Integration and Synthesis Summary for Mammals

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 mammal 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 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 that the main route of exposure for mammals is dietary, through consumption of contaminated food items. We do not anticipate significant carbaryl exposure through inhalation or dermal contact with residues on surfaces or in the air. 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 areas 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, dietary needs, 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% 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 from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this biological opinion. Species that we expect will have a large portion of their range (>10%) treated with carbaryl each year based on past SUUM usage 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 Hawaiʻi 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 are high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. (As usage is a subset of overlap, the overlap score will always be greater than the usage score). In cases where overlap is high, but usage is low, we anticipate a moderate portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. Past usage data for carbaryl is not available for species located on Pacific or Caribbean islands, including the 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 as there are several existing mitigation measures that are protective of listed species. In addition, usage data summarized by the EPA indicate that all non-agricultural UDLs have very low levels of past usage (at most, 2.5% of areas treated with carbaryl annually across the country). Some use patterns, like rights of way, are particularly low usage areas, with less than 500 lbs of carbaryl applied annually across the nation.

Additionally, based on application information, we anticipate carbaryl uses 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 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 as 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 with carbaryl 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 attract mammal species or result in spray drift or contact exposure.

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 areal extent 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 listed species' habitats (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 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, reproduction, impaired motor activity or behavior) 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 mammals are not sensitive to carbaryl at most estimated environmental concentrations and will likely only experience direct adverse effects, including mortality and sublethal effects, at high exposure concentrations. Mammals exposed to carbaryl at sublethal concentrations may experience neurological effects such as impaired motor activity or behavior.

We anticipate species that only rely on plant-based resources, such as seeds or leaves 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 arthropods for food resources may experience high levels of indirect adverse effects as carbaryl exposure will likely reduce the abundance and availability of prey. Impacts to vertebrate prey will vary depending on location. We expect larger impacts to vertebrate prey survival on application sites and lower impacts in off-site areas adjacent to use sites.

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

We determine the overall toxicity ranking for mammals by qualitatively assessing both the expected levels of direct adverse effects (e.g., mortality) and indirect adverse effects (e.g., prey loss).

Summary of Mammals 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 64 of the 69 mammal species in this Appendix. For the other five 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.

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

Experimental, non-essential populations

The EPA included in the consultation the experimental, non-essential populations for the following mammal species: black-footed ferret, grizzly bear, red wolf, Sonoran pronghorn, gray wolf, and Mexican wolf. We do not provide separate analyses and 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 lands 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. Mammals with low exposure as informed by low overlap between the species' range and agricultural use sites.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Antilocapra americana sonoriensis	Sonoran pronghorn	High	Low	Low	3.8	No Jeopardy
Aplodontia rufa nigra	Point Arena mountain beaver	Medium	Low	Low	0.7	No Jeopardy
Canis lupus baileyi	Mexican wolf	High	Low	Low	0.2	No Jeopardy
Corynorhinus (=Plecotus) townsendii ingens	Ozark big-eared bat	High	Low	Low	1.9	No Jeopardy
Corynorhinus (=Plecotus) townsendii virginianus	Virginia big-eared bat	High	Low	Low	1.8	No Jeopardy
Dipodomys merriami parvus	San Bernardino Merriam's kangaroo rat	High	Low	High	4.0	No Jeopardy
Dipodomys stephensi (incl. D. cascus)	Stephens' kangaroo rat	High	Low	Low	3.5	No Jeopardy
Emballonura semicaudata semicaudata	Pacific sheath-tailed Bat	High	Low	Medium	4.3	No Jeopardy
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	High	Low	Low	0.3	No Jeopardy
Gulo gulo luscus	North American wolverine	Medium	Low	Low	3.0	No Jeopardy

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Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Leptonycteris nivalis	Mexican long-nosed bat	Medium	Low	Low	1.0	No Jeopardy
Lynx canadensis	Canada Lynx	Medium	Low	Low	1.9	No Jeopardy
Martes caurina	Pacific Marten, Coastal Distinct Population Segment	High	Low	Low	0.5	No Jeopardy
Microtus pennsylvanicus dukecampbelli	Florida salt marsh vole	High	Low	Low	0.1	No Jeopardy
Neotoma floridana smalli	Key Largo woodrat	High	Low	Low	0.6	No Jeopardy
Odocoileus virginianus clavium	Key deer	High	Low	Low	0.2	No Jeopardy
Ovis canadensis nelsoni	Peninsular bighorn sheep	High	Low	Low	3.3	No Jeopardy
Ovis canadensis sierrae	Sierra Nevada bighorn sheep	High	Low	Low	0.2	No Jeopardy
Panthera onca	Jaguar	Medium	Low	Low	2.7	No Jeopardy
Pekania pennanti	Fisher	High	Low	Low	2.7	No Jeopardy
Perognathus longimembris pacificus	Pacific pocket mouse	High	Low	Low	0.2	No Jeopardy
Peromyscus gossypinus allapaticola	Key Largo cotton mouse	High	Low	Low	0.6	No Jeopardy
Peromyscus polionotus allophrys	Choctawhatchee beach mouse	High	Low	Low	0.7	No Jeopardy
Peromyscus polionotus peninsularis	St. Andrew beach mouse	Medium	Low	Low	1.3	No Jeopardy
Peromyscus polionotus phasma	Anastasia Island beach mouse	High	Low	Low	3.8	No Jeopardy
Peromyscus polionotus trissyllepsis	Perdido Key beach mouse	High	Low	Low	1.2	No Jeopardy

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Pteropus mariannus mariannus	Mariana fruit Bat (=Mariana flying fox)	High	Low	High	1.1	No Jeopardy
Rangifer tarandus ssp. caribou	Southern Mountain Caribou DPS	Medium	Low	Low	0.6	No Jeopardy
Sylvilagus palustris hefneri	Lower Keys marsh rabbit	High	Low	Low	0.1	No Jeopardy
Tamias minimus atristriatus	Penasco least chipmunk	High	Low	High	0.5	No Jeopardy
Tamiasciurus fremonti grahamensis	Mount Graham red squirrel	High	Low	Low	0.6	No Jeopardy
Thomomys mazama glacialis	Roy Prairie pocket gopher	High	Low	High	1.0	No Jeopardy
Thomomys mazama pugetensis	Olympia pocket gopher	High	Low	High	4.1	No Jeopardy
Thomomys mazama tumuli	Tenino pocket gopher	High	Low	High	1.6	No Jeopardy
Thomomys mazama yelmensis	Yelm pocket gopher	High	Low	High	2.9	No Jeopardy
Urocitellus brunneus	Northern Idaho Ground Squirrel	High	Low	Low	1.2	No Jeopardy
Urocyon littoralis catalinae	Santa Catalina Island Fox	Medium	Low	Low	0.2	No Jeopardy
Vulpes vulpes necator	Sierra Nevada red fox	High	Low	Low	0.2	No Jeopardy
Zapus hudsonius luteus	New Mexico meadow jumping mouse	High	Low	High	3.4	No Jeopardy

All the species listed in Table 1 have a medium or high vulnerability ranking, indicating that the species are likely less robust to any adverse effects that occur to individuals. However, while these species may be more vulnerable to adverse effects from pesticides, all species in this group have a low exposure ranking, specifically based on the low level of total overlap between their ranges and agricultural use areas (including application sites and spray drift and runoff areas). The total overlap metric we use 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 (which we expect would only further decrease the likelihood of exposure). Given that exposure is unlikely to occur without considering any additional factors that would further reduce the extent of exposure reasonably certain to occur, we have high confidence that, at most, only small numbers of individuals of each of these species are likely to experience exposure to carbaryl.

In addition to agricultural uses, the species listed above may be exposed to carbaryl through non-agricultural uses. While it is possible individuals in these areas may be exposed to carbaryl, we anticipate that exposure is unlikely to occur given the low level of usage that occurs in these use sites. For instance, species like the Mexican wolf, jaguar, Canada lynx, Ozark big-eared bat, southern mountain (=woodland) caribou, Carolina northern flying squirrel, Point Arena mountain beaver, New Mexico meadow jumping mouse, and Sierra Nevada red fox can be found in managed forests. However, available usage data from the U.S. Forest Service show that no carbaryl has been applied to managed forests in the ranges of any of these species (except for the Canada lynx and woodland caribou) during the reporting period. Even in the case of the Canada lynx and woodland caribou, usage data indicate that 879 acres have been treated with carbaryl over a 5-year period (2016-2020), with the majority of applications covering less than 1 acre and distributed over 3 regions covering 11 different states (some of which contain the Canada lynx or woodland caribou's range). Applications in these areas are made using hand-held mist blowers, which we expect to be a highly targeted application method that renders drift unlikely and reduces the extent of area treated, suggesting that exposure to the lynx and caribou are unlikely to occur.

Many species in the table above, including the jaguar, Roy Prairie pocket gopher, Pacific sheath-tailed bat, New Mexico meadow jumping mouse, Olympia pocket gopher, Tenino pocket gopher, and the Yelm pocket gopher can occur on rangeland habitats where carbaryl might be used. Available usage data from USDA APHIS show that, from 2019-2023, no carbaryl has been used on rangeland habitats within the ranges of these species. While there are records of some carbaryl applications to rangeland habitats within the Utah prairie dog's range, these applications were made using carbaryl insect bait. Bait applications are not likely to result in direct exposure to the prairie dog as we do not anticipate carbaryl bait is attractive to rodents and bait applications will not result in off-target spray drift exposure. In addition, 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 programs (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. Thus, we do not expect these species are likely to be exposed to carbaryl through rangeland uses.

Species like the Virginia big-eared bat and Pacific sheath-tailed bat can occur in and travel through urban areas where carbaryl can be used. Current product labels limit most residential and developed uses of carbaryl to spot and crack-and-crevice treatments using hand-held equipment, which we anticipate will greatly limit the extent of spray drift and off-target exposure to these bats. These bats, along with the San Bernardino Merriam's kangaroo rat and the Pacific marten, can also occur in open space developed areas, while the Pacific pocket mouse can occur in rights of way. Available data on open space developed uses of carbaryl (such as turf or golf course applications) indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl while only 500 pounds of carbaryl are used nationally on rights of way each year. While this open space developed and rights of way 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 open space developed and rights of way usage are likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within a particular species' range. Given the variety of usage data available, as well as existing conservation measures, for non-agricultural uses of carbaryl, we anticipate no more than a small number of individuals of each of the species in Table 1 will be exposed and experience adverse effects from non-agricultural uses of carbaryl.

Additionally, many species in this group have a low toxicity ranking and they are not likely to experience direct adverse effects. For species with low toxicity rankings, we do not anticipate they will occur on or forage in agricultural use sites. EPA's environmental fate modeling indicates that mammal species in off-field areas are not likely to accumulate more than low levels of carbaryl, further reducing the likelihood of adverse effects to the species.

In the case of species that can occur in or forage on agricultural use sites, such as the San Bernardino Merriam's kangaroo rat, Roy Prairie pocket gopher, Penasco least chipmunk, Pacific sheath-tailed bat, New Mexico meadow jumping mouse, Olympia pocket gopher, Tenino pocket gopher, Yelm pocket gopher, and Mariana fruit bat, we expect individuals on-field will accumulate high levels of carbaryl and are likely to die or experience high levels of sublethal effects (such as impaired motor activity and behavior and reduced growth and reproduction), which can increase an individual's risk of predation or decrease their overall fitness. However, we anticipate this level of adverse effect will occur infrequently as agricultural use sites make up only a small portion of the species' range and they do not preferentially occur on agricultural use sites. As such, while there may be a high level of adverse effects to exposed individuals, we expect only a small number of individuals will be exposed on-field throughout the duration of the proposed action.

Given that we anticipate small numbers of individuals of the species in Table 1 are likely to be exposed and that most exposed individuals will not experience high levels of mortality, sublethal effects, or loss of food resources, we expect the proposed action will result in the death or sublethal adverse effects to, at most, a very small number of individuals of these species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce 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 the species listed in Table 1.

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Note: The Sonoran pronghorn (EXPN Entity ID: 10141) and Mexican wolf (EXPN Entity ID: 10484) have non-essential experimental populations.

Species with low past usage - California Department of Pesticide Regulation

The species in Table 2 are grouped together because they occur completely within California and have low exposure as informed by low levels of past carbaryl usage within their ranges (% Range Treated), according to the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data. 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. Mammals with low exposure (informed by low past usage from California Department of Pesticide Regulation (CalPUR) data).

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Dipodomys heermanni morroensis	Morro Bay kangaroo rat	High	Low	High	0.1	No Jeopardy
Dipodomys ingens	Giant kangaroo rat	High	Low	Low	0.9	No Jeopardy
Dipodomys nitratoides exilis	Fresno kangaroo rat	High	Low	Low	0.8	No Jeopardy
Dipodomys nitratoides nitratoides	Tipton kangaroo rat	High	Low	Low	1.2	No Jeopardy
Microtus californicus scirpensis	Amargosa vole	High	Low	Low	0.0	No Jeopardy
Neotoma fuscipes riparia	Riparian woodrat (=San Joaquin Valley)	High	Low	Low	0.7	No Jeopardy
Reithrodontomys raviventris	Salt marsh harvest mouse	High	Low	High	0.0	No Jeopardy
Sylvilagus bachmani riparius	Riparian brush rabbit	High	Low	High	1.4	No Jeopardy
Vulpes macrotis mutica	San Joaquin kit fox	High	Low	High	0.5	No Jeopardy

All species 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. The Amargosa vole, Fresno kangaroo rat, giant kangaroo rat, Tipton kangaroo rat, and riparian woodrat have low toxicity rankings, indicating that individuals exposed to carbaryl are not likely to die or experience sublethal effects (e.g., impaired motor activity and behavior, reduced growth and reproduction). These species are not known to occur on agricultural use sites, indicating that individuals are only likely to be exposed to carbaryl in off-field areas, where exposure concentrations will be low.

In contrast, species like the San Joaquin kit fox, Morro Bay kangaroo rat, salt marsh harvest mouse, riparian brush rabbit, and Buena Vista Lake ornate shrew have high toxicity rankings. These species may occur on and forage in agricultural use sites, which will result in high levels of exposure and high levels of direct adverse effects, including mortality. Individuals that do not die from on-field exposure are likely to experience high levels of sublethal adverse effects, which include temporary impairment of motor activity and behavior. However, we expect these adverse effects will occur infrequently as we anticipate very little carbaryl usage is likely to occur within these species' ranges.

All species in this group have a low exposure ranking. Mandatory pesticide usage reporting data collected by the state of California indicates very little carbaryl has been used in the agricultural areas where these species' ranges occur, ranging from 0 to 1.4% of each species' range treated annually with carbaryl from 2013-2022. Given that usage reporting is mandated by the state of California and that these data are provided regularly with relatively high spatial resolution, we have high confidence that only a small percentage of the species' ranges are likely to be exposed to carbaryl from agricultural uses in the proposed action.

In addition to agricultural uses, the species listed above may be exposed to carbaryl through non-agricultural uses. For instance, the San Joaquin kit fox can migrate, travel, or forage in open space developed and rangeland use sites, while the riparian brush rabbit may forage short distances into open space developed areas that are adjacent to its habitat. While it is possible these species may be exposed to carbaryl in non-agricultural use sites, we anticipate that exposure is unlikely to occur given the low level of carbaryl usage on non-agricultural areas. Available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland habitats in California have been treated with carbaryl. In addition, 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 programs (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. Available carbaryl usage data on open space developed areas (such as turf or golf course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. 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 open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the San Joaquin kit fox's range. Given this usage data, we anticipate no more than small numbers of individuals of each species listed in Table 2 will be exposed to carbaryl through non-agricultural uses and experience adverse effects (including death or sublethal impacts).

Given that we anticipate small numbers of individuals in Table 2 are likely to be exposed and that most exposed individuals will not experience high levels of mortality, sublethal effects, or loss of food resources, we expect the proposed action will result in the mortality of, at most, a very small number of individuals of these species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce 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 the species listed in Table 2.

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

The species in Table 3 are grouped together because we expect low exposure (% Range Treated) confirmed by low levels of past insecticide usage within their ranges, as informed by the USDA's Census of Agriculture (CoA). 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. Species with low exposure (confirmed by low past usage from U.S. Department of Agriculture's Census of Agriculture (CoA)).

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Mustela nigripes	Black-footed ferret	High	Low	High	1.6	No Jeopardy
Odocoileus virginianus leucurus	Columbian white-tailed deer	High	Low	High	0.3	No Jeopardy
Peromyscus polionotus ammobates	Alabama beach mouse	High	Low	High	2.4	No Jeopardy
Ursus arctos horribilis	Grizzly bear	Medium	Low	High	1.0	No Jeopardy
Zapus hudsonius preblei	Preble's meadow jumping mouse	Medium	Low	High	3.3	No Jeopardy

All species in Table 3 have a medium or high vulnerability ranking, indicating that the species are likely less robust to any adverse effects that might occur to individuals than those with low vulnerability. Additionally, these species have high toxicity rankings as we anticipate a large proportion of individuals that forage on carbaryl use sites recently after an application is made (i.e., within 24 hours) are likely to die.

However, while these species may be more vulnerable to adverse effects from pesticides and are likely to experience high levels of on-field adverse effects, all species in this group have a low exposure ranking. As such, we anticipate only a small number of individuals are likely to be exposed to carbaryl given the low insecticide usage in the past across their ranges as informed by the USDA CoA. Low CoA all insecticide usage indicates that very little insecticide usage (of any type) occurred in the past in the counties where these species' ranges occur. Given that this reporting broadly includes all insecticide usage, we consider CoA data to be conservative estimates of carbaryl usage that indicate very little of the species' ranges are likely to be treated.

In addition to agricultural uses, the species in Table 3 may be exposed to carbaryl through non-agricultural uses. For example, the grizzly bear and Columbian white-tailed deer can occur in managed forests, open space developed, and rangeland use sites. Similarly, the Preble's meadow jumping mouse and Alabama beach mouse can occur in open space developed use sites, and the jumping mouse can also occur in rangeland use sites. While it is possible these species may be exposed to carbaryl in non-agricultural use sites, we anticipate that exposure is unlikely to occur given the low level of non-agricultural usage. Available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland habitats within the ranges of the Columbia white-tailed deer or the Preble's meadow jumping mouse have been treated with carbaryl. While rangeland habitat in three counties within the grizzly bear's range were treated with carbaryl from 2019-2023, all three applications were made with carbaryl bait. We expect bait will not result in direct exposure because it is not attractive to bears and it will not cause off-target spray drift. In addition, 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 programs (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. Similarly, available usage data from the U.S. Forest Service indicate that, from 2016-2020, no carbaryl has been used in managed forests within the Columbia white-tailed deer's range. U.S Forest Service usage data indicate that 557 acres of managed forests within the general regions overlapping the grizzly bear's range were treated with carbaryl over a 5-year period (2016-2020). We do not anticipate all treated acres of managed forests occur in a single location nor are they all concentrated within the grizzly bear's range as the majority of applications cover less than 1 acre and are distributed over three regions covering 10 different states. Furthermore, applications in these areas are made using hand-held mist blowers, which we expect to be a highly targeted application method that renders drift unlikely and reduces the extent of area treated, suggesting that exposure to the grizzly bear is unlikely to occur from forestry applications of carbaryl.

Similarly, available usage data on open space developed uses of carbaryl (such as turf or golf course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. 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 open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the Columbia white-tailed deer, grizzly bear, Alabama beach mouse, or Preble's meadow jumping mouse ranges. Given the available usage data, we anticipate no more than a small number of individuals of each of the species listed in Table 3 will be exposed and experience mortality or sublethal adverse effects from non-agricultural carbaryl use.

In summary, while the species in Table 3 have medium and high vulnerabilities and can experience high levels of mortality if exposed to carbaryl on-field, we anticipate very few individuals of these species are likely to be exposed on-field and experience direct adverse effects as there is a low level of past insecticide usage within their ranges as informed by the USDA Census of Agriculture. Therefore, we expect only small numbers of individuals of each species will die and 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 appreciably reduce 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 the species listed in Table 3.

Note: The grizzly bear (EXPN Entity ID: 12372; proposed Entity ID: 1302) and black-footed ferret (EXPN Entity ID: 7572) have non-essential experimental populations.

