaryl for rangeland uses from 2014-2018 in the states where the Poweshiek skipperling's range occurs, we expect any rangeland uses that may occur in the future will be carried out through the USDA APHIS grasshopper and Mormon cricket suppression program. Carbaryl applications made through or in association with this program are required to implement conservation measures for the protection of listed species in general, including reduced application rates and reduced number of applications made per year. Additionally, USDA APHIS have agreed to additional measures designed to specifically protect the Poweshiek skipperling, including a 1-mile buffer for ultra-low volume aerial applications of carbaryl, a 750-ft buffer for ground applications, and a 500-ft aerial and 250-ft ground buffer for all bait applications for carbaryl for the Poweshiek skipperling under this program. We expect

these mitigation measures will be sufficient to protect the species from any possible future uses of carbaryl within rangeland areas that occur in the species' range.

Exposure Summary

There is a high degree of overlap between agricultural use sites and their associated areas of off-site transport and the species' range (49.7% total overlap). Past usage data suggests a high level of usage within the species' range (up to 49.7% range treated annually). Given that the extent of overlap is high and that expected usage is high, we expect a large number of individuals are likely to experience exposure from the proposed action.

Based on differences in the low likelihood of Poweshiek skipperling occurring in non-agricultural use sites, low levels of usage, and existing conservation measures, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that carbaryl use will result in any indirect adverse effects to individuals as we do not anticipate carbaryl is likely to reduce the abundance and availability of necessary food resources to support individuals at all life stages.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (49.7% total overlap) and a high level of past usage (up to 49.7% range treated annually), indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die. As such, the overall risk of adverse effects to the Poweshiek skipperling is high. Based on available usage data and existing conservation measures from the use of carbaryl in rangelands based on the USDA-APHIS grasshopper and Mormon cricket suppression program, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conclusion

The Poweshiek skipperling is an endangered species found only in undisturbed, high-quality prairie habitats, including wet-mesic tallgrass prairie to dry-mesic mixed-grass prairie. 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 carbaryl 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.

Agricultural carbaryl use sites overlap 49.7% of the species range, 27.3% of which is on-field. A large portion of the range (49.7%) has been treated annually with carbaryl in the past. The species range occurs near agricultural carbaryl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range. Agricultural carbaryl exposure and resultant mortality is likely throughout some of the most critical time periods in the 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 carbaryl exposure. After considering the conservation measures mentioned above (e.g., rangeland buffers under the USDA APHIS grasshopper and Mormon cricket suppression program), we expect exposure from agricultural uses of carbaryl to drive our level of concern for the Poweshiek skipperling. We anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl.

We expect impacts to Poweshiek skipperlings to be high and the large number of individuals adversely affected will likely reduce the reproduction, numbers, and distribution of the species. Considering the high vulnerability of the species, high level of exposure, and large number of individual skipperlings likely to die, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Poweshiek skipperling.

References

U.S. Fish and Wildlife Service. 2020. Multi-state Mitchells' satyr butterfly and Poweshiek skipperling Habitat Conservation Plan. Michigan Department of Natural Resources. 126 pp.

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, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 9), and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high, we determine the risk of adverse effects to the species is high. As such, we expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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: 06-11-2024; Wherever found; *States within the range:* IA, IL, IN, MA, MD, ME, MN, OH, VA, WI, WV