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

Scientific Name	Common Name	Determination
Myotis sodalis	Indiana bat	Jeopardy
Puma (=Felis) concolor coryi	Florida panther	No Jeopardy
Canis lupus	Gray wolf	No Jeopardy
Canis lupus	Gray wolf (Minnesota DPS)	No Jeopardy
Canis rufus	Red wolf	Jeopardy
Cynomys parvidens	Utah prairie dog	Jeopardy
Myotis grisescens	Gray bat	No Jeopardy
Puma yagouaroundi cacomitli	Gulf Coast jaguarundi	No Jeopardy
Leopardus (=Felis) pardalis	Ocelot	No Jeopardy
Peromyscus polionotus niveiventris	Southeastern beach mouse	No Jeopardy
Sorex ornatus relictus	Buena Vista Lake ornate shrew	Jeopardy
Brachylagus idahoensis	Pygmy Rabbit	No Jeopardy
Dipodomys elator	Texas kangaroo rat	No Jeopardy
Eumops floridanus	Florida bonneted bat	Jeopardy
Myotis septentrionalis	Northern Long-Eared Bat	No Jeopardy
Perimyotis subflavus	Tricolored bat	No Jeopardy

Integration and Synthesis Summary: Indiana bat

Scientific Name:	Common Name:	Entity ID:
Myotis sodalis	Indiana bat	1

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 medium. 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 and medium past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. As such, 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 Indiana bat. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 7/24/2024; Wherever found; *States within the range:* AL, AR, CT, DE, GA, IA, IL, IN, KS, KY, MD, MI, MO, MS, NC, NE, NJ, NY, OH, OK, PA, SC, TN, VA, VT, WI, WV

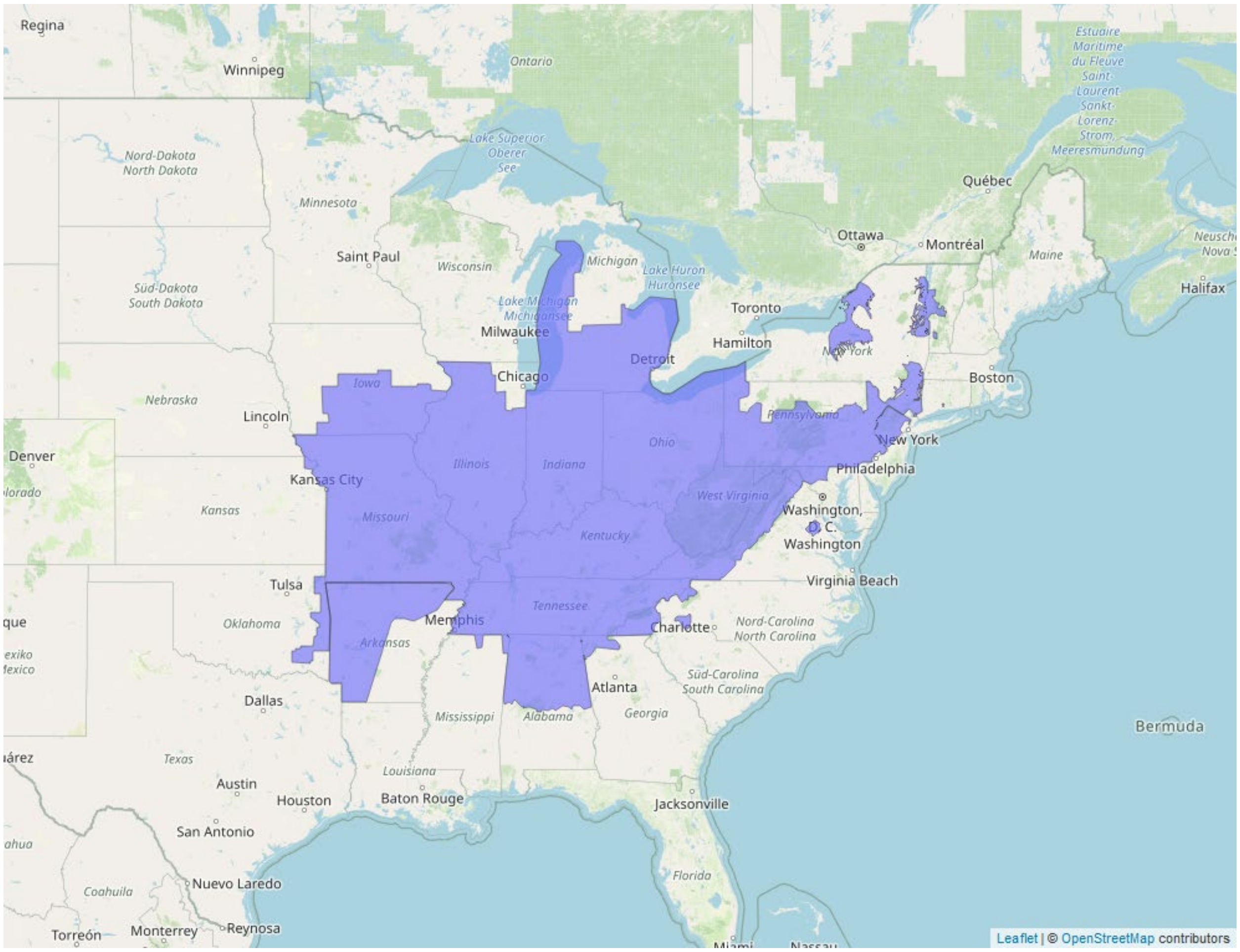

Figure 1. Range map of Indiana bat (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/5949.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 9/30/2019

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (numerous)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Indiana bats are insectivorous, temperate, migratory bats that hibernate colonially in caves and mines in winter. They are restricted to suitable underground hibernacula in winter, typically caves located in karst areas of the east-central U.S. They will also occasionally hibernate in abandoned mines. In summer, most reproductive females occupy roost sites under exfoliating bark of dead trees, usually those that receive direct sunlight for more than half of the day. Their historical distribution is believed to be the eastern United States from the central Mississippi Valley to northern AL and western New England. The current distribution is restricted from the historical distribution and fewer maternity colonies appear in the Midwest and central portions of the range than historically (USFWS 2007). Indiana bat populations declined from listing in 1967 through 2001, after which the population increased due to growth at hibernacula in Illinois, Indiana, Kentucky, New York, and West Virginia. The range-wide population decreased distinctly after 2009. In 2013, a very large previously unknown Indiana bat hibernaculum was discovered near Hannibal, Missouri and it contained at least 123,000 bats. Hannibal had over 197,000 bats when surveyed again in 2017. The 2019 range-wide Indiana bat population estimate was 537,297 with 71% hibernating in Missouri and Indiana. The 2019 estimate was a 4% decline from 2017 estimates and represented a 19% decline since 2007 (USFWS 2019).

Destruction and degradation of the bat's winter hibernacula (i.e., caves and mines) and summer habitat (i.e., forests) has been identified as a longstanding and ongoing threat to the species (USFWS 2019). Human disturbance of hibernating bats was originally identified as one of the primary threats to the species and remains a threat at several important hibernacula in the bat's range (USFWS 2007). Most human disturbance to hibernating bats result from cave commercialization (e.g., cave tours and other commercial uses of caves), recreational caving, vandalism, and research-related activities. Most Indiana bat declines were attributed to declines at high-priority hibernacula in Kentucky and Missouri and to a lesser extent, Indiana. White-Nose Syndrome (white-nose) emerged in New York in 2007 and caused mortality of thousands of hibernating bats, including Indiana bats. As of 2017, the entire range of Indiana bats is affected by white-nose. Indiana bats fare better than other species affected by white-nose, but their fitness, reproductive success, and survival is still affected, and they remain at risk of long-term extinction from effects of white-nose. Several populations of Indiana bats have severely declined due to white-nose (USFWS 2019). Additional threats include: quarrying and mining operations (summer and winter habitat), loss/degradation of summer/migration/swarming habitat, loss of forest habitat connectivity, some silvicultural practices and firewood collection, disease (i.e., white-nose, rabies) and parasites, predation (i.e., raccoons, mink, snakes, owls, and feral cats), competition with other bat species, environmental contaminants, climate change, and collisions with man-made objects (e.g., wind turbines, communication towers, airplane strikes, and roadkill) (USFWS 2007). Organophosphate and carbamate insecticides, oil spills, and polychlorinated biphenyls (PCBs) were noted as anthropogenic threats. Wind turbines have been associated with bat fatalities; multiple wind energy companies are working with the Service to operate their facilities in ways to avoid impacts to Indiana bats. Changes in climate (e.g., precipitation, temperature) may affect hibernation periods, roosting areas, and general habitat condition in the future (USFWS 2019).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

Data indicate that 30.2% of the species' range overlaps with agricultural use sites and 11.3% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 5). In total, there is approximately 41.5% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 5. Agricultural use overlap and annual usage data (% Range Treated) for the Indiana bat.

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	1.3	1.8	3.1	<0.1	<0.1	0.2
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	23.3	5.9	29.2	0.8	0.2	1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.9	2.4	5.2	2.5	2.1	4.6
Other Grains	0.4	0.6	1	<0.1	<0.1	<0.1
Other Orchards[2]	0.2	0.2	0.3	<0.1	<0.1	0.2

[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.

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 Row Crops	0.3	0.1	0.4	<0.1	<0.1	<0.1
Soybeans[3]	24.7	5.8	30.5	3.3	0.8	4.1
Vegetables and Ground Fruit	0.5	0.4	0.9	0.2	0.1	0.3
Total	**30.2**	**11.3**	**41.5**	**6.1**	**3.2**	**9.3**

Usage

Past usage data indicate that up to 9.3% of the species' range has been treated with carbaryl annually from agricultural uses (Table 5).

Additional Exposure Considerations

Indiana bats make extensive use of agricultural edges for foraging and as travel corridors. Maternity colonies are commonly found near agricultural areas. Bats hibernate from late October to early April, and they congregate near hibernacula in the fall when bats forage intensively and breed just prior to hibernation. We anticipate pup rearing likely coincides with periods of high agricultural activity, including pesticide application. As such, we expect individuals are likely to experience exposure at different life stages.

Non-agricultural Uses

In addition to agricultural uses of carbaryl, we anticipate individuals may be exposed to non-agricultural uses of carbaryl, specifically uses in managed forests and rangelands, as the species is known to nest in and along the edges of managed forests and rangelands. However, we do not anticipate these uses will significantly contribute to the overall exposure of the species. U.S. Forest Service indicate that no carbaryl has been used in the regions where the Indiana bat's range occurs from 2016 - 2022. Similarly, available usage data from USDA APHIS indicate that no carbaryl has been used on rangelands within the states where the Indiana bat's range occurs from 2019 - 2023. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024). As such, we do

[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.

not expect non-agricultural uses will result in the exposure of more than a small number of individuals.

Exposure Summary

There is a high extent of overlap between agricultural use areas and the species' range (41.5% total overlap). Based on past usage data, we expect a medium level of usage within the species' range, with up to 9.3% of the range treated with carbaryl annually. We do not anticipate non-agricultural uses of carbaryl will result in exposure to more than a small number of individuals. Given that a large portion of the species' range overlaps with agricultural use areas and that a moderate portion of the species' range is likely to be treated annually, we anticipate a large number of individuals are likely to be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

The Indiana bat primarily consumes flying insects for food and has been observed foraging over agricultural fields (among other areas). As such, we anticipate individuals are likely to consume contaminated prey on- and off-field. EPA's exposure modeling predicts individuals that feed on-field are likely to accumulate levels of carbaryl up to 32.2-107.4 mg/kg-bw depending on the application rate, which can cause up to 37-99% mortality of exposed individuals. Dietary exposure to carbaryl in areas off-field (up to 30 meters from the edge of field) will result in 1.1-1.4 mg/kg-bw, which will not cause any mortality or sublethal adverse effects.

Indirect Effects:

The Indiana bat is considered an obligate insectivore. Based on available toxicity data in insect species, we anticipate there will be a high level of insect mortality. However, we expect the level of mortality will vary across species as a result of natural variability in physiology, exposure, and other factors. As such, we do not expect the entire insect community is likely to experience complete mortality and that individual bats will still have sufficient food resources available, particularly in areas away from carbaryl use sites. As such, we do not anticipate more than low levels of indirect adverse effects are likely. Additionally, we anticipate individuals can find alternative food sources in areas that are not near carbaryl use sites as individuals are highly mobile and can forage in a wide array of habitats.

Toxicity Summary

The Indiana bat is likely to experience a high level of direct adverse effects. Given that individuals are known to forage for insects on agricultural areas, we anticipate most individuals will accumulate a high level of carbaryl, resulting in a high level of mortality (up to 37-99% of exposed individuals). We do not anticipate individuals that are only exposed to carbaryl off-field (up to 30 m) are likely to experience any mortality or sublethal adverse effects.

The Indiana bat is likely to experience low levels of indirect effects. While the species primarily consumes flying insects, we do not anticipate the entire insect community will experience complete mortality with carbaryl exposure and that there will still be some prey available for individuals to consume. Additionally, as a highly mobile species, we expect individuals are likely to find other sources of prey away from use sites that are not likely to experience large reductions in insect abundance.

While we anticipate only low levels of adverse indirect effects are likely to occur, the high level of mortality of individuals that forage on-field result in a high toxicity ranking for the species.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Indiana bat has a high exposure ranking. There is a high extent of overlap between the action area and the species' range and a moderate level of past usage, indicating a large number of individuals are likely to be exposed over the duration of the proposed action. Furthermore, given that individuals are known to forage in and near agricultural areas, including agricultural use sites, we anticipate exposure is likely to occur. Based on available non-agricultural usage data, we do not anticipate more than a small number of individuals will be exposed through non-agricultural uses.

The Indiana bat has a high toxicity ranking as a large percentage of individuals foraging on recently treated agricultural fields are likely to experience mortality. We do not anticipate any direct adverse effects are likely to occur off-field. We anticipate only a low level of indirect adverse effect as do not anticipate the entire insect prey community will die and there will be sufficient food resources available, especially in areas far from use sites.

Given that we expect a large number of individuals are likely to be exposed and die from agricultural uses, we expect the overall risk of adverse effects to the species is high.

Conclusion

The Indiana bat has a medium vulnerability based on its status, distribution, and trends, as described above. The likelihood of exposure from labeled uses across the range is high, with a medium amount of estimated usage, but a high level of overlap suggesting the species is likely to be exposed across a large percentage of its range.

We anticipate mortality will occur to bats primarily from consumption of insects exposed on use sites. Carbaryl usage on any use site has the potential to result in mortality to terrestrial invertebrate prey resources from spray drift (whether the species will use the site itself). Indiana bats make extensive use of agricultural edges (and edges between forested areas and other open areas) for foraging and as travel corridors (D. Sparks, Indiana Field Office, personal communication, 2024). Thus, we anticipate such direct exposure to contaminated prey will be the largest source of adverse effects to the species. We also anticipate low levels of adverse effects will occur from a reduction in prey resources (i.e., terrestrial invertebrates) within some use areas and spray drift areas, but that individuals encountering treated fields lacking invertebrate prey can and will seek alternative feeding areas. As the species actively forages in use sites and the edges of such sites, we anticipate large, intense but short duration, reductions in prey resources over the duration of the proposed action.

Therefore, we expect impacts to be high and an unknown, but significant, number of individuals to die from consumption of contaminated prey on and adjacent to use sites. Considering the medium 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 Indiana bat.

References

Kniowski, A. B., and S. D. Gehrt. 2014. Home range and habitat selection of the Indiana bat in an agricultural landscape. The Journal of Wildlife Management 78(3):503-512.

Sparks, D. W., C. M. Ritzi, J. E. Duchamp, and J. O. Whitaker, Jr. 2005. Foraging habitat of the Indiana bat (*Myotis sodalis*) at an urban-rural interface. Journal of Mammalogy 86(4):713-718.

U.S. Fish and Wildlife Service. 2019. Indiana Bat (*Myotis sodalis*) 5-Year Review: Summary and Evaluation. Fort Snelling, Minnesota. 91 pp.

U.S. Fish and Wildlife Service. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Fort Snelling, Minnesota. 258 pp.

Integration and Synthesis Summary: Florida panther

Scientific Name:	Common Name:	Entity ID:
Puma (=Felis) concolor coryi	Florida panther	8

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 and medium past usage of carbaryl within the species' range, indicating a high extent of exposure. No exposed individuals are likely to die, and few exposed individuals are likely to experience sublethal adverse effects. As such, we determine the risk of adverse effects to the 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 likely 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 expected to jeopardize the continued existence of the Florida panther. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/27/2022; Wherever found; *States within the range:* FL

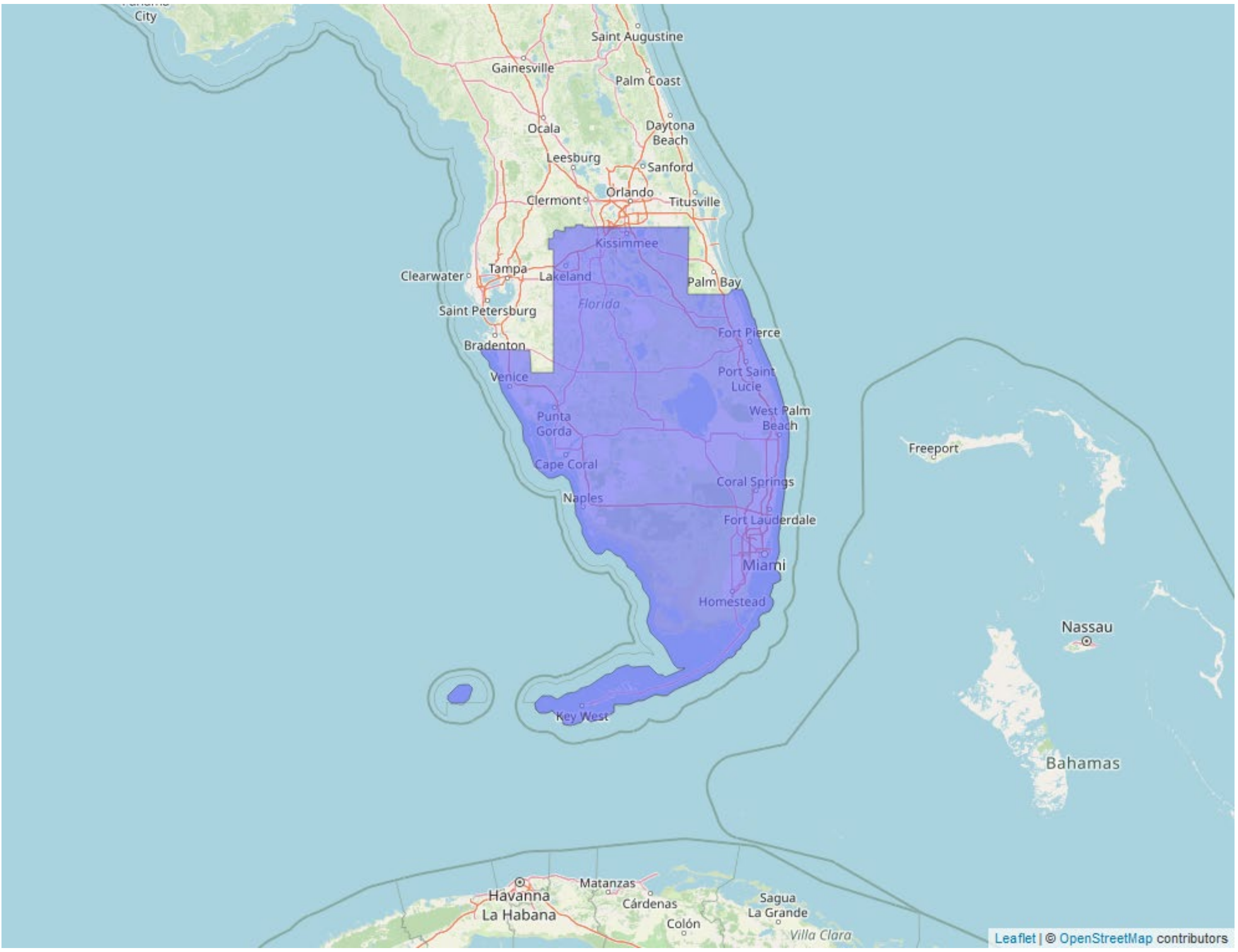

Figure 2. Range map of Florida panther (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1763.

Vulnerability

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

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 4/28/2009

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

Number of populations: Single population

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Florida panther is the last subspecies of puma remaining in the eastern U.S. Florida panthers are wide-ranging, secretive, and require large contiguous areas with dense understory to meet their social, reproductive, and energetic needs. They historically occurred throughout the southeastern U.S. (from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee) and are now restricted to less than 5% of their historical range. Florida panthers are only found in one breeding population in south Florida, which increased from 12-20 adults in the 1970s to 100-120 adults in 2007 (USFWS 2008). The population is believed to be increasing, at least in the short-term, due to increased sightings of uncollared panthers, numbers of roadkill panthers, and number of known den sites (USFWS 2009). The primary threat to Florida panthers is human development and resultant habitat loss, degradation, and fragmentation. Potential panther habitat in southern Florida continues to be affected by urbanization, residential development, road construction, conversion to agriculture, mining and mineral exploration, and lack of land use planning (USFWS 2008).

Panthers are also threatened by environmental contaminants, including mercury and pesticides, and they experience bioaccumulation because they are carnivores (USFWS 2009). At least one panther was believed to have died from mercury toxicosis and elevated levels of a breakdown product of an organochloride pesticide (i.e., p,p`-DDE) were detected in fat from a deceased panther (USFWS 2008). Documented mortality causes of collared panthers include intraspecific aggression and vehicle collisions. Natural genetic exchange with other panther populations ceased when the Florida panther became geographically isolated over a century ago, and loss of genetic variability and diminished health are concerns for the Florida panther (USFWS 2009).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 15.4% of the species' range overlaps with agricultural use sites and 6.1% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 6). In total, there is approximately 21.5% 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 Florida panther.

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[4]	6.2	2.9	9.1	0.7	0.3	1
Corn[5]	0.3	0.2	0.6	0.1	<0.1	0.2
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	4	1.8	5.8	4	1.8	5.8
Other Grains	4.4	0.7	5.1	<0.1	<0.1	<0.1
Other Orchards	0.6	0.4	1	0.6	0.4	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	0.4	0.5	0.9	<0.1	0.1	0.2
Total	**15.4**	**6.1**	**21.5**	**4.9**	**2.3**	**7.2**

Usage

Past usage data indicate that up to 7.2% of the species' range has been treated with carbaryl annually from agricultural uses (Table 6).

Non-agricultural Uses

In addition to agricultural uses of carbaryl, we anticipate individuals may be exposed to non-agricultural uses of carbaryl, specifically uses in managed forests and rangelands, as the species

[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.

is known to forage, den, and travel through forests and rangelands. However, we do not anticipate these uses will significantly contribute to the overall exposure of the species. Past usage data from the U.S. Forest Service and USDA APHIS indicate that no carbaryl has been used on managed forests or rangelands within the state of Florida, where the panther's range occurs, within the reporting years described above. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024). As such, we do not expect non-agricultural uses will result in the exposure of more than a small number of individuals.

Exposure Summary

There is a high extent of overlap between agricultural use areas and the species' range (21.5% total overlap). Based on past usage data, we expect a moderate level of usage within the species' range (up to 7.2% of the range treated annually). Despite the lower level of usage, the large extent of overlap suggests that a large portion of the range is likely to be treated over the duration of the proposed action. We do not anticipate non-agricultural use of carbaryl will expose more than a small number of individuals over the duration of the proposed action as we expect very low usage non-agricultural uses within the panther's habitat. Based on the high level of overlap and moderate level of past usage in agricultural areas, we expect a large number of individuals are likely to be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate the main route of exposure for the Florida panther is through dietary exposure (i.e., consuming prey that consumed food contaminated with carbaryl). While the panther can consume a variety of prey items, we expect individuals primarily consume large mammal prey (e.g., deer, feral hogs) but may consume smaller animals as well (e.g., raccoons, armadillos, rabbits) and occasionally reptiles (e.g., alligators). EPA's exposure modeling indicates that individuals that consume large mammals that have recently fed on contaminated food on carbaryl use sites can accumulate up to 2-6.6 mg/kg-bw depending on the specific application rate. We do not anticipate this level of exposure will cause any mortality. We anticipate minor sublethal adverse effects to growth and reproduction are likely to occur, but only at the highest dietary exposures estimated to occur. We do not expect any direct adverse effects are likely to occur in individual exposed to carbaryl off-field (up to 30 meters off-field) as dietary doses are predicted to be well below levels where any adverse effects were observed in mammalian toxicity studies.

Indirect Effects:

EPA's exposure modeling indicates that large mammal prey (such as those the Florida panther primarily consumes) may experience a range of adverse effects depending on where they forage. Large mammal prey that exclusively forage on carbaryl use sites are likely to experience high levels of mortality, while individuals that forage off-site are not likely to experience any direct adverse effects. Given that we expect only a portion of the prey base is likely to die, we anticipate sufficient prey resources will still be available for individual panthers to consume. As such, we expect only low levels of indirect effects are likely to occur.

Toxicity Summary

Individual panthers are most likely exposed to carbaryl through dietary exposure on-field. We do not anticipate any mortality is likely to occur as estimated dietary doses on-field are well below levels where toxicity studies suggest mortality would occur. While some sublethal adverse effects to growth and reproduction may occur, we anticipate this sublethal effect will be minor as only the highest estimated dietary dosage on-field is likely to cause this effect. We do not anticipate any direct adverse effects are likely to occur off-field as we expect individuals will accumulate only low levels of carbaryl in areas away from treatment sites.

We expect a low level of indirect adverse effects will occur. While large mammal prey that consume contaminated food items on carbaryl use sites are likely to die, we do not expect any prey mortality will occur off-field. As such, while we anticipate some reductions in prey abundance are likely, we do not anticipate this will result in more than low levels of indirect adverse effects as we expect there will be sufficient prey resources remaining to support individuals.

Given that we expect only low levels of direct adverse effects and low levels of indirect adverse effects, we determine the Florida panther has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Florida panther has a high exposure ranking. There is a high extent of overlap between the species' range and a moderate level of past usage within the species' range, indicating that a large number of individuals are likely to be exposed annually from the proposed action. Based on available usage data for non-agricultural uses, we do not anticipate more than a small number of individuals will be exposed to carbaryl through non-agricultural uses over the duration of the proposed action.

The Florida panther has a low toxicity ranking. We do not anticipate any mortality will occur to individuals exposed to carbaryl both on and off-field. We anticipate some minor sublethal adverse effects to growth or reproduction may occur from on-field dietary exposure, but we expect this effect will be minor. We expect there will only be minor prey loss from the proposed action as large mammal prey is only likely to die when foraging on carbaryl use sites immediately after applications are made, which we expect is unlikely to occur.

While we anticipate a large number of individuals will be exposed, we anticipate only minor adverse effects are likely to occur to exposed individuals and that only very small numbers of individuals are expected to die or experience sublethal effects. As such, we anticipate the overall risk of adverse effects to the species is low.

Conclusion

The Florida panther has a high vulnerability based on its status, distribution, and trends, as described above. While the overlap of carbaryl use sites is high, we anticipate the likelihood of exposure from usage across the range is low as the species is not likely to come into contact with prey items containing a dietary dose likely to cause mortality (i.e., large mammal prey that have foraged on a treatment site immediately after an application of carbaryl). Likewise, we expect a low level of indirect adverse effects we only expect large mammal prey foraging on carbaryl treatment sites will die, resulting in only a small impact to the panther's prey base.

Therefore, while exposure may be high, we anticipate only a small number of individuals will experience any level of adverse effect. Considering the anticipated low level of adverse effects, species-level effects are unlikely 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 Florida panther.

References

U.S. Fish and Wildlife Service. 2009. Florida panther (*Puma concolor coryi*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 32 pp.

U.S. Fish and Wildlife Service. 2008. Florida Panther Recovery Plan. 3rd Revision. Atlanta, Georgia. 233 pp.

Integration and Synthesis Summary: Gray wolf

Scientific Name:	Common Name:	Entity ID:
Canis lupus	Gray wolf	11

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 medium. 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 and medium past usage of carbaryl within the species' range, indicating a high extent of exposure. However, no exposed individuals are likely to die and only small levels of prey loss are likely to occur. As such, we determine the risk of adverse effects to the 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 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 gray wolf. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/17/2024; U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, IA, IN, IL, KS, KY, LA, MA, MD, ME, MI, MO, MS, NC, ND, NE, NH, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, and WV; and portions of AZ, NM, OR, UT, and WA as follows: (1) Northern AZ (that portion north of the centerline of Interstate Highway 40); (2) Northern NM (that portion north of the centerline of Interstate Highway 40); (3) Western OR (that portion of OR west of the centerline of Highway 395 and Highway 78 north of Burns Junction and that portion of OR west of the centerline of Highway 95 south of Burns Junction); (4) Most of Utah (that portion of UT south and west of the centerline of Highway 84 and that portion of UT south of Highway 80 from Echo to the UT/WY Stateline); and (5) Western WA (that portion of WA west of the centerline of Highway 97 and Highway 17 north of Mesa and that portion of WA west of the centerline of Highway 395 south of Mesa). Mexico.; *States within the range:* CA, MI, OR, WA, WI

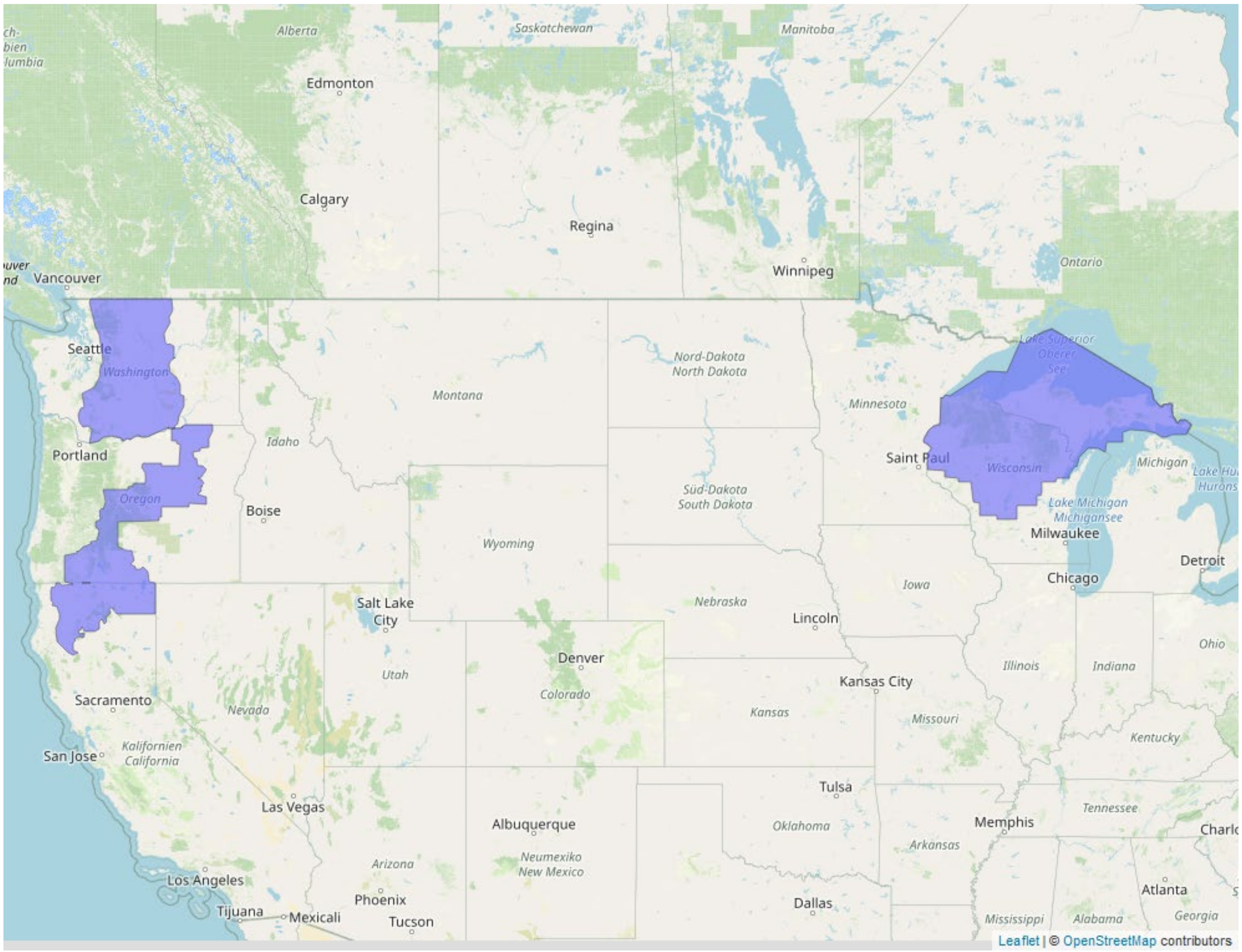

Figure 3. Range map of Gray wolf (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4488.

Vulnerability

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

Listing status: Endangered

Most recent 5 Year Status Review recommendation: Delist: The species does not meet the definition of an endangered species or a threatened species.

Most recently completed 5 Year Status Review: 11/3/202011/3/2020

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (numerous)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Gray wolves are the largest wild members of the canid (dog) family and have a broad circumpolar range including North America, Europe, and Asia. The gray wolf is a keystone predator (in North American, primarily medium and large mammals) and an integral component of their ecosystems. The wide range of habitats in which wolves thrive reflects their adaptability and includes temperate forests, mountains, tundra, taiga, and grasslands. We consider suitable habitat to be areas containing adequate wild ungulate populations (e.g., elk and deer) and a low risk of conflict with humans (e.g., low road density, low human density, adequate natural cover without agricultural land), which generally allows for increased pack persistence (Mech 2017). Specifically, wolf presence is negatively correlated with agricultural land uses. They are highly social animals with the ability to quickly expand and recolonize vacant habitats. Historical population estimates for gray wolves in the western U.S. are in the hundreds of thousands. They used to occupy most of the conterminous U.S., except the southeast (USFWS 2023). In the northeast, wolves were extirpated by 1900 and as of 2003, there was no reliable evidence of breeding pairs or wolves with established territories. Wolves were also extirpated from the Great Plains by the early 1900s. By the 1940s, wolves in Washington and Oregon became rare due to human persecution and were only found in remote mountainous areas (i.e., National Forests, Cascade Mountains). They were extirpated from Washington, Oregon, California, and Nevada soon after (USFWS 2012). In the 1980s and 1990s, wolves naturally recolonized northern Montana from Canada. In 1995-1996, wolves were reintroduced to central Idaho and Yellowstone National Park. Since then, wolves have continued to expand their range in the western U.S., and wolf packs have established in California, Oregon, Washington, and Colorado. Dispersing wolves have also been observed in Arizona, Nevada, New Mexico, and Utah. Wolves in the western U.S. generally seem to be increasing and their range is expanding (USFWS 2023). The gray wolf metapopulation in the western U.S. is connected to a large and expansive population of about 15,000 wolves in western Canada (USFWS 2020). As of 2022, states estimated that there were 2,797 wolves distributed among over 286 packs in seven states (USFWS 2023). In Colorado, there is a non-essential experimental population (Entity ID: 11698).

Between European settlement and the 1930s, poisoning, unregulated trapping and shooting, and public funding of wolf extermination efforts nearly eliminated gray wolves from the western U.S. Still, the primary threat to western gray wolves is human-caused mortality (i.e., regulated harvest in Idaho, Montana, Washington, and Wyoming; lethal control of wolves depredating livestock in the Northern Rocky Mountains; illegal take; vehicle collisions). Because of gray wolf social structure, the death of one or both breeders in a pack may increase breeder turnover and negatively affect pack persistence, reproductive success, and recruitment because, in most instances, only the dominant male and female in a pack breed. Diseases are common in carnivores and cause episodic, but usually short-term, population decreases for gray wolves. Inbreeding depression and other genetic concerns have been documented in wild wolf populations. Climate change may affect wolves through long-term changes to prey availability, increased frequency or intensity of wildfires, and increased exposure to disease (USFWS 2023).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

Data indicate that 14% of the species' range overlaps with agricultural use sites and 8.3% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 7). In total, there is approximately 22.3% 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 gray wolf.

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	3.8	2.7	6.5	0.4	0.3	0.8
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn[6]	4.8	2	6.8	0.4	0.2	0.6
Grapes	0.2	0.2	0.4	<0.1	<0.1	<0.1
Other Crops	2.4	1.5	3.9	2.1	1	3
Other Grains	0.9	1.1	2	<0.1	<0.1	<0.1
Other Orchards[7]	0.6	0.4	1	0.4	0.3	0.7

[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.

[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.

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 Row Crops	0.1	0.1	0.2	<0.1	<0.1	<0.1
Soybeans	2.8	1.5	4.3	0.2	0.1	0.3
Vegetables and Ground Fruit	1.4	0.6	1.9	0.3	0.1	0.5
Total	**14**	**8.3**	**22.3**	**3.6**	**1.9**	**5.5**

Usage

Past usage data indicate that up to 5.5% of the species' range has been treated with carbaryl annually from agricultural uses (Table 7).

Additional Exposure Considerations

Gray wolves are habitat generalists and can successfully occupy a wide range of habitats, provided adequate prey exists and human-caused mortality is sufficiently minimized. Preferred habitat is characterized by relatively large blocks of undeveloped land, abundant year-round wild ungulate populations, low road densities, and low agricultural land uses, including crop fields. As such, we anticipate individuals are not generally likely to occur in or near carbaryl use sites.

Non-agricultural Uses

While gray wolves can occupy a wide range of habitats, we do not anticipate individuals are likely to occur in highly developed urban areas, indicating that the species is unlikely to be exposed through developed or nurseries uses of carbaryl. While individuals may occur in open space developed, managed forests, rangeland, and rights of way use areas, we do not anticipate individuals are likely to be exposed to carbaryl through these uses as past usage data suggests non-agricultural uses are infrequent within the gray wolf's range.

For instance, available usage data on open space developed uses of carbaryl (such as turf or gold course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or within the wolf's range, we expect this is highly unlikely to occur. Rather, we expect open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the wolf's range.

Available usage data from the U.S. Forest Service show no carbaryl has been applied in the regions containing the gray wolf's range from 2016 - 2020. Similarly, available usage data from USDA APHIS indicate that, between 2019 and 2023, rangeland areas in only in a single county in Washington state have been treated with carbaryl, in the form of carbaryl bait. We do not expect carbaryl in the form of insect bait will result in exposure to wolves. In addition, if applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024).

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 on an annual basis. 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 gray wolf's range for rights of way use.

In summary, based on available usage data, we do not anticipate non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

The gray wolf has a high extent of overlap (22.3% total overlap) with agricultural use areas. Past usage data indicate a moderate level of agricultural usage within the species' range (up to 5.5% range treated annually). We anticipate non-agricultural uses of carbaryl will not result in exposure to more than a small number of individuals. Given that there is a high level of overlap and a moderate level of usage in agricultural areas, we expect a large number of individuals are likely to be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate gray wolves will be exposed to carbaryl through dietary exposure by consuming prey species that have accumulated carbaryl through consuming contaminated food items and have yet to eliminate residues. Available information on gray wolves indicates that individuals primarily consume large mammals but have been known to switch to other prey species opportunistically. Consumption of large mammal prey items on agricultural use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses ranging from 2.2-2.9 mg/kg-bw, depending on the rate of application used on-field. We do not anticipate any individuals are likely to die or experience sublethal adverse effects (e.g., reduced growth, reduced reproduction, disrupted locomotor activity) as these levels are well below levels where mammalian studies have observed toxic effects. Similarly, we do not anticipate individuals that consume prey in off-field areas are likely to accumulate more than low levels of carbaryl (up to 0.5 mg/kg-bw) and are not likely to experience any direct adverse effects from off-field dietary exposure.

Indirect Effects:

We anticipate any large mammal prey that consume contaminated food items in agricultural fields that have been recently treated with carbaryl (i.e., within the last 24 hours) are likely to die. In contrast, we do not anticipate any direct adverse effects to large mammal prey will occur in areas off-field as dietary doses will be well below levels expected to cause any mortality or sublethal effects.

Toxicity Summary

We expect the gray wolf will primarily be exposed to carbaryl through dietary exposure. We do not expect any exposed individuals will experience any direct adverse effects as dietary dosages will be low. There may be some indirect adverse effect in the form of reduced large mammal prey abundance, but we only expect large mammal prey will die if they feed on agricultural use sites immediately after an application of carbaryl is made. We do not anticipate any large mammal prey will die in off-field areas. As such, the toxicity ranking for the species is low.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The gray wolf has a high exposure ranking. While we do not anticipate any non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action, there is still a high extent of overlap between the species' range and agricultural use areas and a moderate level of past usage, suggesting that a large number of individuals are likely to be exposed over the duration of the proposed action.

The gray wolf has a low toxicity ranking as we do not anticipate dietary dosages will be high enough to cause any mortality or sublethal adverse effects to exposed individuals. We anticipate only low levels of indirect adverse effects in the form of prey loss as we do not anticipate any large mammal prey will die, with the exception of those that forage on-field after a carbaryl application is made.