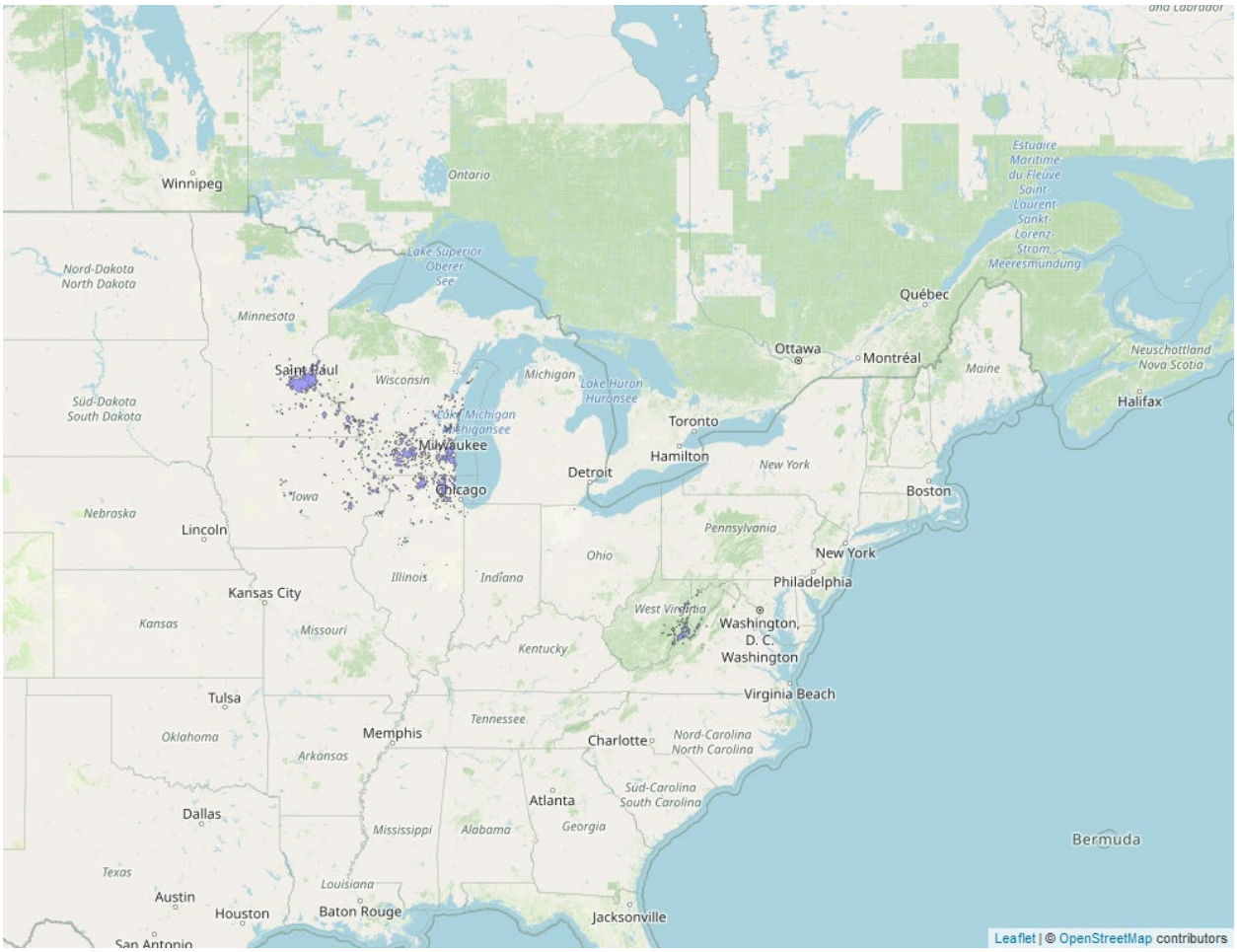

Figure 9. Range map of rusty patched bumble bee (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9383.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status 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 has been observed and collected in a variety of habitats, including prairies, woodlands, marshes, agricultural landscapes, and residential parks and gardens. It 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 food resources from early spring through fall, undisturbed nest sites in proximity to foraging resources (e.g., within 1 km), and overwintering sites for the next year's queens. The maximum dispersal distance of the rusty patched bumble bee is likely 1-10 km.

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 hibernate, so to meet its nutritional needs, the rusty patched bumble bee requires a constant and diverse supply of flowers that bloom throughout their long lifecycle, from April through September. Populations consist of tens to hundreds of colonies, and the health (long-term productivity) of populations is affected by the quantity and quality of nectar and pollen resources 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 were occupied by the rusty patched bumble bee between 1996-2016, and the relative abundance of the rusty patched bumble bee declined from 8% historically to 1%. The number of occupied states declined by 68%, the number of occupied counties declined by 89%, and the number of occupied ecoregions declined by 60%. As of 2016, the species existed in 6 ecoregions across 41 counties in 13 states and one province (Illinois, Indiana, Massachusetts, Maryland, Maine, Minnesota, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, Wisconsin, and Ontario). The species' range is currently 8% of its historical range, a reduction that 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 its listing in 2017 (82 FR 10285), the species experienced a widespread and precipitous decline 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 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 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 by 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 increased survey effort (USFWS 2022). Many of the existing populations continue to face 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. These threats continue to adversely affect the species and may have increased in severity and imminence. It is likely that several risk factors are acting synergistically on the species, and the combination of multiple stressors is likely more harmful than a single stressor acting alone. As fewer and fewer populations persist, the ability to withstand normal environmental stochasticity is diminished, and thus the decline to extinction is accelerated. Only 2% of the extant sites are on 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 with Agricultural Use Sites

Data indicate that 28.1% of the species' range overlaps with agricultural use sites and 18.1% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 13). In total, there is approximately 46.2% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 13. Agricultural use overlap and annual usage data (% Range Treated) for the Rusty patched bumble bee.