While we anticipate a large number of individuals are likely to be exposed, we do not expect any exposed individuals will experience adverse effects. As such, the overall risk of adverse effects to the species is low.

Conclusion

The gray wolf has a medium vulnerability based on its status, distribution, and trends, as described above. Though we anticipate a moderate extent of estimated usage across its range, the risk to the gray wolf posed by carbaryl across the range is low. We anticipate that individuals of the species will only rarely encounter and consume prey that have recently been exposed to carbaryl given the species general preference for remote sites away from human agricultural activities. Moreover, we do not expect exposed individuals will experience any direct adverse effects, nor that small reductions in prey species that are likely to die on-field would substantially impact fitness, survival, or reproduction for individuals of this species as we expect this represents only a minor portion of the species' available prey base.

Thus, while we anticipate a large number of individuals are likely to be exposed, we anticipate no more than a small number of individuals are likely to experience any direct adverse effects and that the species will experience only low levels of indirect adverse effects through small reductions in prey. We do not anticipate such adverse effects would impact survival, growth, reproduction of individual wolves or result in species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 gray wolf.

References

Mech, D.L. 2017. Where can wolves live and how can we live with them? Biological Conservation 210: 310-317.

U.S. Fish and Wildlife Service. 2023. Species status assessment for the gray wolf (*Canis lupus*) in the western United States. Version 1.2. Lakewood, Colorado. 362 pp.

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Removing Gray Wolf (*Canis lupus*) from the List of Endangered and Threatened Wildlife. Final Rule. Federal Register 85(213):69778-69895.

U.S. Fish and Wildlife Service. 2012. Lower 48-state and Mexico gray wolf (*Canis lupus*) listing, as reviewed. 5-Year Review: Summary and Evaluation. Arlington, Virginia. 22 pp.

Integration and Synthesis Summary: Gray wolf

Scientific Name:	Common Name:	Entity ID:
Canis lupus	Gray wolf	12

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 medium. 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 and medium past usage of carbaryl within the species' range, indicating a high extent of exposure. However, no exposed individuals are likely to die, and only small levels of prey loss are likely to occur. As such, we determine the risk of adverse effects to the 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 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 gray wolf. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 1/16/2024; U.S.A. (MN); *States within the range:* MN

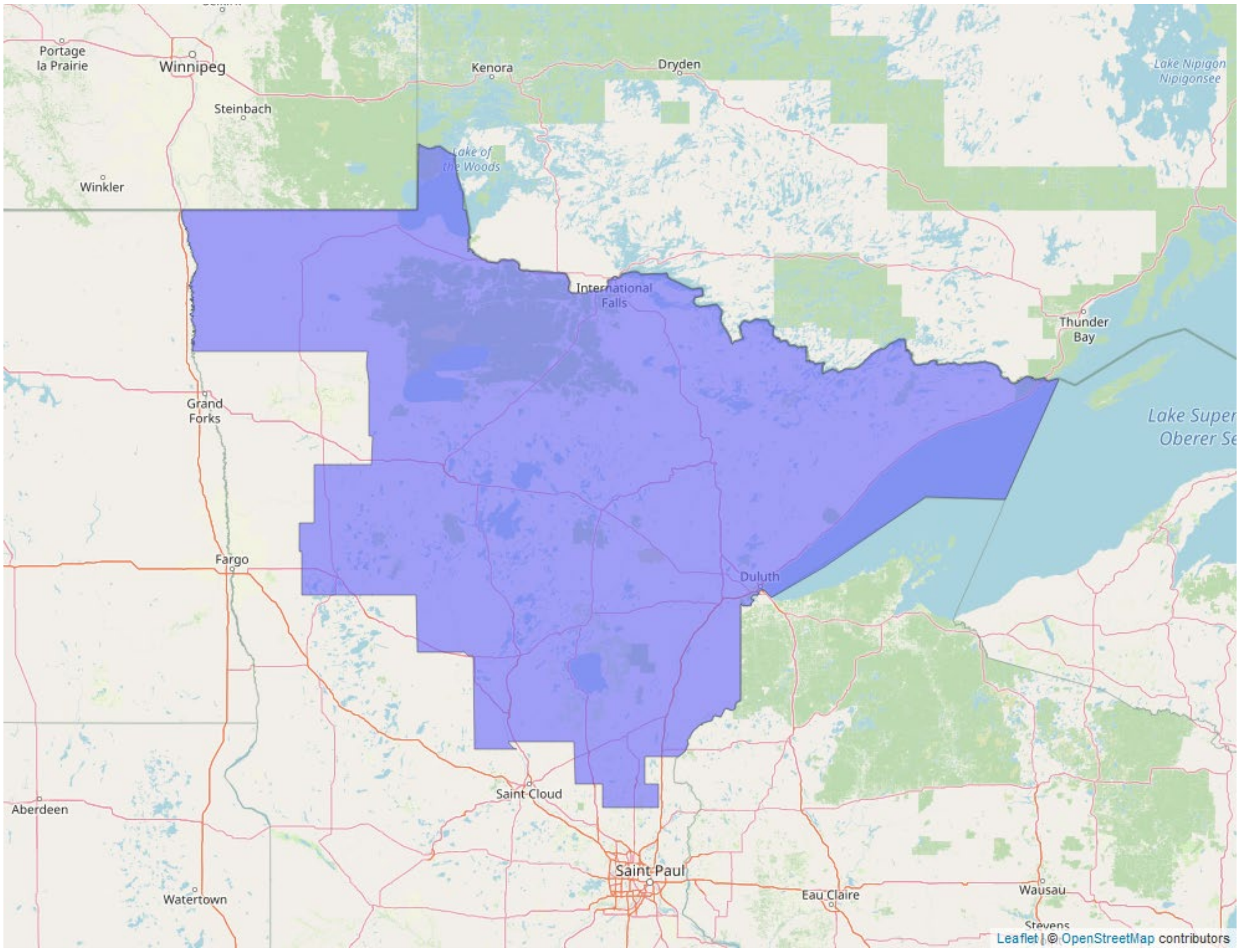

Figure 4. Range map of Gray wolf (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4488.

Vulnerability

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

Listing status: Threatened

Most recent 5 Year Status Review recommendation: Delist: The species does not meet the definition of an endangered species or a threatened species.

Most recently completed 5 Year Status Review: 11/3/202011/3/2020

Distribution: Species/Populations widespread or wide-ranging

Number of populations: Multiple populations (numerous)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Gray wolves are the largest wild members of the canid (dog) family and have a broad circumpolar range including North America, Europe, and Asia. The gray wolf is a keystone predator (in North American, primarily medium and large mammals) and an integral component of their ecosystems. The wide range of habitats in which wolves thrive reflects their adaptability and includes temperate forests, mountains, tundra, taiga, and grasslands. We consider suitable habitat to be areas containing adequate wild ungulate populations (e.g., elk and deer) and a low risk of conflict with humans (e.g., low road density, low human density, adequate natural cover without agricultural land), which generally allows for increased pack persistence (Mech 2017). Specifically, wolf presence is negatively correlated with agricultural land uses. They are highly social animals with the ability to quickly expand and recolonize vacant habitats (USFWS 2023). Historical population estimates for gray wolves in the Great Lakes suggest there were 4,000-8,000 in Minnesota, 3,000-5,000 in Wisconsin, and fewer than 6,000 in Michigan (USFWS 2020). They used to occupy most of the conterminous U.S., except the southeast (USFWS 2023). In the northeast, wolves were extirpated by 1900 and as of 2003, there was no reliable evidence of breeding pairs or wolves with established territories. Wolves were also extirpated from the Great Plains by the early 1900s. By the 1940s, wolves in Washington and Oregon became rare due to human persecution and were only found in remote mountainous areas (i.e., National Forests, Cascade Mountains). They were extirpated from Washington, Oregon, California, and Nevada soon after (USFWS 2012). In 1978, gray wolves were largely confined to northern Minnesota, with some wolves occupying Isle Royale and possibly other individuals scattered in Wisconsin and Michigan (43 FR 9608). There are no significant physical barriers separating Minnesota wolves from those in Wisconsin and Michigan, as evidenced by frequent movement of wolves among the three States. Eventually, wolves in northern Minnesota dispersed and recolonized Wisconsin and Michigan, resulting in a Great Lakes metapopulation with effective interbreeding. As of 2020, the Great Lakes metapopulation consists of more than 4,200 individuals that are connected via documented dispersals to the large and expansive population of about 12,000-14,000 wolves in eastern Canada (USFWS 2020).

Between European settlement and the 1930s, poisoning, unregulated trapping and shooting, and public funding of wolf extermination efforts nearly eliminated gray wolves from the western U.S. Still, the primary threat to western gray wolves is human-caused mortality (i.e., regulated harvest in Idaho, Montana, Washington, and Wyoming; lethal control of wolves depredating livestock in the Northern Rocky Mountains; illegal take; vehicle collisions). Because of gray wolf social structure, the death of one or both breeders in a pack may increase breeder turnover and negatively affect pack persistence, reproductive success, and recruitment because, in most instances, only the dominant male and female in a pack breed. Diseases are common in carnivores and cause episodic, but usually short-term, population decreases for gray wolves. Inbreeding depression and other genetic concerns have been documented in wild wolf populations. Climate change may affect wolves through long-term changes to prey availability, increased frequency or intensity of wildfires, and increased exposure to disease (USFWS 2023).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

Data indicate that 17.2% of the species' range overlaps with agricultural use sites and 8% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 8). In total, there is approximately 25.2% 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 gray wolf.

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	2.4	4.8	0.2	0.2	0.4
Citrus	0	0	0	0	0	0
Corn	4.2	1.8	6.1	1.6	0.7	2.3
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.3	1.4	3.8	2.3	1.4	3.8
Other Grains	1.4	0.9	2.3	<0.1	<0.1	<0.1
Other Orchards[8]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Row Crops	1.5	0.5	2	0.2	<0.1	0.2

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

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Soybeans[9]	8.9	2.4	11.3	1.7	0.5	2.2
Vegetables and Ground Fruit	0.7	0.4	1.1	0.2	0.1	0.3
Total	**17.2**	**8**	**25.2**	**4.6**	**2.4**	**7**

Usage

Past usage data indicate that up to 7% of the species' range has been treated with carbaryl annually from agricultural uses (Table 8).

Additional Exposure Considerations

Gray wolves are habitat generalists and can successfully occupy a wide range of habitats, provided adequate prey exists and human-caused mortality is sufficiently minimized. Preferred habitat is characterized by relatively large blocks of undeveloped land, abundant year-round wild ungulate populations, low road densities, and low agricultural land uses, including crop fields. As such, we anticipate individuals are not generally likely to occur in or near carbaryl use sites.

Non-agricultural Uses

While gray wolves can occupy a wide range of habitats, we do not anticipate individuals are likely to occur in highly developed urban areas, indicating that the species is unlikely to be exposed through developed or nurseries uses of carbaryl. While individuals may occur in open space developed, managed forests, rangeland, and rights of way use areas, we do not anticipate individuals are likely to be exposed to carbaryl through these uses as past usage data suggests non-agricultural uses are infrequent within the gray wolf's range.

For instance, available usage data on open space developed uses of carbaryl (such as turf or gold course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or entirely in the wolf's range, we expect this is highly unlikely to occur. Rather, we expect open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the wolf's range.

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

Available usage data from the U.S. Forest Service show no carbaryl has been applied in the regions containing the gray wolf's range from 2016 - 2020. Similarly, available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland areas within the wolf's range have been treated with carbaryl. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024).

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 on an annual basis. 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 gray wolf's range for rights of way use.

In summary, based on available usage data, we do not anticipate non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

The gray wolf has a high extent of overlap (25.2% total overlap) with agricultural use areas. Past usage data indicate a moderate level of agricultural usage within the species' range (up to 7% range treated annually). While we do not anticipate non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action, given that there is a high level of overlap and a moderate level of usage in agricultural areas, we expect a large number of individuals are likely to be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate gray wolves will be exposed to carbaryl through dietary exposure by consuming prey species that have accumulated carbaryl through consuming contaminated food items and have yet to eliminate residues. Available information on gray wolves indicates that individuals primarily consume large mammals but have been known to switch to other prey species opportunistically. Consumption of large mammal prey items on agricultural use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses ranging from 2.2-2.9 mg/kg-bw, depending on the rate of application used on-field. We do not anticipate any individuals are likely to die or experience sublethal adverse effects (e.g., reduced growth, reduced reproduction, disrupted locomotor activity) as these levels are well below levels where mammalian studies have observed toxic effects. Similarly, we do not anticipate individuals that consume prey in off-field areas are likely to accumulate more than low levels of carbaryl (up to

0.5 mg/kg-bw) and are not likely to experience any direct adverse effects from off-field dietary exposure.

Indirect Effects:

We anticipate any large mammal prey that consume contaminated food items in agricultural fields that have been recently (i.e., within the last 24 hours) are likely to die. In contrast, we do not anticipate any direct adverse effects to large mammal prey will occur in areas off-field as dietary doses will be well below levels expected to cause any mortality or sublethal effects.

Toxicity Summary

We expect the gray wolf will primarily be exposed to carbaryl through dietary exposure. We do not expect any exposed individuals will experience any direct adverse effects as dietary dosages will be low. There may be some indirect adverse effect in the form of reduced large mammal prey abundance, but we only expect large mammal prey will die if they feed on agricultural use sites immediately after an application of carbaryl is made. We do not anticipate any large mammal prey will die in off-field areas. As such, the toxicity ranking for the species is low.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The gray wolf has a high exposure ranking. While we do not anticipate any non-agricultural uses of carbaryl will exposure more than a small number of individuals over the duration of the proposed action, there is still a high extent of overlap between the species' range and agricultural use areas and a moderate level of past agricultural usage, suggesting that a large number of individuals are likely to be exposed over the duration of the proposed action.

The gray wolf has a low toxicity ranking as we do not anticipate dietary dosages will be high enough to cause any mortality or sublethal adverse effects to exposed individuals. We anticipate only low levels of indirect adverse effects in the form of prey loss as we do not anticipate any large mammal prey will die, with the exception of those that forage on-field after a carbaryl application is made.

While we anticipate a large number of individuals are likely to be exposed, we do not expect any exposed individuals will experience adverse effects. As such, the overall risk of adverse effects to the species is low.

Conclusion

The gray wolf has a medium vulnerability based on its status, distribution, and trends, as described above. Though we anticipate a moderate extent of estimated usage across its range, the risk to the gray wolf posed by carbaryl across the range is low. We anticipate that individuals of the species will only rarely encounter and consume prey that have recently been exposed to carbaryl given the species general preference for remote sites away from human agricultural activities. Moreover, we do not expect exposed individuals will experience any direct adverse effects, nor that small reductions in prey species that are likely to die on-field would substantially impact fitness, survival, or reproduction for individuals of this species as we expect this represents only a minor portion of the species' available prey base.

Thus, while we anticipate a large number of individuals are likely to be exposed, we anticipate no more than a small number of individuals are expected to experience any direct adverse effects and the species is expected to experience only low levels of indirect adverse effects through small reductions in prey. We do not anticipate such adverse effects would impact survival, growth, reproduction of individual wolves or result in species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 gray wolf.

References

Mech, D.L. 2017. Where can wolves live and how can we live with them? Biological Conservation 210: 310-317.

U.S. Fish and Wildlife Service. 2023. Species status assessment for the gray wolf (Canis lupus) in the western United States. Version 1.2. Lakewood Colorado. 362 pp.

U.S. Fish and Wildlife Service. 2020. Endangered and Threatened Wildlife and Plants; Removing Gray Wolf (Canis lupus) from the List of Endangered and Threatened Wildlife. Final Rule. Federal Register 85(213):69778-69895.

U.S. Fish and Wildlife Service. 2012. Lower 48-state and Mexico gray wolf (Canis lupus) listing, as reviewed. 5-Year Review: Summary and Evaluation. Arlington, Virginia. 22 pp.

Integration and Synthesis Summary: Red wolf

Scientific Name:	Common Name:	Entity ID:
Canis rufus	Red wolf	14

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 and medium past usage of carbaryl within the species' range, indicating a high extent of exposure. We expect most exposed individuals are likely to die as the species is known to select for agricultural areas, which is where we expect adverse effects are most severe. As such, 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 red wolf. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 9/13/2023; Wherever found, except where listed as an experimental population; *States within the range:* NC

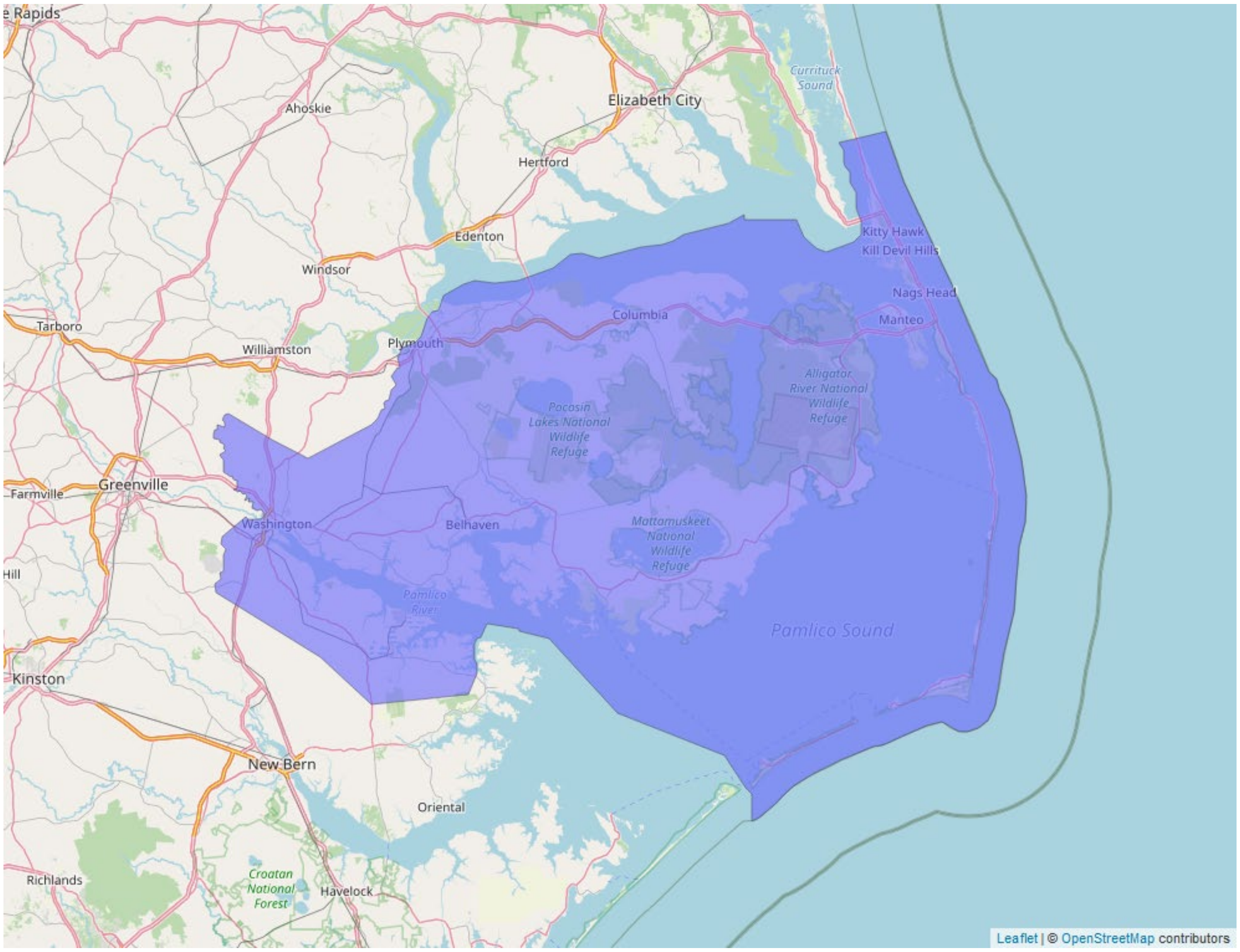

Figure 5. Range map of Red wolf (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/37.

Vulnerability

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

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 4/3/2024

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

Number of populations: Single population

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The red wolf is a social, territorial canid found in the southeastern U.S. Even though it is widely believed to not be their preferred habitat, the population in Texas and Louisiana (source for reintroductions) was found in fallow fields, bayous, marshes, and coastal prairie. Their preferred habitat is believed to be open pine forests and bottomland hardwoods, and reintroduced animals use agricultural lands, pine forests, and pocosins (e.g., wetlands found in coastal areas with sandy peat soils and shrubs). They are opportunistic predators and often predate ungulates, small mammals (e.g., rabbits, rodents, nutria), livestock (e.g., sheep, goats, cattle), and birds (USFWS 2018a). The historical range of red wolves encompassed southeastern United States westward to the Edwards Plateau in Texas, north to the lower Midwest (i.e., southeastern Missouri, southern Illinois), and east into southern Pennsylvania and extreme southeastern New York. Between 1973-1980, over 400 canids were captured for the red wolf recovery program and 15 of those became a breeding stock for the captive population and reintroduction efforts. Red wolves were declared extinct in the wild in 1980. In 1987, a nonessential experimental population was initiated in eastern North Carolina with four males and four females (EXPN Entity ID: 4369); sixty more were released between 1987-1994 and the population began maintaining territories, forming packs, and breeding successfully. Another reintroduction was initiated in Tennessee but was terminated in 1998 due to low pup survival and population emigration (USFWS 2018a). As of 2018, it had three breeding pairs (n= ~44) and did not appear to be self-sustaining. The captive population has maintained about 150 individuals for over 20 years across 43 locations. The nonessential experimental population is likely to be extirpated within decades without substantial intervention (USFWS 2018b).

Threats to the red wolf include genetics concerns (i.e., small population size), hybridization and competition with coyotes (*Canis latrans*), disease and parasites, poisoning, shooting, development, vehicle collisions, fire, hurricanes and storms, sea level rise and habitat inundation, and carcass use of agricultural areas (USFWS 2018b). Coyotes have been expanding their range and they directly compete with red wolves for habitat and prey. Red wolves are at risk of habitat loss, but this concern is outweighed by genetic concerns from small population sizes. The founding stock was very small and resultant genetic diversity is limited. Wolves are susceptible to mange, ticks, biting lice, and other parasites that are carried and transported by coyotes. They also hybridize with other species, mainly coyotes. Poisoning and shooting of red wolves have been confirmed in North Carolina. Development is not considered a historical threat to the species where it is currently found, but development potential in the future may become a concern if habitat is limited by other factors like sea level rise. Wolves adapt well to suburban and urban areas, but then interact more with humans (USFWS 2018a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 13.1% of the species' range overlaps with agricultural use sites and 3.8% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 9). In total, there is approximately 16.9% 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 red wolf.

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	0	0	0	0	0
Corn	10.9	2.5	13.4	2.3	0.5	2.9
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	0.4	0.9	1.3	0.4	0.9	1.3
Other Grains	0.1	0.1	0.2	<0.1	<0.1	0.1
Other Orchards[10]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Row Crops	0.3	0.2	0.5	0.3	0.2	0.5
Soybeans[11]	12.1	2.4	14.5	6.7	1.3	8
Vegetables and Ground Fruit	0.2	0.1	0.3	0.2	0.1	0.3

[10] 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.

[11] 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
Total	**13.1**	**3.8**	**16.9**	**7.6**	**2.7**	**10.3**

Usage

Past usage data indicate that up to 10.3% of the species' range has been treated with carbaryl annually from agricultural uses (Table 9).

Additional Exposure Considerations

Recent studies show that red wolves are selecting agricultural areas over other cover types, indicating that occurrence on carbaryl use sites is likely.

Non-agricultural Uses

Based on available information on the species, we can infer that functional habitat for red wolves may include non-agricultural carbaryl use sites, including managed forests and rangeland areas. However, we do not anticipate individuals are likely to experience any exposure to carbaryl through these non-agricultural uses. Available past usage data from the U.S. Forest Service show no carbaryl has been used in managed forests located within the red wolf's range from 2016-2020. Similarly, available usage data from USDA APHIS indicate that no rangeland areas within the species' range have been treated with carbaryl from 2019-2023. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024). As such, we do not expect non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

The red wolf has a high exposure ranking as there is both a high extent of overlap between the species' range and agricultural use areas as well as a high level of past usage within the species' range. Additionally, we expect individuals actively select for agricultural areas over other cover types to use as habitat, further suggesting that exposure is reasonably certain to occur. While we do not anticipate more than small number of individuals are likely to be exposed through non-agricultural uses, given the species' presence on agricultural use sites, we anticipate a large number of individuals are likely to be exposed over the duration of the proposed action.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the main route of exposure for the red wolf. The red wolf can consume a wide variety of prey, including large and small mammals, birds, herpetofauna, fish, crustaceans, and vegetation. We expect individuals foraging in recently treated agricultural fields can accumulate up to 0.06-44.9 mg/kg-bw, depending on the dietary item and the application rate of carbaryl used on-field. At the high end of dietary exposure estimates, we anticipate up to 78% of exposed individuals are likely to die. Individuals that do not die are likely to experience sublethal adverse effects, including reduced growth, reproduction, and even temporary motor activity impairment and behavioral abnormalities. In contrast to on-field exposure, we do not anticipate any individuals that are exposed off-field (e.g., consume prey that have only been exposed to carbaryl through spray drift) are not likely to experience any direct adverse effects as dietary doses will be low in these off-field areas.

Indirect Effects:

We expect prey species, small and large mammalian prey in particular, are likely to die when foraging in recently treated fields (regardless of the application rate used on-field). Given that red wolves are known to favor agricultural areas for habitat, we anticipate this loss of prey on-field may represent a large reduction in the abundance of prey resources, resulting in a high level of indirect adverse effects to the species. We do not anticipate any prey species will die from carbaryl exposure in off-field areas.

Toxicity Summary

We anticipate the red wolf will experience high levels of adverse effects if exposed to carbaryl. Individuals that consume prey on-field are likely to experience high levels of mortality. Individuals that do not die are likely to experience high levels of sublethal adverse effects, including impaired motor activity and behavior, reduced growth, and reduced reproduction. Furthermore, we anticipate there will be high levels of prey loss on agricultural use sites. Given that the species is known to select for agricultural areas for habitat, we anticipate adverse effects to exposed individuals are reasonably certain to occur.

Overall Toxicity Ranking: High

Effects of the Action Summary

The red wolf has a high exposure ranking. While non-agricultural uses are not expected to expose more than a small number of individuals, there is a high extent of overlap between the species' range and agricultural use areas, as well as a moderate level of past agricultural usage within the species' range, suggesting that a large number of individuals are likely to be exposed over the duration of the proposed action.

The red wolf has a high toxicity ranking as we anticipate individuals that consume contaminated prey on-field are likely to die. Exposed individuals that do not die are likely to experience high levels of sublethal adverse effects, including impaired motor activity and behavior and reduced growth and reproduction. We also anticipate there will be high levels of mammalian prey mortality on-field as well, which will result in high levels of indirect adverse effects.

Given that a large number of individuals are likely to be exposed and that the species is known to favor agricultural areas where adverse effects will be the most severe, we anticipate a large number of individuals are likely to die or experience severe sublethal and indirect adverse effects. As such, we anticipate the risk of adverse effects to the species overall is high.

Conclusion

The red wolf has a high vulnerability based on its status, distribution, and trends, as described above. The likelihood of exposure across the range is high, with a high extent of overlap and moderate level of past usage within the species' range. Furthermore, we anticipate that individuals of the species will frequently encounter and consume prey that have recently been exposed to carbaryl given the species' general preference for agricultural sites. We anticipate this will result in the exposure of a large number of individuals over the duration of the proposed action. Given that the most severe adverse effects will occur on agricultural use sites, the species' preference for agricultural areas will result in a large number of individuals that will experience high levels of adverse effects (including mortality and severe sublethal adverse effects). Moreover, we expect a reduction in the abundance of mammalian prey would substantially impact fitness, survival, or reproduction for individuals of this species, due to the reduction in available resources.

Given that we anticipate a large number of individuals will be exposed and that exposed individuals are likely to experience high levels of direct and indirect adverse effects, we anticipate that a large number of individuals will die. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 red wolf.

References

U.S. Fish and Wildlife Service. 2018a. Red Wolf Species Status Assessment. Atlanta, Georgia. 97 pp.

U.S. Fish and Wildlife Service. 2018b. 5-Year Review Red wolf (*Canis rufus*). Atlanta, Georgia. 21 pp.

Integration and Synthesis Summary: Utah prairie dog

Scientific Name:	Common Name:	Entity ID:
Cynomys parvidens	Utah prairie dog	20

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability ranking is high. While there is a low level of overlap between agricultural use sites and the range and low past usage, the species is known to preferentially occur on agricultural use sites, indicating that the likelihood of exposure is high. We anticipate individuals exposed on use sites are likely to die, indicating that toxicity to the species is high. As such, the risk to the species from the registration of carbaryl is high, as described in the following sections. 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 Utah prairie dog. We discuss our rationale for the species in the sections below.

Species range

Last updated: 1/8/2024; Wherever found; *States within the range:* UT. Figure 6 depicts the species' range.

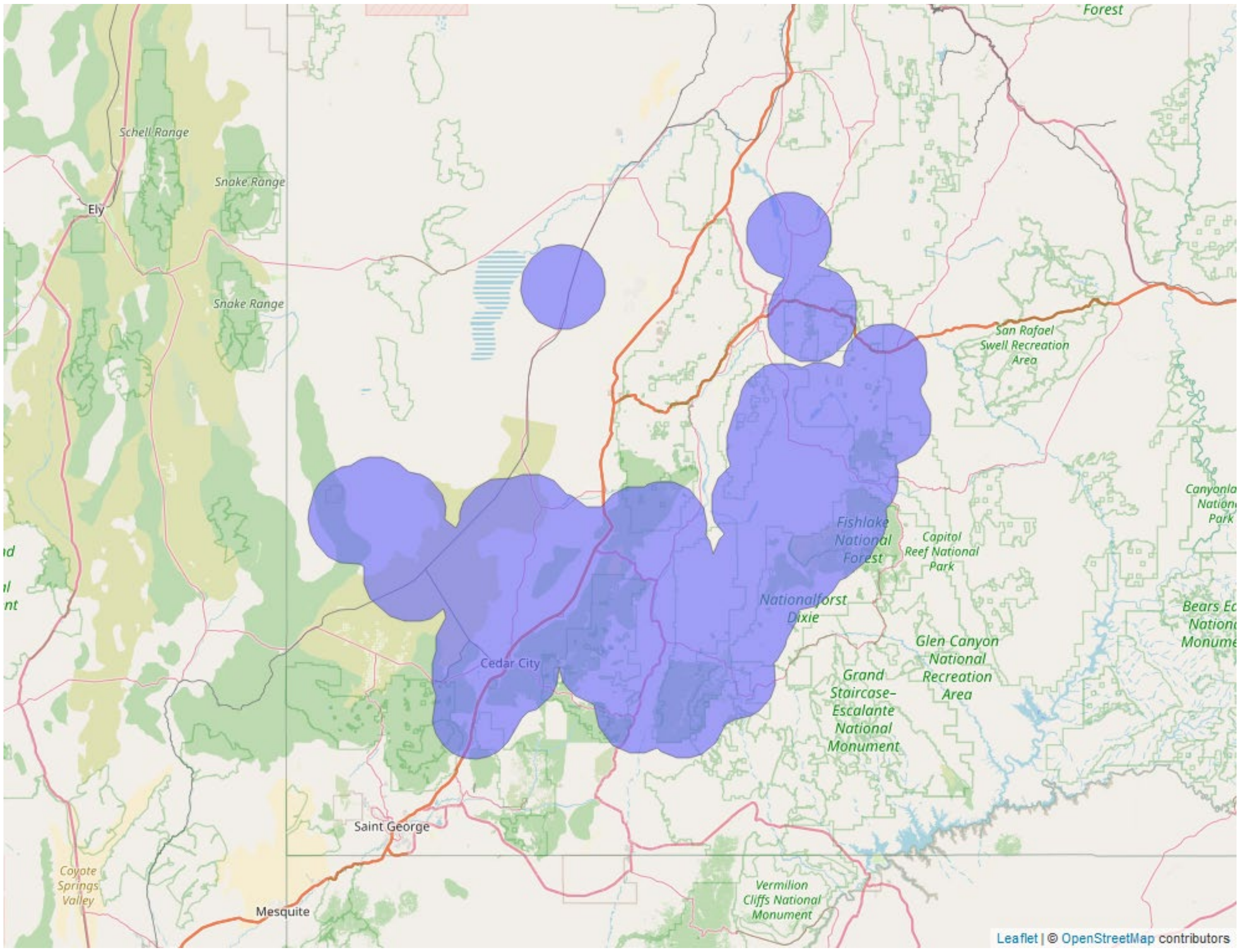

Figure 6. Range map of Utah prairie dog (blue polygons). Range map accessed on August 03, 2023, at https://ecos.fws.gov/ecp/species/5517.

Vulnerability

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

Summary of status

Listing status: Threatened

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

Most recently completed 5-Year Review: 6/14/2021

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

Number of populations: Single population

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Utah prairie dogs are rodents in the white-tail sub-genera of prairie dogs. They hibernate annually and occur in semiarid shrub-steppe and grassland habitats. Within these habitats, they prefer swale-type formations where moist herbaceous vegetation (their primary food source) is available. They also occasionally eat insects. Historically, they were found farther north in Utah; today, they are found in portions of Piute, Garfield, Wayne, Sevier, Kane, and Iron Counties in southwestern Utah. Genetic variance within Utah prairie dog populations is very low, less than half that commonly observed for black-tailed prairie dogs, which may be the result of genetic drift in small populations. Utah prairie dog population trends appeared to be stable or increasing until 2016, after which numbers across the range decreased from 11,478 in 2016 to 6,217 in 2020 (USFWS 2021).

In 1973 at the time of listing, the species was threatened by habitat destruction and modification, over-exploitation, disease, and predation. They remain threatened by habitat loss and fragmentation, plague (*Yersinia pestis*), changing climatic conditions, unauthorized take (i.e., poaching), and disturbance from recreational and economic land uses. Urban expansion and plague comprise the most serious threats to Utah prairie dog populations, either of which could potentially lead to extirpation of entire complexes and significantly increase extinction probabilities. Additional habitat threats include over-grazing, cultivated agriculture, vegetation community changes, invasive plants, off-highway vehicles, energy resource exploration and development, and fire management (USFWS 2012a).

In 2018, we released a 10-year General Conservation Plan to aid in Utah prairie dog conservation while supporting community growth goals. As of 2021, we were working on a Conservation Benefit Agreement with School and Institutional Trust Lands, which will protect existing prairie dog colonies and allow for recovery actions to improve the species status. Starting in 2020, the state of Utah began development of a conservation strategy for the Utah prairie dog that is intended to demonstrate that the species no longer needs federal protection (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 5.8% of the species range will overlap with carbaryl use sites or is likely to be exposed through off-site transport within the action area (Table 10). Up to 3.7% of the species' range overlaps with carbaryl use sites while 2.2% of the range occurs off-field (but may still be exposed to spray drift or runoff.

Table 10. Agricultural use overlap and annual usage data (% Range Treated) for the Utah prairie dog

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)	% Range Treated (On-field)	% Range Treated (90-m)	Total % Range Treated
Alfalfa	2.3	0.8	3.1	0.5	0.1	0.6
Citrus	0	0	0	0	0	0
Corn[12]	0.4	0.2	0.6	0.2	0.1	0.3
Grapes	0	<0.1	<0.1	0	<0.1	<0.1
Other Crops	0.5	0.7	1.2	0.5	0.7	1.2
Other Grains	0.4	0.5	0.9	<0.1	<0.1	<0.1
Other Orchards[13]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Row Crops	<0.1	<0.1	<0.1	0	0	0
Soybeans	0	0	0	0	0	0
Vegetables and Ground Fruit	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total	**3.7**	**2.2**	**5.8**	**1.2**	**1.0**	**2.2**

[12] 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.

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

Usage

Based on past usage data, we anticipate up to 2.2% of the species' range will be treated with carbaryl (i.e., 1.2% on-field and 1% off-field).

Additional Exposure Considerations

Additional data from USDA's Census of Agriculture indicate only 1.4% of the species' range has been treated with any insecticide. Given that this data is spatially specific to the Utah prairie dog's range and includes usage of other insecticides in addition to carbaryl, we consider this a conservative metric of past carbaryl usage and have high confidence that only small portions of the species' range are likely to be treated annually. However, available information on the species' foraging behavior indicates that individuals forage on agricultural fields. When both are available, Utah prairie dogs will preferentially choose alfalfa over grasses (USFWS 2012b). They frequently occur on agricultural lands and in addition to eating grasses and forbs, occasionally eat insects (K. Novak, Utah Field Office, personal communication, 2024). Therefore, we expect that exposure is likely to occur despite a low level of usage.

Non-agricultural Uses

Based on available information on the species, we can infer that functional habitat for the Utah prairie dog does not include non-agricultural use sites in managed forests, developed, open space developed, nursery, or rights of ways areas, but may include non-agricultural carbaryl use sites in rangeland areas. While usage data from USDA APHIS indicate carbaryl usage in some rangeland habitats within one of the counties containing the Utah prairie dog's range, we do not anticipate these uses are likely to result in exposure to the species as all applications have been made using carbaryl formulated bait. We do not anticipate individuals are likely to be exposed to bait as they are not attractive to rodents and are not likely to result in off-site transport through spray drift or runoff. In addition, 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 programs (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. As such, we do not expect non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

While we do not anticipate more than small numbers of individuals will be exposed through non-agricultural uses, there is a moderate extent of overlap between the action area and the species' range (5.8% total overlap). Past usage data indicate a low level of usage within the species' range (up to 2.2% of the range treated annually), which is corroborated by data from the Census of Agriculture that indicate only 1.4% of the species' range has been treated with any insecticide in the past. However, despite this low level of usage, given that individuals are known to preferentially forage on agricultural areas (including carbaryl use sites), we anticipate a large number of individuals are likely to be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the Utah prairie dog, which is primarily an herbivore. Dietary exposure from foraging on agricultural use sites will result in dietary dosages ranging from 24.9-425 mg/kg-bw, depending on the application rate. We expect between 65.9-99% of individuals exposed to this range of concentrations will die. In contrast, dietary dosages in off-field areas will be lower than on-field areas (up to 4.5 mg/kg-bw) and are not likely to cause any mortality or sublethal adverse effects.

Indirect Effects:

Available toxicity data indicate that plants are not likely to experience any adverse effects to survival, growth, or reproduction. As such, we do not anticipate there will be any reductions in the availability of the Utah prairie dog's main food resource. As such, we do not anticipate any adverse indirect effects are likely.

Toxicity Summary

We expect a high level of direct adverse effects will occur. EPA's exposure modeling indicates that individuals that forage on use sites are likely to accumulate high levels of carbaryl, resulting in high levels of mortality (up to 99% of exposed individuals). We do not anticipate individuals that are exposed to carbaryl off-field in adjacent areas will experience any mortality or sublethal adverse effects. We do not anticipate any adverse indirect effects are likely to occur as available toxicity data show no adverse effects to the species' main food resource (i.e., plants).

Given that we expect high levels of mortality, we determine the Utah prairie dog has a high toxicity ranking.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Utah prairie dog has a high exposure ranking. While data from the Census of Agriculture indicate only a very small portion of the range has been treated in the past (up to 1.4%), suggesting only a small portion of the range is likely to be treated, the Utah prairie dog is known to preferentially forage on agricultural land, suggesting the potential for a large number of individuals to be exposed despite the low level of overlap and usage. We do not anticipate non-agricultural uses will expose more than a small number of individuals.

The Utah prairie dog has a high toxicity ranking. The species is known to forage on agricultural areas, which indicate that individuals are likely to be exposed to high levels of carbaryl through their diet. We expect up to 99% mortality of individuals that have foraged on-field within the last 24 hours. In contrast, we do not anticipate any direct adverse effects will occur to individuals exposed off-field in adjacent areas. Additionally, the species is unlikely to experience indirect adverse effects as their main food source is not likely to be adversely affected by carbaryl.

Since we anticipate a large number of individuals are likely to be exposed and that there is a high level of mortality in exposed individuals, we expect a large number of individuals will die. As such, we anticipate the risk of adverse effects to the species overall is high.