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	5.7	6.1	11.8	5.6	5.9	11.5
Citrus	0	0	0	0	0	0
Corn[18]	18.9	7.5	26.4	14.7	5.5	20.2
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	1.9	2.3	4.2	1.8	2.2	4
Other Grains	0.9	1.5	2.4	0.1	0.1	0.2
Other Orchards[19]	0.1	0.1	0.2	0.1	0.1	0.2
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	14.8	6.7	21.5	11.7	5	16.7
Vegetables and Ground Fruit	0.6	0.6	1.2	0.6	0.6	1.2
Total	**28.1**	**18.1**	**46.2**	**22.8**	**14.6**	**37.4**

Usage

Past usage data indicate that up to 37.4% of the species' range has been treated with carbaryl annually from agricultural uses.

Additional Exposure Considerations

The rusty patched bumble bee is typically most active from spring to late summer/early fall. We expect carbaryl applications are likely to coincide with the species' most active periods, indicating that exposure is likely to occur throughout the bee's life cycle.

[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.

[19] 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.

Non-agricultural Uses

In addition to agricultural uses of carbaryl, we anticipate non-agricultural uses will further contribute to the rusty patched bumble bee's exposure. 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). As such, we expect the species is likely to occur in managed forests, rangeland, rights of way, developed, open space developed, and nursery areas, indicating that some exposure to non-agricultural uses of carbaryl may occur. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the rusty patched bumble bee. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As such, we anticipate a low likelihood of carbaryl usage in the range, and that if usage did occur, exposure to the rusty patched bumble bee would be minimal. Similarly, available usage data from USDA APHIS indicate no carbaryl has been used to treat rangeland habitats within the states containing the rusty patched bumble bee's range, indicating that the species is not likely to be exposed to carbaryl through rangeland uses either. Available usage data at the national level indicate only up to 500 pounds of carbaryl are used nationally on rights of way each year. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or within one species' range, we expect this is highly unlikely to occur. Rather, we expect rights of way usage are likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the rusty patched bumble bee's range. As such, we anticipate that non-agricultural uses of carbaryl are not likely to contribute significantly to the overall exposure of the rusty patched bumble bee.

In contrast, while available national usage data suggests that past carbaryl usage in developed, open space developed, and nursery use sites is low (e.g., only about 2.5% of use sites in these areas are treated annually), we anticipate the species is likely to be exposed to carbaryl through usage in these areas. The rusty patched bumble bee requires diverse nectar and pollen sources and are attracted to a number of ornamental species that are commonly planted in residential areas and nurseries, such as cherry and plum trees. Given that the species is known to frequent residential gardens and parks (and presumably nurseries containing attractive flowering ornamental species), we anticipate exposure to carbaryl in developed areas.

Conservation Measures

As a result of the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, many residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the areal extent that can be treated on many use sites within the developed, open space developed, and nurseries use sites.

Exposure Summary

There is a high degree of overlap between agricultural use sites and their associated off-site areas and the species' range (46.2% total overlap). Past usage data suggests a high level of usage within the species' range (up to 34.7% range treated annually). Additionally, given that the species is known to occur in (and are potentially attracted to) residential gardens, parks, and nurseries, we anticipate the species is likely to experience significant additional exposure to carbaryl through non-agricultural uses in developed use areas. Since the extent of overlap is high, the expected usage is high, and that individuals are also likely to be exposed through non-agricultural uses, we expect 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 carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that carbaryl use will result in any indirect adverse effects to individuals as we do not anticipate carbaryl is likely to reduce the abundance and availability of necessary floral resources to support individuals.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (46.2% total overlap), a high level of past usage (up to 34.7% range treated annually), and anticipate exposure to non-agricultural uses of carbaryl, indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We

expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die. As such, the overall risk of adverse effects to the rusty patched bumble bee is high.

Conclusion

The rusty patched bumble bee is an endangered species found in various habitats, including prairies, woodlands, marshes, agricultural landscapes, and residential parks and gardens. They may disperse between 1-10 km and are active for longer portions of the year than other *Bombus* species (April - September). They nest, overwinter, and forage in forests and have been observed in residential parks and gardens. Threats persist for the species from loss of nectar resources (e.g., development, herbicide use, agricultural conversion), insecticide exposure, pathogens, and climate change.

Agricultural carbaryl use sites overlap 46.2% of the species range, 28.1% of which is on-field. A large portion of the range (37.4%) has been treated annually with carbaryl in the past. The species range occurs near agricultural carbaryl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range. Furthermore, we anticipate individuals are likely to occur in residential parks, gardens, and nurseries and are likely to experience additional exposure through non-agricultural carbaryl usage in these developed and open space developed areas. Carbaryl exposure and resultant mortality is likely throughout some of the most critical time periods in the bee's life cycle, between April and September. They are colonial and if they are exposed to carbaryl while nesting, many bees would die.

We expect impacts to rusty patched bumble bees to be high and the large number of individuals adversely affected will likely reduce the reproduction, numbers, and distribution of the species. Considering the high vulnerability of the species, high level of exposure, and large number of individual bees likely to die, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the rusty patched bumble bee.

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 reviewing the status of the species, the environmental baseline and cumulative effects for the action area, the Service has determined that the species' vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is high overlap of the action area with the species' range (Figure 10), and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. Given that exposure is high and the level of indirect effects is high, we determine the risk of adverse effects to the species is high. As such, we expect a large 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is 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: 03-03-2022; Wherever found; *States within the range:* FL

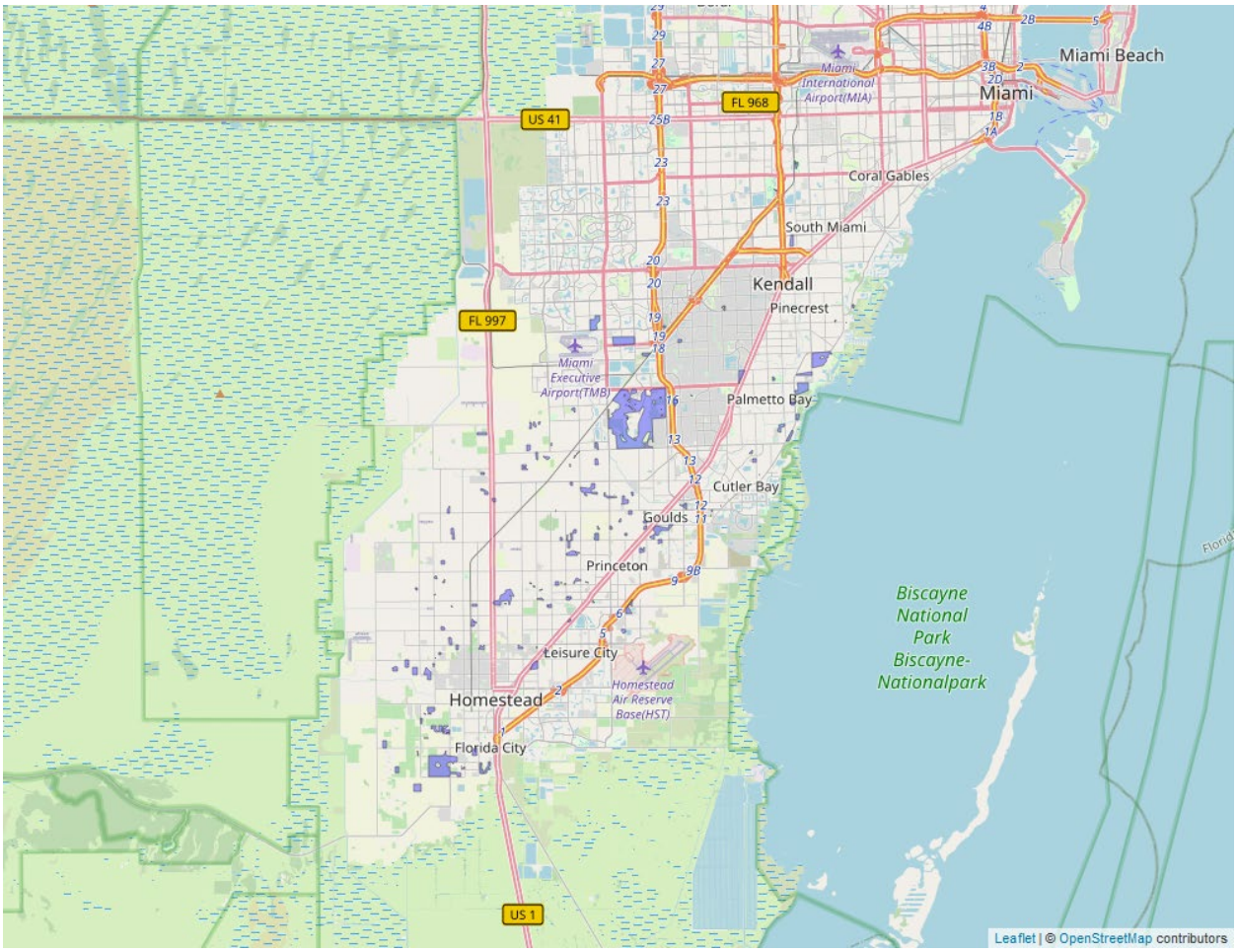

Figure 10. Range map of Miami tiger beetle (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9965.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Status 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 includes any pine rockland habitat (natural or disturbed) within the Miami Rock Ridge.