Conclusion

The Utah prairie dog has a high vulnerability based on its status (i.e., threatened), single population, limited distribution, and decreasing species trends, as described above. The likelihood of exposure from labeled uses across the range is moderate, with 5.8% of the range overlapping with carbaryl use sites or spray drift areas (3.7% on-field and 2.2% off-field where drift and runoff may occur). In the past, up to 2.2% of the range has been treated with carbaryl annually and, according to USDA Census of Agriculture data, 1.4% of the range has been treated with any insecticide in the past. Though we have high confidence in the Census of Agriculture data, we anticipate mortality from direct effects will occur within use areas. Utah prairie dogs primarily use semiarid shrub-steppe and grasslands, but they also often occur on agricultural lands (USFWS 2021, Witmer et al. 2023). They dig burrows and forage on agricultural lands, especially on alfalfa. They preferentially choose alfalfa over other grasses when both are available (USFWS 2012b). Agricultural lands may also aid in their dispersal like other prairie dog species. We expect no mortality of individuals that forage off-field in areas exposed to spray drift, but up to 99% mortality for individuals that forage on-field. Because the species actively forages and burrows on use sites and edges of use sites, we anticipate a large number of individuals will be exposed to and adversely impacted by carbaryl use over the duration of the action.

We expect impacts to be high and an unknown, but significant number of individuals will die. Considering the species' high vulnerability, high anticipated 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 Utah prairie dog.

References

Witmer, G., J. Grant, and K. Cross. 2023. Prairie Dogs. Wildlife Damage Management Technical Series. USDA, APHIS, WS National Wildlife Research Center. Fort Collins, Colorado. 16p.

U.S. Fish and Wildlife Service. 2021. Utah Prairie Dog (*Cynomys parvidens*) 5-Year Review Short Form. West Valley City, UT. 12 pp.

U.S. Fish and Wildlife Service. 2012a. Utah prairie dog *Cynomys parvidens* 5-Year Review: Summary and Evaluation. West Valley City, Utah. 186 pp.

U.S. Fish and Wildlife Service. 2012b. Utah Prairie Dog (*Cynomys parvidens*) Revised Recovery Plan. West Valley City, UT. 169 pp.

Integration and Synthesis Summary: Gray bat

Scientific Name:	Common Name:	Entity ID:
Myotis grisescens	Gray bat	21

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 medium. In our evaluation of the effects of the proposed action to the species, we determine there is medium overlap of the action area with the species' range and low past usage of carbaryl within the species' range, indicating a medium extent of exposure. We do not anticipate more than small numbers of exposed individuals are likely to die. As such, we determine the risk of adverse effects to the 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 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 gray bat. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 12/20/2021; Wherever found; *States within the range:* AL, AR, GA, IA, IL, IN, KS, KY, MO, MS, NC, OH, OK, SC, TN, VA, WV

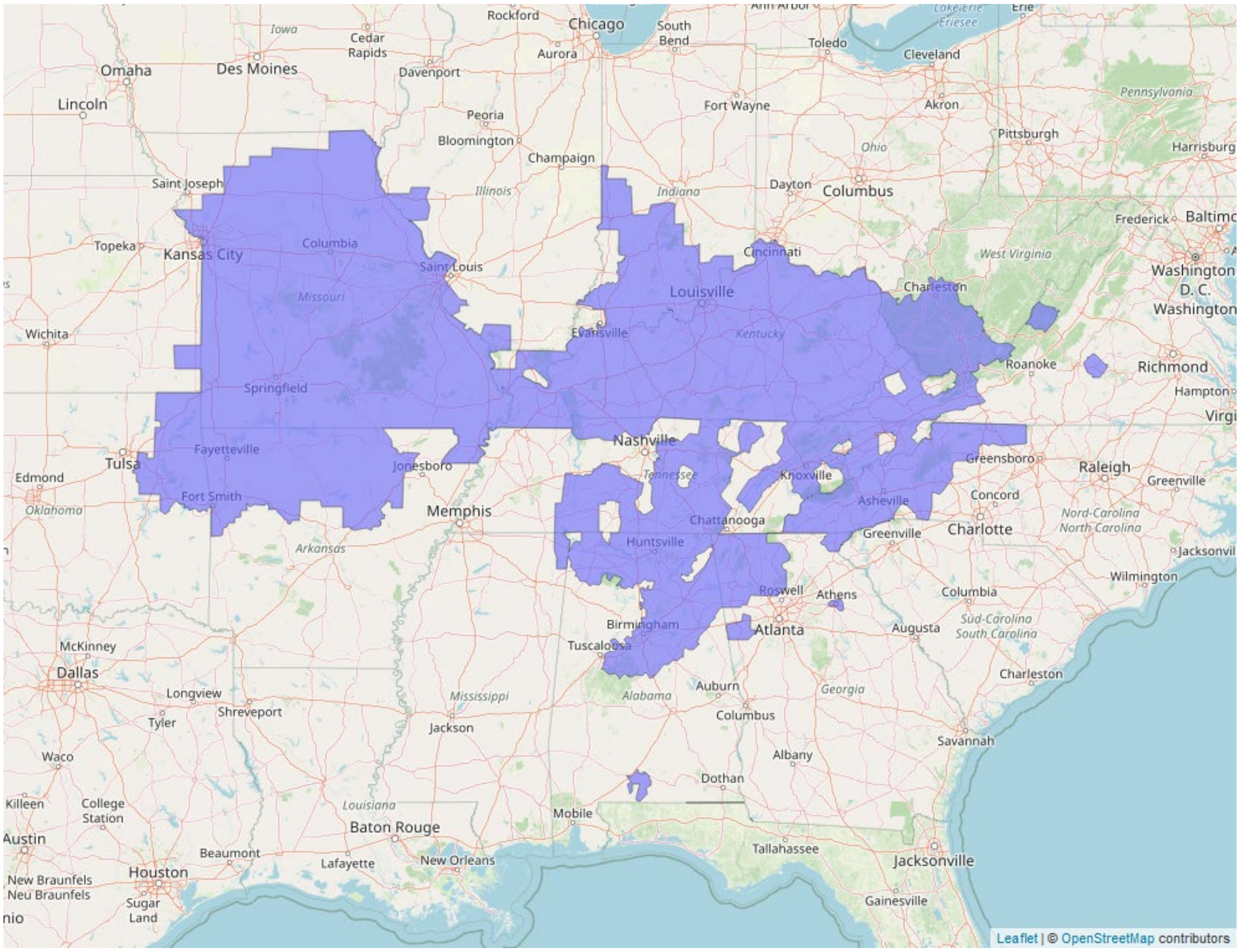

Figure 7. Range map of Gray bat (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/6329.

Vulnerability

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

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 9/30/2009

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

Gray bats are cave-dwelling insectivorous bats found across eastern North America, mostly Alabama, Arkansas, Kentucky, Missouri, and Tennessee. As 2009, there was a growing population in Indiana. They typically inhabit caves year-round, particularly cold hibernating caves in winter and warmer caves in summer. They congregate in large groups and most (95%) of the population is confined to nine caves. Gray bats forage on aquatic insects (e.g., mayflies, caddisflies, and stoneflies) and occasionally moths and beetles in areas with open waters of rivers, streams, lakes, or reservoirs. Only 5% of caves in their range have the requirements gray bats need, and they are a highly philopatric species. Using the U.S. Geological Survey bat population database, Ellison et al. (2003) found that 94.4% of populations were stable or increasing and 6% were decreasing. In 2002, the range-wide population estimate was between 1,575,000-2,678,000 bats, which rose to 3,400,000 in 2004. The gray bat range appears to have expanded into North Carolina (Etchison and Weber 2020) and there is potential for gray bats to expand further into Appalachia as local and global climates change. In addition to caves, gray bats have been discovered roosting in bridges, barns, storm sewers and culverts, and tree roosts (Holliday et al. 2023). Gray bat declines initially occurred due to human disturbance, natural flooding, impoundment of waterways, and contamination from pesticides (USFWS 2009). Human disturbance remains the primary reason for the continued decline of some populations of gray bat and natural and man-made flooding remains a secondary threat at some sites. Flash flooding in caves can adversely affect gray bats by damaging gates at cave entrances that were constructed to protect roosting bats. Pesticides may affect gray bats and the continued increase of gray bats coincided with the reduced use of pesticides in southern Missouri where the landscape was mostly covered in forest, pasture, and hay fields. Gray bats at four maternity caves in Arkansas were exposed to pesticide residues at lower levels than previously reported by others. Climate change could have a significant impact on gray bats by adversely affecting their food supply or the internal roosting temperature of caves. A rise in ambient temperature could make traditional and occupied hibernacula and maternity sites unsuitable for roosting gray bats and cause a shift in the species' range northward. A shift in the species' range could adversely affect their food supply, affect the ability of bats to adequately deposit important fat reserves, and ultimately reduce their hibernation survival rates. Gray bats are affected by white-nose Syndrome, particularly through long migrations (up to 775 km) and their co-occurrence with other bat species while roosting (USFWS 2009).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

Data indicate that 15.5% of the species' range overlaps with agricultural use sites and 6.3% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 11). In total, there is approximately 21.8% 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 gray bat.

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	0.3	0.4	<0.1	<0.1	<0.1
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	10.4	4	14.4	1.2	0.5	1.8
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	1.7	1.3	3	1.4	1.1	2.5
Other Grains	0.2	0.2	0.4	<0.1	<0.1	<0.1
Other Orchards[14]	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
Other Row Crops	0.3	0.2	0.5	<0.1	<0.1	<0.1
Soybeans[15]	13	4.2	17.2	1.9	0.8	2.7
Vegetables and Ground Fruit	<0.1	<0.1	0.2	<0.1	<0.1	0.1
Total	**15.5**	**6.3**	**21.8**	**3.5**	**2.1**	**5.6**

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

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

Usage

Past usage data indicate that up to 5.6% of the species' range has been treated with carbaryl annually from agricultural uses (Table 11).

Additional Exposure Considerations

Summer foraging is strongly associated with open water areas of rivers, streams, lakes, or reservoirs for gray bat. Although individuals may travel up to 35 kilometers between prime feeding areas over lakes or rivers and occupied caves, most maternity colonies are located between 1-4 kilometers from foraging locations. Given this close association with aquatic areas, we do not expect individuals are likely to forage on-field and will likely only be present near use sites during dispersal events. As such, we only consider off-field exposure and effects in this analysis.

Non-agricultural Uses

We anticipate the gray bat may roost, forage, or travel in open space developed areas, managed forests, or rangeland areas, suggesting that individuals may be exposed to carbaryl through non-agricultural uses. However, despite this habitat use, we anticipate non-agricultural uses of carbaryl are not likely to result in significant exposure to the species as past usage data suggests non-agricultural uses are infrequent within the gray bat's range. For instance, available usage data on open space developed uses of carbaryl (such as turf or gold course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or entirely within the bat's range, we expect this is highly unlikely to occur. Rather, we expect open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the gray bat's range. Available usage data from the U.S. Forest Service show no carbaryl has been applied in the regions containing the gray bat's range from 2016 - 2020. Similarly, available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland areas within the gray bat's range have been treated with carbaryl. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024). In summary, while the gray bat is known to occur in some non-agricultural carbaryl use sites, the low level of past usage suggests that no more than a small number of individuals will be exposed to carbaryl through non-agricultural uses. Based on this available usage data, we anticipate non-agricultural uses of carbaryl will expose more than small numbers of individuals over the duration of the proposed action.

Exposure Summary

Given that we do not expect individual gray bats to be present on carbaryl use sites beyond dispersal events, we only consider off-field exposure in our analyses. There is a moderate extent of overlap between off-field areas that are likely to be exposed to carbaryl through spray drift and the gray bat's range (6.3% total off-field overlap). There is a low level of past usage within the species' range, with up to 2.1% of off-field areas treated each year. While we anticipate low levels of usage, the moderate extent of overlap suggests that a moderate portion of the species' range is likely to be treated over the duration of the proposed action. We expect no more than small numbers of individuals will be exposed through non-agricultural uses. As such, the species has a medium exposure ranking.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the gray bat. Gray bats are insectivorous and can feed on a variety of flying insects. EPA's exposure models indicate that individuals foraging on agricultural use sites can accumulate high levels of carbaryl (up to 103.6 mg/kg-bw). In contrast, individuals that forage off-field are not likely to accumulate more than low levels of carbaryl from dietary exposure (at most 1.1 mg/kg-bw). Given that individuals are not likely to forage on-field as gray bat foraging behavior is strongly correlated with open waters of rivers, streams, lakes, and reservoirs rather than agricultural sites, we anticipate individuals are not likely to accumulate only low levels of carbaryl from dietary exposure. As such, we do not anticipate individuals are likely to experience any mortality or sublethal adverse effects (e.g., impaired motor activity and behavior or reduced growth and reproduction).

Indirect Effects:

The gray bat is considered an obligate insectivore. Based on available toxicity data in insect species, we anticipate there will be a high level of insect mortality. However, we expect the level of mortality will vary across species as a result of natural variability in physiology, exposure, and other factors. As such, we do not expect the entire insect community is likely to experience complete mortality and that individual bats will still have sufficient food resources available, particularly in areas away from carbaryl use sites. As such, we do not anticipate more than low levels of indirect adverse effects are likely. Additionally, we anticipate individuals can find alternative food sources in areas that are not near carbaryl use sites as individuals are highly mobile and can forage in a wide array of habitats.

Toxicity Summary

The gray bat has a low toxicity ranking. We do not anticipate individuals are likely to accumulate more than low levels of carbaryl from dietary exposure as individuals are not likely to forage on agricultural use sites where exposure levels would be highest. Instead, we anticipate individuals that forage off-field are not likely to accumulate only low levels of carbaryl, resulting in no direct adverse effects. While we anticipate carbaryl will reduce the abundance of insect prey species, we anticipate this indirect adverse effect will only be minor as we do not anticipate all insect species will be equally sensitive to carbaryl exposure and that there will be sufficient food resources to support the species in areas further away from carbaryl use sites.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The gray bat has a medium exposure ranking. While we anticipate only a small portion of the species' range is likely to be treated with carbaryl annually, there is a moderate extent of overlap between the species' range and agricultural use areas. We do not anticipate more than a small number of individuals will be exposed through non-agricultural uses of carbaryl. This suggests that a moderate number of individuals are likely to be exposed over the duration of the proposed action.

The gray bat has a low toxicity ranking. We do not anticipate individuals will accumulate more than low levels of carbaryl through dietary exposure as we anticipate individuals will primarily forage on insects in off-field areas, where dietary doses are much lower. As such, we do not anticipate any individuals are likely to experience direct adverse effects. While we anticipate some decreases in the abundance of insect prey species, we expect the overall level of indirect adverse effect will be low as we anticipate there will be sufficient food resources available in areas far from agricultural use sites.

Thus, while a moderate number of individuals are likely to be exposed over the duration of the proposed action, we do not anticipate more than a small number of exposed individuals are likely to die or experience sublethal adverse effects. Similarly, we do not anticipate more than low levels of indirect adverse effects through the form of lost prey resources. Therefore, we expect the overall risk of adverse effects the species is low.

Conclusion

The gray bat has a medium vulnerability based on its status (i.e., endangered) and decreasing species trends, as described above. The likelihood of exposure across the range is medium. The species is closely associated with open water areas and may fly over fields during dispersal but is not expected to forage on-field. Therefore, we focused on off-field exposure. Spray drift and runoff may impact 6.3% of the species' range and, in the past, up to 2.1% of the range was exposed to carbaryl usage through off-site transport annually. Even with low past usage, the moderate level of off-field overlap indicates that a moderate portion of the range is likely to be exposed and we expect a moderate number of individuals will be exposed to carbaryl throughout the duration of the proposed action. Because gray bats forage primarily over open water areas, we do not expect individuals are likely to exclusively consume insect prey that has recently foraged on carbaryl use sites. We do not anticipate individuals are likely to experience any direct adverse effects as off-field dietary doses will likely be low.

We expect impacts to be low and very few individuals will die. Even though gray bats have a medium vulnerability ranking, they have medium exposure and low toxicity ranking. We do not expect the small number of individuals likely to die will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 gray bat.

References

Holliday, C., Wisby, J.P., Roby, P.L., Samoray, S.T., and Vannatta, J.M. 2023. Modeling migration and movement of gray bats. The Journal of Wildlife Management 87: e22364.

Etchison, K.L.C., and Weber, J.A. 2020. The discovery of gray bats (*Myotis grisescens*) in bridges in western North Carolina. Southeastern Naturalist 19(3): N53-56.

U.S. Fish and Wildlife Service. 2009. Gray bat (*Myotis grisescens*) 5-Year Review: Summary and Evaluation. Columbia, Missouri. 34 pp.

Integration and Synthesis Summary: Gulf Coast jaguarundi

Scientific Name:	Common Name:	Entity ID:
Puma yagouaroundi cacomitli	Gulf Coast jaguarundi	22

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 and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Exposed individuals are unlikely to die, but they may experience prey loss from on-field carbaryl exposure. As such, we determine the risk of adverse effects to the 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 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 Gulf Coast jaguarundi. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 2/14/2022; Wherever found; *States within the range:* TX

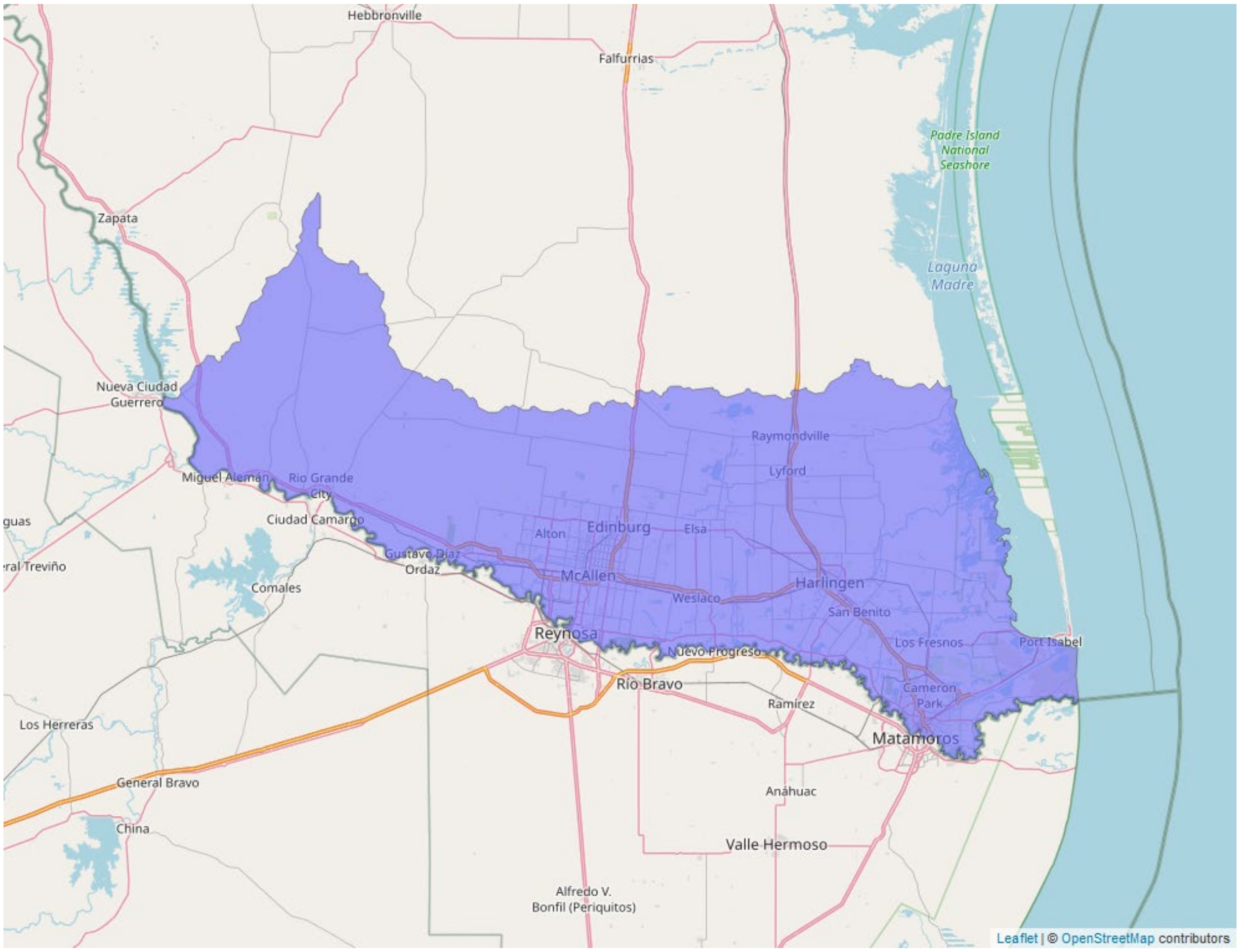

Figure 8. Range map of Gulf Coast jaguarundi (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3945.