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 near 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.

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. The use insecticides (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. In 2023, several unoccupied areas and the known population areas were designated as critical habitat for the Miami tiger beetle (USFWS 2023).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 with Agricultural Use Sites

Data indicate that 29.2% of the species' range overlaps with carbaryl agricultural use sites and 28.1% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff; Table 15). In total, there is approximately 57.3% overlap between the species' range and the agricultural footprint of

carbaryl use. **Table 14. Agricultural use overlap and annual usage data (% Range Treated) for the Miami tiger beetle.**

Agricultural Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Alfalfa	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Citrus	0.3	0.9	1.2	0.3	0.9	1.2
Corn[20]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Grapes	<0.1	0.1	0.1	<0.1	0.1	0.1
Other Crops	1.7	4.3	6	1.7	4.3	6
Other Grains	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Orchards[21]	19.7	15.9	35.6	19.7	15.9	35.6
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vegetables and Ground Fruit	7.7	7.8	15.5	7.7	7.8	15.5
Total	**29.2**	**28.1**	**57.3**	**29.2**	**28.1**	**57.3**

Usage

Past usage data indicate that up to 57.3% of the species' range has been treated with carbaryl annually from agricultural uses.

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. As such, we do not anticipate individuals are

[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.

likely to occur in agricultural or non-agricultural use sites. Thus, we only consider the overlap between the species' range and off-site areas in our analyses for this species.

The breeding season is from May-October 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).

Non-agricultural Uses

We do not anticipate individuals are likely to occur in managed forests, nurseries, rights of way, or rangeland use sites. While we do not anticipate individuals are likely to occur on developed or open space developed, the few known locations of the species are located adjacent to developed and open space developed areas and may experience some exposure to non-agricultural uses of carbaryl. However, we anticipate there is a low likelihood of exposure to the species through these non-agricultural uses as these use sites do not represent the species' preferred habitat (i.e., pine rockland), there is a low level of expected usage, and we anticipate application methods will not result in large amounts of off-site transport of carbaryl residues. Based on the known locations of existing populations (e.g., two preserves, a park, a U.S. Coast Guard facility, and a university facility), we do not anticipate broadcast application of carbaryl is likely and that most non-agricultural applications of carbaryl in these areas will be made using hand-held equipment for spot treatments, which will have minimal off-site transport and off-target exposure. As such, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Exposure Summary

While we do not anticipate individuals are likely to be exposed on agricultural use sites of carbaryl, there is still a high degree of agricultural use of carbaryl overlap between areas adjacent to agriculture and the species' range (28.1% off-field overlap). Past usage data suggests a high level of usage within these areas of the species' range (28.1%) as well. Given that the extent of overlap is high and that expected usage is high we expect a large number of individuals are likely to experience exposure from the proposed action. Based on differences in application methods that are not likely to result in significant off-site transport and low levels of usage, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Overall Exposure: High

Effects of the Action: Toxicity

Direct Effects

Based on toxicity data for insects, we expect that exposure to carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We expect carbaryl exposure will reduce the abundance of prey species that the species relies on as food resources such as ants and other small arthropods. As such, we expect a high level of indirect adverse effect is likely to occur.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites will die, as will prey items this beetle consumes.

Overall Toxicity: High

Effects of the Action Summary

There is a high level of overlap between the species' range and agricultural use sites and associated off-field areas (28.1% total overlap) and a high level of past usage (up to 28.1% range treated annually), indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We expect insect species are highly sensitive to carbaryl, indicating a large number of individuals are likely to die and the abundance of available prey will be reduced. As such, the overall risk of adverse effects to the Miami tiger beetle is high.

As the Miami tiger beetle is not expected to be on non-agricultural use sites carbaryl use sites and we expect off-site transport from these use sites to be minor, we anticipate that no more than a small number of individuals will be exposed through these uses. Therefore, we anticipate low adverse effects from non-agricultural uses of carbaryl.

Conclusion

The Miami tiger beetle is listed as endangered and is a narrow endemic species that exists in two disjunct population clusters in Pine Rockland habitats of Miami-Dade County, Florida. They feed on small arthropods, primarily ants. 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 separates them and serves as a barrier. If individuals are lost from one population due to carbaryl 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. Miami-Dade County has a management plan for the Richmond Pine Rocklands, in which they outline concerns for pesticides drifting from nearby agricultural and commercial land uses (Possley et al. 2018). Some occupied lands are protected but not specifically for the Miami tiger beetle. Threats persist for the species from development, vegetation encroachment, and climate change.