Vulnerability

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

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 7/24/2018

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

Number of populations: Single population

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Gulf Coast jaguarundi was historically distributed from the Lower Rio Grande Valley in southern Texas to eastern Mexico. It is currently believed to be found in the Tamaulipan Biotic Province of Texas, where it uses dense, thorny shrublands or woodlands and bunchgrass pastures adjacent to dense brush or woody cover. Radio-collared jaguarundis spent up to 40% of their time in tall, dense grass habitats, but habitat analysis showed that their preferred habitat was natural undisturbed forest. The last confirmed sighting of jaguarundi in the U.S. was a roadkill specimen found in 1986 near Brownsville, Texas and the closest confirmed sightings since 1986 have been in Nuevo Leon, Mexico (95 mi southwest of Brownsville) (USFWS 2013). Primary threats to the Gulf Coast jaguarundi include habitat destruction, degradation, and fragmentation associated with agriculture and urbanization, and, to some extent, border security activities. Rapid human population growth in the region caused agricultural land to be converted to urban development, which fragmented habitat. Borderland activities (i.e., building construction, sewage dumping, road construction and maintenance, water development, brush clearing, pesticide run-off, lighting, human activities, fences, and off-road vehicle activity) could affect jaguarundis. Barriers to movement (bridges, dams) also exist across the species' range, including several that may act as east-west barriers for jaguarundis. Additional threats include mortality from collisions with vehicles, competition with bobcats, illegal hunting near settlements, and climate change (i.e., temperature increases and precipitation decreases) (USFWS 2013).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 52.8% of the species' range overlaps with agricultural use sites and 32.5% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 12). In total, there is approximately 85.3% 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 Gulf Coast jaguarundi.

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[16]	2.1	1.7	3.7	0.1	<0.1	0.2
Corn[17]	11.8	9.4	21.2	5.3	4.3	9.6
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.8	3.9	6.8	2.8	3.9	6.8
Other Grains	29.8	12.1	41.9	9.2	3.7	12.9
Other Orchards	<0.1	0.2	0.3	<0.1	0.2	0.3
Other Row Crops	1.9	1.1	3	0.5	0.3	0.9
Soybeans	0.5	0.4	0.9	0.5	0.4	0.9
Vegetables and Ground Fruit	4.4	4.1	8.5	3.2	3	6.3
Total	**52.8**	**32.5**	**85.3**	**21.3**	**15.6**	**36.8**

Usage

Past usage data indicate that up to 36.8% of the species' range has been treated with carbaryl annually from agricultural uses (Table 12).

Additional Exposure Considerations

We do not anticipate that individual Gulf Coast jaguarundi are likely to occur on carbaryl use sites beyond short periods needed to move between habitats or dispersal events. The jaguarundi's

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

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

preferred habitat is natural, undisturbed forests, but can forage or otherwise use areas of thorny shrub lands or bunchgrass pastures if dense brush or woody cover is nearby. As such, we only consider off-field exposures in our analyses.

Non-agricultural Uses

We anticipate the Gulf Coast jaguarundi may occur in non-agricultural carbaryl use sites, including managed forests and rangelands. While exposure to carbaryl through these non-agricultural uses is possible, based on past usage data, we anticipate exposure is unlikely to occur. Available usage data from the U.S. Forest Service show no carbaryl has been applied in the regions containing the jaguarundi's range from 2016 - 2020. Similarly, available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland areas within the jaguarundi's range have been treated with carbaryl. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024). In summary, while the Gulf Coast jaguarundi is known to occur in some non-agricultural carbaryl use sites, the low level of past usage suggests that non-agricultural uses of carbaryl will expose no more than a small number of individuals over the duration of the proposed action.

Exposure Summary

The Gulf Coast jaguarundi's habitat requirements indicate that individuals are not likely to enter or forage on agricultural carbaryl use sites. As such, we only consider off-field exposures in our analysis. There is a high extent of overlap between off-field areas that are likely to be exposed to carbaryl and the species' range (32.5% off-field overlap). There is a high level of past carbaryl usage within the species range (up to 15.6% of the range exposed to carbaryl annually). Given that both off-field overlap and past usage is high, we anticipate a large portion of the range is likely to be exposed to carbaryl throughout the duration of the proposed action. Non-agricultural uses of carbaryl will not expose more than a small number of individuals. As such, given the high overlap and past usage within agricultural areas, we anticipate a large number of individuals will be exposed to carbaryl.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the Gulf Coast jaguarundi. Jaguarundi are carnivorous and primarily consume small mammals, birds, and reptiles. EPA's exposure modeling indicates that jaguarundi that exclusively consume prey that have recently foraged on contaminated food items on carbaryl use sites (i.e., within the last 24 hours) are likely to accumulate high levels of carbaryl (up to 12.2-55.2 mg/kg-bw). In contrast, individuals foraging off-field are likely to accumulate only low levels of carbaryl (up to 0.6 mg/kg-bw). Given that the jaguarundi is not likely to forage on-field, we anticipate individuals will only be exposed to low levels of carbaryl through dietary exposure. We do not anticipate any direct adverse effects (i.e., mortality, impaired motor activity or behavior, reduced growth or reproduction) at these dosages.

Indirect Effects:

We expect some prey species, specifically mammalian prey, will die with exposure to carbaryl. However, we only anticipate mammalian prey that forage on agricultural use sites are likely to die. Given that the Gulf Coast jaguarundi is not likely to forage on use sites, we do not anticipate this level of prey mortality is not likely to result in significant reductions in the abundance of prey for individuals, resulting in no more than low levels of indirect adverse effects.

Toxicity Summary

The Gulf Coast jaguarundi has a low toxicity ranking. We do not anticipate individuals will accumulate more than low levels of carbaryl through dietary exposure as we do not anticipate individuals will feed on agricultural use sites where dietary doses are the highest. We do not anticipate any exposed individuals are likely to experience any direct adverse effects at predicted off-field dietary dosages. While there will be some loss of mammalian prey from on-field exposure, we do not expect this will represent a significant loss of prey resources for the species, resulting in no more than low levels of indirect adverse effects.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Gulf Coast jaguarundi has a high exposure ranking. While individuals are not likely to occur on agricultural use sites, there is still a high extent of overlap between the species' range and off-field areas as well as a high level of past usage, resulting in the exposure of a large number of individuals over the duration of the proposed action. We do not anticipate non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action.

The Gulf Coast jaguarundi has a low toxicity ranking. We do not anticipate individuals foraging in off-field areas will accumulate more than low levels of carbaryl that are not likely to result in mortality or sublethal adverse effects to more than a small number of exposed individuals. While there will be some loss of mammalian prey from on-field foraging, we anticipate this prey loss will not affect the overall availability of prey resources for the species, resulting in no more than low levels of indirect adverse effects.

While there will likely be a large number of individuals exposed to carbaryl, we do not anticipate more than a small number of individuals will die or experience sublethal adverse effects. We expect the species will experience low levels of indirect adverse effects through the loss of prey. As such, we anticipate the overall risk of adverse effects to the species is low.

Conclusion

The Gulf Coast jaguarundi has a high vulnerability based on its status (i.e., endangered), single population, limited distribution, and declining trends, as described above. However, we do not expect jaguarundis will occur on agricultural carbaryl use sites for longer than short periods while moving between habitats or during dispersal events. Their preferred habitat is natural, undisturbed forests, but they can forage or use areas of thorny shrubs or bunchgrass pastures if dense brush or woody cover is nearby. Therefore, we only consider off-field exposure in our analysis. Spray drift and runoff may impact 32.5% of the species' range and, in the past, up to 15.6% of the range was exposed to carbaryl through spray drift annually. Because both off-field overlap and off-field past usage are high, we anticipate that a large number of individuals are likely to be exposed. However, we do not anticipate exposures are likely to cause any direct adverse effects as individuals are not likely to accumulate more than low levels of carbaryl in off-field areas. While there will be some prey loss from on-field exposure, we do not expect this loss of prey will be at a level that will cause any adverse effects to the species' survival.

Given that only a small number of individuals are likely to die or experience sublethal adverse effects, we do not anticipate the proposed action will result in any species-level impacts. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 Gulf Coast jaguarundi.

References

U.S. Fish and Wildlife Service. 2018. 5-Year Review Jaguarundi (*Puma yagouaroundi cacomitli*). Albuquerque, New Mexico. 3 pp.

U.S. Fish and Wildlife Service. 2013. Gulf Coast Jaguarundi Recovery Plan (*Puma yagouaroundi cacomitli*). Albuquerque, New Mexico. 70 pp.

Integration and Synthesis Summary: Ocelot

Scientific Name:	Common Name:	Entity ID:
Leopardus (=Felis) pardalis	Ocelot	30

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 medium overlap of the action area with the species' range and low past usage of carbaryl within the species' range, indicating a medium extent of exposure. We do not expect any exposed individuals are likely to die and will experience only low levels of indirect adverse effects. As such, we determine the risk of adverse effects to the 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 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 ocelot. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 12/14/2021; wherever found; *States within the range:* AZ, TX

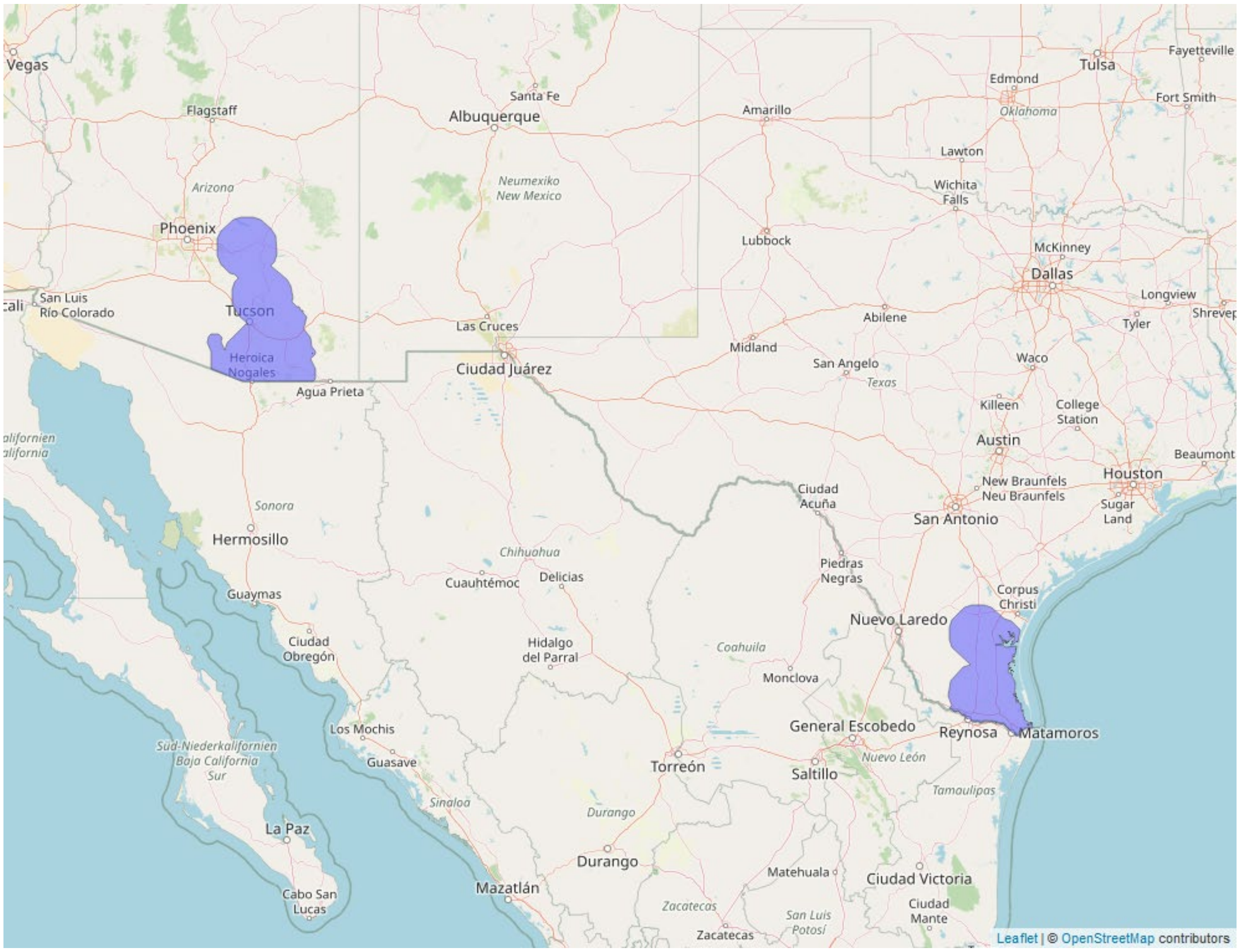

Figure 9. Range map of Ocelot (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/4474.

Vulnerability

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

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 7/24/2018

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

Ocelots are small, cryptic, spotted cats found in the extreme southern U.S. (Texas and Arizona), Mexico, and South America. They use a wide variety of habitats, including thornscrub and semi-arid vegetation, coastal grasslands and coastal tropical forests, tropical dry forests, tropical rain forests, oaks and grasslands, piedmont/montane scrub, cloud forest, pine-oak forests, and fir forests. They are also known to use agricultural lands, especially during dispersal events. Rivers, former river meanders, irrigation canals, irrigation drains, natural drainages, shorelines, fence lines, and brushy road margins provide suitable travel corridors for ocelots, especially as density and percent-cover of thornscrub vegetation increase. One study suggested that ocelots disperse between 2.5-9 km, mostly using narrow (5-100 m) corridors of brush along remnants of former river meanders and drainage ditches. In 2018, the Texas ocelot population was estimated at 80 ocelots found in two populations. A third population is found in Mexico and is geographically isolated from the Texas populations. In Arizona between 2009-2013, only four individuals were detected, and they appeared to be dispersers as opposed to a population (USFWS 2018). After 1990, the Texas Ocelot Research and Conservation Consortium started research on captive breeding ocelots, and we believe there is potential for captive breeding in the future (USFWS 2016). Primary threats to ocelots are habitat conversion, fragmentation, and loss. In Texas, over 95% of the dense thornscrub habitat in the Lower Rio Grande Valley was converted to agriculture, rangelands, or urban land uses. Ocelots are threatened by genetic impoverishment from small populations and lack of connectivity among populations due to highways and other roads. Issues associated with developing and patrolling the border between the United States and Mexico further exacerbate the isolation of ocelots in Mexico from those in Texas and Arizona (USFWS 2018). Agricultural pesticides and herbicides (i.e., Round-Up) may have negative impacts on the ocelot, through both direct effects to ocelots and effects to prey. In Texas in 1991, an ocelot was poisoned and killed incidentally when it ate chicken meat laced with aldicarb, a carbamate insecticide, by a hunter (USFWS 2016).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 14.3% of the species' range overlaps with agricultural use sites and 8.2% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 13). In total, there is approximately 22.4% 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 ocelot.

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	0.2	<0.1	0.3	0.2	<0.1	0.3
Citrus[18]	0.4	0.3	0.7	<0.1	<0.1	<0.1
Corn[19]	2.9	2.2	5.1	1	0.8	1.8
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	0.8	1.2	2	0.8	1.2	2
Other Grains	8.6	3.2	11.8	1.7	0.6	2.4
Other Orchards	<0.1	0.1	0.2	<0.1	<0.1	0.1
Other Row Crops	0.4	0.2	0.6	0.1	<0.1	0.2
Soybeans	<0.1	0.1	0.2	<0.1	0.1	0.2
Vegetables and Ground Fruit	1	0.9	1.9	0.6	0.6	1.2
Total	**14.3**	**8.2**	**22.4**	**4.5**	**3.4**	**8**

Usage

Past usage data indicate that up to 8% of the species' range has been treated with carbaryl annually from agricultural uses (Table 13).

[18] 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.

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

Additional Exposure Considerations

The species’ habitat consists of thorny scrub lands of the Lower Rio Grande Valley and Rio Grande Plains. While the species may use some agricultural areas as transitional corridors, we do not expect individuals are likely to spend large amounts of time on-field because carbaryl use sites do not likely provide the necessary habitat features needed to support individual ocelots. As such, we only consider off-field exposure in our analyses.

Non-agricultural Uses

Based on our knowledge of the species’ biology, we anticipate some ocelot individuals may occur in non-agricultural carbaryl use sites, including managed forests, rangeland, and rights of way areas. While it is possible individuals in these areas may be exposed to carbaryl, we anticipate that exposure is unlikely to occur given the low level of usage that occurs in these use sites. Available usage data from the U.S. Forest Service show no carbaryl has been applied in the regions containing the ocelot’s range from 2016 - 2020. Similarly, available usage data from USDA APHIS indicate that, from 2019-2023, no rangeland areas within the ocelot’s range have been treated with carbaryl. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024).

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 on an annual basis. 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. Rather, we 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 ocelot’s range for rights of way use. In summary, while the ocelot is known to occur in some non-agricultural carbaryl use sites, the low level of past usage suggests that non-agricultural uses of carbaryl will expose no more than a small number of individuals over the duration of the proposed action.

Exposure Summary

Given that we do not anticipate ocelots will likely occupy carbaryl use sites for more than short periods of time, we focus our analyses for this species on off-field areas. There is a moderate extent of overlap between the action area and the species’ range (8.2% total off-field overlap). Based on past usage data, we anticipate only a small portion of the species’ range is likely to be exposed to carbaryl (up to 3.4% off-field annually). While we anticipate only a small portion of the range will be treated, the higher level of overlap suggests that a moderate number of individuals are likely to be exposed to carbaryl. We do not anticipate non-agricultural uses of carbaryl will expose more than a small number of individuals.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the ocelot. Ocelots are carnivorous and we expect that they primarily consume small mammals, birds, and reptiles. EPA's exposure modeling indicates that ocelots that consume prey that have recently foraged on contaminated food items on carbaryl use sites (i.e., within the last 24 hours) are likely to accumulate high levels of carbaryl (up to 12.2-57.2 mg/kg-bw). In contrast, individuals foraging off-field are likely to accumulate only low levels of carbaryl (up to 0.6 mg/kg-bw). Given that the ocelot is not likely to forage on-field, we anticipate individuals will only be exposed to low levels of carbaryl through dietary exposure. We do not anticipate any direct adverse effects (i.e., mortality, impaired motor activity or behavior, reduced growth or reproduction) at these dosages.

Indirect Effects:

We expect some prey species, specifically mammalian prey, will die with exposure to carbaryl. However, we only anticipate mammalian prey that forage on agricultural use sites are likely to die. Given that the ocelot is not likely to forage on use sites, we do not anticipate this level of prey mortality is not likely to result in significant reductions in the abundance of prey for individuals, resulting in no more than low levels of indirect adverse effects.

Toxicity Summary

The ocelot has a low toxicity ranking. We do not anticipate individuals will accumulate more than low levels of carbaryl through dietary exposure as we do not anticipate individuals will feed on agricultural use sites where dietary doses are the highest. We do not anticipate any exposed individuals are likely to experience any direct adverse effects at predicted off-field dietary dosages. While there will be some loss of mammalian prey from on-field exposure, we do not expect this will represent a significant loss of prey resources for the species, resulting in no more than low levels of indirect adverse effects.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The ocelot has a medium exposure ranking. While individuals are not likely to occur on agricultural use sites and past usage within the range is low, there is still a moderate extent of overlap between the species' range and off-field areas. Thus, we expect a moderate number of individuals are likely to be exposed over the duration of the proposed action. We do not anticipate non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action.

The ocelot has a low toxicity ranking. We do not anticipate individuals foraging in off-field areas will accumulate more than low levels of carbaryl that are not likely to cause any direct adverse effects. While there will be some loss of mammalian prey from on-field foraging, we anticipate this prey loss will not affect the overall availability of prey resources for the species, resulting in no more than low levels of indirect adverse effects.

While there will likely be a moderate number of individuals exposed to carbaryl, we do not anticipate more than small number of individuals are likely to die or experience sublethal adverse effects. We expect the species will experience only low levels of indirect adverse effects through prey loss. As such, we anticipate the overall risk of adverse effects to the species is low.

Conclusion

The ocelot has high vulnerability based on its status (i.e., endangered), limited distribution, and declining trends, as described above. Though their primary habitat is grasslands, forests, scrub, and riparian areas, ocelots use a wide variety of habitats and are known to use agricultural lands and pasture, especially during dispersal. We do not expect ocelots will occur on carbaryl use sites for longer than short periods while moving between habitats. Therefore, we only consider off-field exposure in our analysis. Spray drift and runoff may impact 8.2% of the species' range and, in the past, up to 3.4% of the range was exposed to carbaryl through spray drift or runoff annually. Because off-field overlap is medium and off-field past usage is low, we anticipate a medium portion of the range and a moderate number of individuals will be exposed throughout the duration of the action. We expect it to be rare for an ocelot to exclusively consume prey (i.e., small mammals, birds, reptiles) that has foraged on agricultural use sites. While there may be some loss of mammalian prey from on-field exposure, we do not expect this prey loss will result in mortality or adverse effects to growth or reproduction, resulting in only low levels of indirect adverse effects.