Agricultural carbaryl use sites overlap 57.3% of the species range, 28.1% of which is off-field. Even though we do not expect the species to occur on-field, a high portion (28.1%) of the range has been exposed to carbaryl in the past through drift and runoff. The species range occurs near agricultural carbaryl use sites and we anticipate exposure will occur from drift off these sites in a large portion of the range. Additionally, carbaryl 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, the species is unlikely to regain most individuals lost due to carbaryl exposure. After considering the species is unlikely to occur on non-agricultural carbaryl use sites and we expect off-site transport from these use sites to be minor, we expect exposure from agricultural uses of carbaryl to drive our level of concern for the monarch. We anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl.

We expect impacts to Miami tiger beetles to be high and the large number of individuals adversely affected will likely reduce the reproduction, numbers, and distribution of the species. Considering the high vulnerability of the species, high level of exposure, large number of individual Miami tiger beetles likely to die, and indirect effects through prey reduction across a large portion of its range, 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Miami tiger beetles.

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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 and cumulative effects for the action area, the Service has determined that the species’ vulnerability is high. In our evaluation of the effects of the proposed action to the species, we determine there is low overlap of the action area with the species’ range (Figure 11) and low past usage of carbaryl within the species’ range, indicating a low extent of exposure. Most exposed individuals are likely to die. Given that exposure is low, we determine the risk of adverse effects to the species is low. Because the species has not been observed since 2006, we further refined our analysis using the species’ high-priority zones, in which we expect exposure with carbaryl to be unlikely. 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 expected to appreciably reduce the survival and recovery of the species in the wild. 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 this conclusion for the species in the sections below.

Species range

Based on range map dated: 12-28-2023; Wherever found; *States within the range:* CA, OR

=

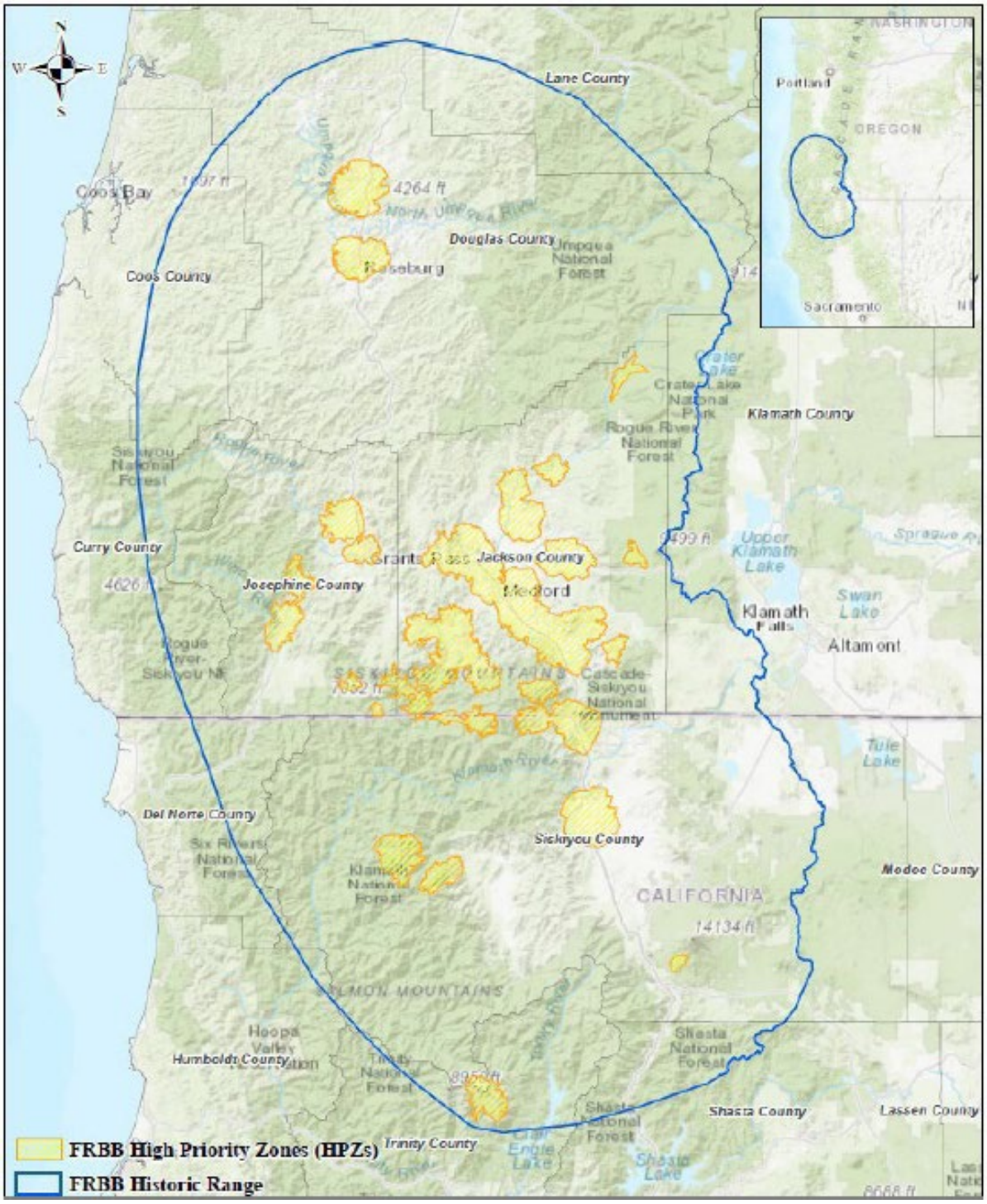

Figure 11. The Franklin's bumble bee species' range is outlined in blue and the high-priority zones are highlighted in yellow. Species' experts anticipate the species is most likely to be found in areas of high elevation in the high-priority zones (OFWO pers. comm., 2024). Figure copied from OFWO 2024.

Vulnerability

As mentioned above, vulnerability considers the present and likely future condition of the species to determine its vulnerability to additional stressors. 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. These are summarized below for this species.

Summary of Status

Listing status: Endangered

Most recent 5-Year Status Review recommendation: N/A

Most recently completed 5-Year Status 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: 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 are 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% 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% 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, pesticide is a broad term that includes herbicides, insecticides, fungicides, and the adjuvants often used in their application. Several 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 with Agricultural Use Sites

Data indicate that 1.7% of the species' range overlaps with carbaryl agricultural use sites and 1.6% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (i.e., from spray drift or runoff). In total, there is approximately 3.3% overlap between the species' range and the agricultural footprint of carbaryl use (Table 16). Though only a small percentage of the species range overlaps with agricultural areas, we present an individual analysis for this species due to its highly vulnerable status, such that the loss of one or few individuals could have species level effects.

Table 15. Agricultural use overlap and annual usage data for Franklin's bumble bee.

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	1.0	0.6	1.6	0.4	0.3	0.7
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn[22]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Grapes	<0.1	0.1	0.2	<0.1	0.1	0.2
Other Crops	0.2	0.3	0.5	0.2	0.3	0.5
Other Grains	0.3	0.3	0.6	0.1	0.1	0.2
Other Orchards	0.2	0.3	0.5	0.2	0.3	0.5
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	<0.1	<0.1	0.1	<0.1	<0.1	0.1
Total	**1.7**	**1.6**	**3.3**	**1**	**1**	**2**

Usage

Past usage data indicate that up to 2% of the species' range has been treated with carbaryl annually from agricultural uses.

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 carbaryl 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 carbaryl used in the past. As such, we further

[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.

expect a low likelihood of carbaryl usage, and subsequent exposure of individuals, is likely to occur.

Additional Exposure Considerations

The flight season is mid-May to the end of September. The species may forage up to 10 km from the nest, but the typical dispersal distance is likely around 1 km (OFWO, pers. comm., 2024). Franklin's bumble bee may prefer wet fen, riparian, and other wetland type habitat seasonally, as drier areas during the latter part of the summer cease to provide floral resources. Floral resources that bloom 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 Service identified areas where Franklin's bumble bee may be most likely to occur called "high-priority zones." 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 the action overlaps with 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, as 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; 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.

Non-agricultural Uses

We do not anticipate the Franklin's bumble bee will occur in nurseries, managed forests, or rights of way use sites. There was one observation of the Franklin's bumble bee nesting in a residential garage before 1998, although even with hundreds of surveys hours and outreach to citizen scientists since that time, there have been no additional sightings documented in residential areas. Franklin's bumble bee occasionally occurred in rangeland areas, indicating that some exposure to non-agricultural uses of carbaryl could occur through registered developed and rangeland uses. However, available information indicates that carbaryl treatments in these use areas will be limited to small areas that are treated infrequently over the duration of the proposed

action, and these are not areas where the species is likely to occur (OFWO, pers. comm. 2024). We anticipate non-agricultural uses of carbaryl will not substantially contribute to the overall exposure of the species.

Conservation Measures

We expect existing conservation measures on product labels as well as measures required in the USDA APHIS Letter of Concurrence regarding carbaryl use by other federal agencies will help reduce the likelihood of exposure to the species. Label measures limit many residential uses of carbaryl to spot, crack-and-crevice, or narrow perimeter bands around urban structures (from 1 inch to 6 feet in width), which we expect will substantially reduce the likelihood of exposure to the species from developed uses. The USDA APHIS BA considered grasshopper and Mormon cricket program activities in states where their program is active, which include the implementation of conservation measures such as employing a reduced agent area treatment strategy, allowance of only one application per year, reducing application rates, minimizing treatment area size within 750 feet and 1 mile from the Franklin's bumble bee for ground and aerial applications, respectively. In addition, under the grasshopper and Mormon cricket program, carbaryl baits can be used beyond a 500-ft (aerial) or 250-ft (ground) buffer from the Franklin's bumble bee range. We expect theses existing conservation measures substantially reduce the likelihood of exposure to the species from non-agricultural uses of carbaryl.

Exposure Summary

There is a low extent of overlap between the action area and the species' range (3.3% total overlap). Past usage data suggests that only a small proportion of the range will likely experience exposure (up to 2% 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. While individuals may occur in non-agricultural use sites, we expect existing conservation measures required for developed and rangeland uses of carbaryl will effectively protect individuals from exposure to non-agricultural uses of carbaryl. As such, we anticipate, at most, very low levels of effects are likely to occur 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 carbaryl on-field or from concentrations in spray drift in adjacent areas (i.e.., up to 30 meters off-field) will result in mortality of any individuals exposed.

Indirect Effects

We do not expect that carbaryl use will result in any indirect adverse effects to individuals as we do not anticipate carbaryl is likely to reduce the abundance and availability of necessary food resources to support individuals.

Toxicity Summary

Given the high sensitivity of insects to carbaryl at estimated environmental concentrations, we anticipate all individuals exposed to carbaryl on use sites or up to 30 meters adjacent to use sites 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 (3.3% total overlap), a low level of past usage (up to 2% of the range treated annually), and individuals tend to prefer habitat away from agricultural areas, reducing the likelihood of exposure. We expect existing conservation measures for developed and rangeland uses of carbaryl will effectively protect individuals from exposure to non-agricultural uses of carbaryl. The species has a high toxicity ranking as available data indicate that insect species are highly sensitive to carbaryl, suggesting that any exposed individuals are likely to die. However, we anticipate the low level of exposure will result in zero to a small number of mortalities. As such, we determine the overall risk of adverse effects to the species is low.

Conclusion

The Franklin's bumble bee is an endangered species that occurs in one population in southern Oregon and northern California. The species has not been observed since 2006 despite focused efforts. Little life history information for this species is known, so we rely on other *Bombus* species to assess its habitat needs. We believe it is a habitat generalist that does not rely on a specific host plant and that it uses rodent burrows or other cavities for nesting. It may nest and forage in upland grasslands, shrublands, forest and woodland edges, and it may also forage in marshes, swamps, bogs, and fens. Inferred threats to the species persist from introduced pathogens, pesticide use, habitat loss, small population dynamics, and climate change.

Agricultural carbaryl use sites overlap 3.3% of the species range, 1.7% of which is on-field. A small proportion of the range will likely experience exposure (up to 2% of range treated annually with carbaryl) in the future, which is corroborated by the very low level of insecticide usage in the past according to USDA's Census of Agriculture (0.38% annually). We presume the bee is a ground nester that prefers areas near forests edges and within open wet fens that are not likely to

be near agricultural areas or other carbaryl use sites. After considering the conservation measures mentioned above, we expect exposure from agricultural uses of carbaryl to drive our level of concern for the Franklin's bumble bee. We anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl.

Though exposure of an extant population would likely have severe consequences to the species, and the species' range includes a low level of overlap with carbaryl use sites, we expect the risk of a Franklin's bumble bee being exposed to carbaryl to be low for several reasons. A small area of the species' range is registered for carbaryl use, and an even smaller proportion of the range has been treated with carbaryl in the past. Additionally, the species is believed to only occur on high-elevation areas of the Franklin's bumble bee high-priority zones where agricultural and other carbaryl 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.

Even though the species is highly vulnerable, we expect the likelihood of exposure to Franklin's bumble bee to be extremely low. We do not expect Franklin's bumble bees to forage or nest on agricultural lands, and we do not expect exposure from non-agricultural uses of carbaryl. Therefore, we do not 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 expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Franklin's bumble bee.

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