We expect impacts to the species will be low. Even though ocelots have high vulnerability and medium exposure, we expect low levels of toxicity to exposed individuals, as we anticipate no more than a small number of exposed individuals are likely to die or experience sublethal adverse effects. The species will experience no more than low levels of indirect adverse effects through the loss of prey species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 ocelot.

References

U.S. Fish and Wildlife Service. 2018. 5-Year Review: Summary and Evaluation Ocelot (*Leopardus pardalis*). Laguna Atascosa National Wildlife Refuge, Los Fresnos, Texas. 13 pp.

U.S. Fish and Wildlife Service. 2016. Recovery Plan for the Ocelot (*Leopardus pardalis*) First Revision. Albuquerque, New Mexico. 237 pp.

Integration and Synthesis Summary: Southeastern beach mouse

Scientific Name:	Common Name:	Entity ID:
Peromyscus polionotus niveiventris	Southeastern beach mouse	53

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 medium overlap of the action area with the species' range and medium past usage of carbaryl within the species' range, indicating a medium extent of exposure. We do not anticipate any exposed individuals are likely to die or experience sublethal effects as expected dosages are low and only minor indirect effects through the loss of food resources are likely to occur. As such, we determine the risk of adverse effects to the 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 likely 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 expected to jeopardize the continued existence of the southeastern beach mouse. We discuss our rationale for this conclusion for the species in the sections below.

Species range

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

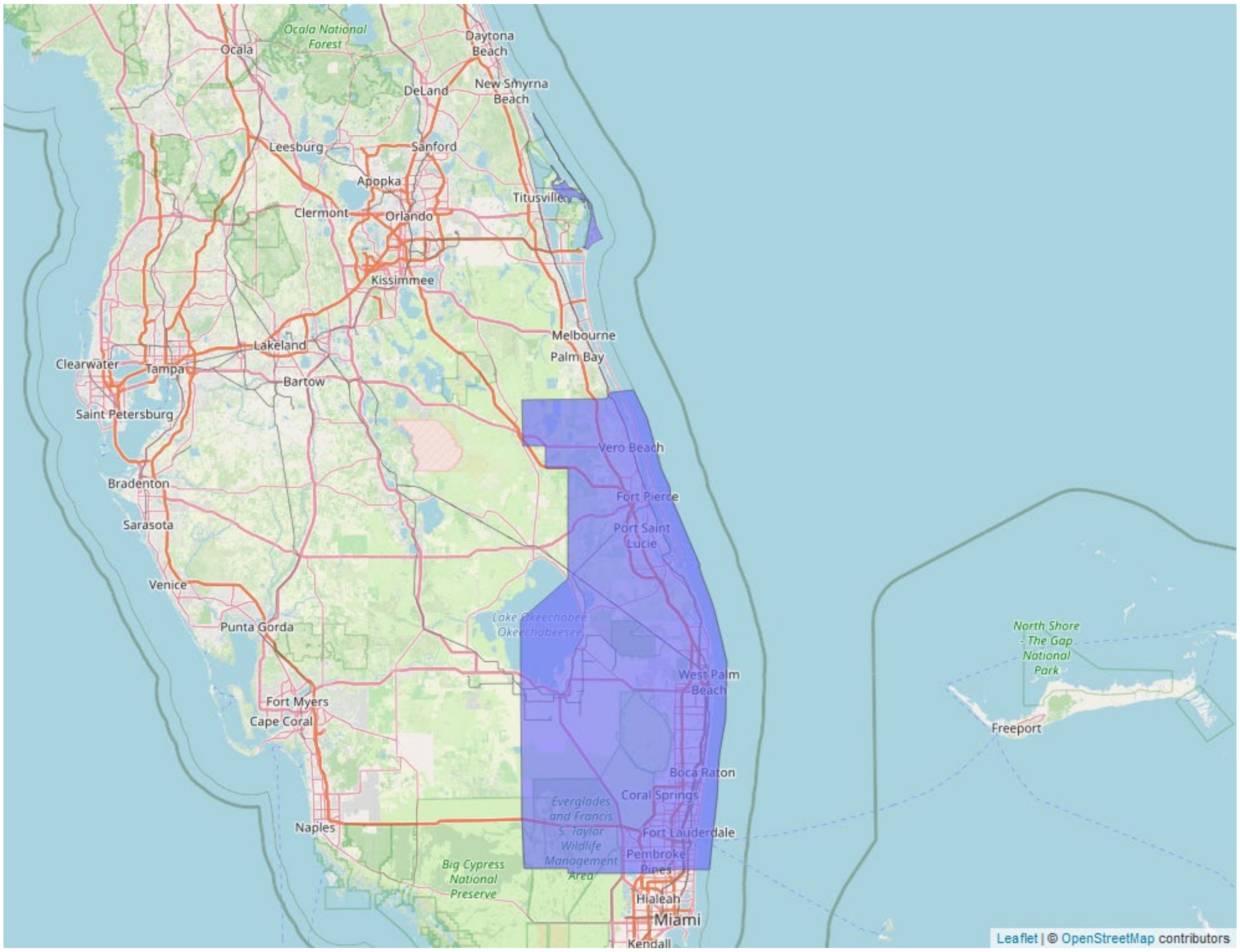

Figure 10. Range map of Southeastern beach mouse (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/3951.

Vulnerability

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

Listing status: Threatened

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

Most recently completed 5 Year Status Review: 10/11/2019

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Southeastern beach mice are found on frontal dunes and scrub dunes in coastal Florida. The species historically occupied 360 km of the Atlantic coastline from Volusia to Broward Counties. Due to habitat loss, they now occupy 80.5 km of the coastline from Volusia to Indian River Counties. Two extant populations occur in the northern part of the historic range (i.e., Smyrna Dunes Park and a metapopulation on the Cape Canaveral Complex). The species is extirpated from the coastal dunes from Port Canaveral Inlet south to Sebastian Inlet, and their fate between Sebastian Inlet and Ft. Pierce Inlet is uncertain (USFWS 2019). The species is considered stable across remaining populations. All known areas that currently have the species are in county, state, or Federal ownership. Reintroduction is being considered within the historic range to establish additional populations (USFWS 2008), but areas of suitable habitat large enough to support southeastern beach mouse no longer occur south of Palm Beach Inlet (USFWS 2019).

The primary threat to the southeastern beach mouse is the continued loss, fragmentation, and alteration of beach dune, coastal strand, and scrub habitat. Large-scale commercial and residential development on the Atlantic coast eliminated beach mouse habitat in Palm Beach and Broward Counties. Coastal development and inlet construction fragmented habitat and limited movement of the species to recolonize adjacent sites. Urbanization increased the recreational use of dunes and impacted the vegetation needed for dune maintenance and stabilization. Loss of dune vegetation results in widespread wind and water erosion and reduces the effectiveness of the dune to protect beach mouse habitat. Habitat is no longer lost from development within the species' range, but development borders the existing protected areas where the species occurs and could affect species management at these sites. Increased predation pressure on isolated beach mouse populations from natural and non-native predators can have substantial impacts to the southeastern beach mouse. Free-roaming and feral cats are considered the primary cause of the extirpation of isolated populations of beach mice and a contributing factor to the extinction of the Pallid beach mouse (P. polionotus decoloratus). The encroachment of residential housing on the Atlantic Coast increases the likelihood of predation by domestic cats. A healthy population of the species at Sebastian Inlet State Park (north of the inlet) in Brevard County was completely extirpated by 1972, presumably by feral cats. Large and small hurricanes can cause waves to overwash dunes and impact or eliminate occupied habitat (USFWS 2008). At times, habitat loss resulted from beach renourishment projects that eliminated coastal vegetation. Most of the public lands now have crossovers that allow visitors to access the beach, which has alleviated some impacts to the dunes. Smyrna Dunes Park and Sebastian Inlet State Park are working on restoring the habitat by implementing resource management activities within those areas. At Merritt Island National Wildlife Refuge, Kennedy Space Center, and Cape Canaveral Air Force Station, where mice occupy the coastal scrub, some prescribed burning to reduce hardwoods and create open sandy areas has occurred. Sebastian Inlet State Park and Archie Carr National Wildlife Refuges (just north of Sebastian Inlet State Park) implemented a feral cat removal program and may now be suitable reintroduction sites (USFWS 2019).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 32% of the species' range overlaps with agricultural use sites and 9% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 14). In total, there is approximately 41% 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 southeastern beach mouse.

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[20]	4.5	2.3	6.8	3	1.5	4.5
Corn[21]	1.2	0.7	1.9	0.5	0.3	0.8
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	12.1	3.8	15.9	12.1	3.8	15.9
Other Grains	13.8	1.5	15.3	<0.1	<0.1	<0.1
Other Orchards	0.3	0.4	0.7	0.3	0.4	0.7
Other Row Crops	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

[20] 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.

[21] 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
Soybeans	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vegetables and Ground Fruit	0.4	0.7	1.1	0.4	0.7	1.1
Total	**32**	**9**	**41**	**16**	**6.3**	**22.3**

Usage

Past usage data indicate that up to 22.3% of the species' range has been treated with carbaryl annually from agricultural uses (Table 14).

Additional Exposure Considerations

Currently, the southeastern beach mouse is found in two areas in Volusia and Brevard Counties, specifically in Smyrna Dunes Park, Canaveral National Seashore, Merritt Island National Wildlife Refuge/Kennedy Space Center, and Cape Canaveral Air Force Station. We do not anticipate carbaryl is likely used in these areas. Available information on the Southeastern beach mouse indicate that the species avoids agricultural areas. As such, we only consider off-field overlap and usage in our analysis of the species.

Non-agricultural Uses

Based on available information on the species' biology, we do not anticipate the southeastern beach mouse is likely to be exposed to carbaryl through non-agricultural uses like developed, nurseries, managed forests, rangeland, or rights of way areas, but may occur on open space developed use sites. While carbaryl exposure through open space developed use is possible, we do not anticipate exposure is likely to occur as we expect low usage in the specific locations the species is known to occur in. Available usage data on open space developed uses of carbaryl (such as turf or gold course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or entirely within the southeastern beach mouse's range, we expect this is highly unlikely to occur. Rather, we expect open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the southeastern beach mouse's range. We expect an even smaller portion of the species' range is likely to be treated for open space developed uses as the habitat at most sites known to be occupied by southeastern beach mouse are primarily located on local, county, state and federally publicly managed lands where we anticipate low levels of pesticide use are likely to occur. As such, we do not anticipate non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

Based on available information on the species' biology and current known locations, we do not anticipate individuals will occur on agricultural use sites. There is a medium extent of overlap between the species' range and agricultural off-field areas and a medium level of past usage within the species' range, indicating that a moderate portion of the species' range is likely to be treated annually. We do not anticipate non-agricultural uses will expose more than a small number of individuals. Thus, we anticipate a moderate number of individuals will be exposed over the duration of the proposed action.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the southeastern beach mouse. This species primarily consumes seeds but can also consume invertebrates during periods of low seed availability. Consumption of food items on agricultural use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses ranging from 2-6.6 mg/kg-bw, depending on the rate of application used (which varies by crop type). In contrast, individuals in off-field areas that consume food items exposed to carbaryl through spray drift will likely accumulate only low levels of carbaryl (up to 0.1 mg/kg-bw). Given that the species is unlikely to occur on agricultural use sites, we anticipate individuals will only accumulate low levels of carbaryl through dietary exposure. Based on available toxicity data, we do not anticipate any individuals will experience direct adverse effects (i.e., reduced survival, impaired motor activity or behavior, reduced growth, reduced reproduction) at this level of exposure.

Indirect Effects:

The southeastern beach mouse primarily consumes seeds but can switch to invertebrate prey when seed abundance is low. Based on available toxicity data in plants, we do not anticipate any adverse effects to plant growth or survival are likely to occur. Thus, we do not anticipate any reductions in the abundance of the beach mouse's primary food source are likely to occur with carbaryl use. In contrast, available toxicity studies in insects indicate that insect prey are likely to experience a high level of mortality. However, given that the coastal dune habitat that the species occupies is not likely near agricultural areas, we anticipate insect prey are not likely to experience high levels of exposure or mortality. As such, we do not expect any reductions in the beach mouse's primary food source and only small reductions in secondary food resources, indicating that only low levels of indirect adverse effects are likely to occur.

Toxicity Summary

We expect the southeastern beach mouse will only accumulate low levels of carbaryl through dietary exposure as the species is not likely to occur and forage on agricultural use sites where exposure is most severe. We do not anticipate any direct adverse effects are likely to occur to individuals exposed in off-field areas as predicted dietary doses are low. We anticipate only minor indirect adverse effects are likely as carbaryl is not likely to adversely affect the beach mouse's main dietary resource (seeds). Thus, the species' overall toxicity ranking is low.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The southeastern beach mouse has a medium exposure ranking. While we do not anticipate individuals will occur on agricultural use sites, there is still a medium extent of overlap between the species' range and off-field areas and a medium level of past usage within the species' range, suggesting that a medium number of individuals are likely to be exposed over the duration of the proposed action.

The southeastern beach mouse has a low exposure ranking. We do not anticipate individuals are likely to accumulate more than low levels of carbaryl as predicted dietary exposures in off-field areas are well below levels where adverse effects have been observed in mammalian toxicity studies. We do not anticipate more than minor indirect adverse effects as the species' main food resource (seeds) are not likely to be affected by carbaryl usage.

Thus, while we anticipate a moderate number of individuals are likely to be exposed over the duration of the action, we do not anticipate exposed individuals are likely to experience more than low levels of adverse effects. As such, the overall risk of adverse effects to the species is low.

Conclusion

The southeastern beach mouse a has a high vulnerability based on its limited distribution, loss of habitat to development, stochastic events (e.g., hurricanes), predation (e.g., feral cats), and declining trends, as described above. The likelihood of exposure from labeled uses across the range is considered low. There is a medium extent of overlap between the species' range and agricultural use areas and a medium level of past usage within the species range, indicating a moderate number of individuals are likely to be exposed over the duration of the proposed action. However, available information on the current distribution of the species indicates that the two remaining populations of southeastern beach mouse are located on protected lands with county, state, or federal ownership, and are not likely to occur in agricultural use sites.

We do not anticipate more than a small number of exposed individuals are likely to die or experience any sublethal adverse effects from dietary exposure of carbaryl. Similarly, while carbaryl will likely reduce insect prey abundance, we expect only minor indirect adverse effects as carbaryl is not likely to adversely affect the beach mouse's primary food resource (seeds).

We do not expect the small number of individuals likely to die will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 southeastern beach mouse.

References

U.S Fish and Wildlife Service. 2019. Southeastern beach mouse (*Peromyscus polionotus niveiventris*) 5-Year Review: Summary and Evaluation. Jacksonville, Florida. 33 pp.

U.S Fish and Wildlife Service. 2008. Southeastern beach mouse (*Peromyscus polionotus niveiventris*) 5-Year Review: Summary and Evaluation. Jacksonville, Florida. 38 pp.

Integration and Synthesis Summary: Buena Vista Lake ornate shrew

Scientific Name:	Common Name:	Entity ID:
Sorex ornatus relictus	Buena Vista Lake ornate shrew	58

Species Overview

In reviewing the status of the species, the environmental baseline for the action area, cumulative effects, and the effects of the action, we determined that the species' vulnerability ranking is high. While there is a low level of past usage within the range, there is a very high extent of overlap, the range is surrounded by agriculture, and available information on the species' distribution indicate that individuals are likely to occur in close proximity to agricultural use sites, resulting in a high exposure ranking. We anticipate individuals exposed on- and immediately adjacent to use sites will experience high mortality. Thus, the risk to the species from the registration of carbaryl is high, as described in the following sections. 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 Buena Vista Lake ornate shrew. We discuss our rationale for the species in the sections below.

Species range

Based on range map dated: 2/16/2023; Wherever found; *States within the range:* CA. Figure 11 depicts a map of the species' range.

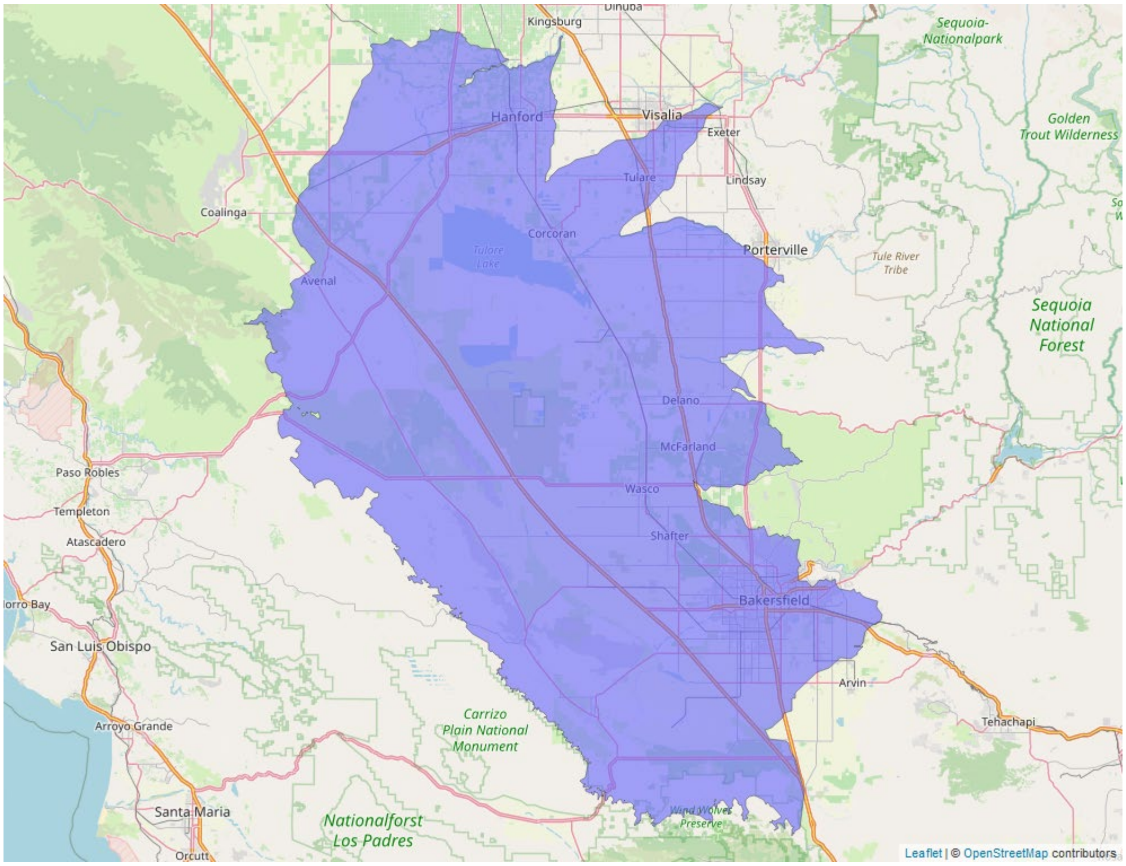

Figure 11. Range map of Buena Vista Lake ornate shrew (blue polygons). Range map accessed on August 03 2023 at https://ecos.fws.gov/ecp/species/1610.

Vulnerability

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

Summary of status

Listing status: Endangered

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

Most recently completed 5-Year Review: 8/31/2020

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Buena Vista Lake ornate shrew is one of nine subspecies of ornate shrews known to occur in California. Its habitat is riparian and wetland vegetation communities with abundant leaf litter and dense herbaceous cover, and the species is often found near reliable water bodies. They feed indiscriminately on available larvae and adults of aquatic and terrestrial invertebrates, including insects, spiders, centipedes, slugs, snails, and earthworms. Historically, the Buena Vista Lake ornate shrew inhabited the interconnected network of tule marshes and other permanent and seasonal lakes, wetlands, and sloughs around the historic Tulare, Kern, and Buena Vista lakes, and presumably throughout the Tulare Basin. Though the current distribution of the shrew is unknown, it is likely to be restricted due to the loss of >95% of its wetland habitat, lack of connectivity, and additional habitat loss. By 2010, the species was found in eight locations: Goose Lake, Atwell Island, Main Drain Canal/Semitropic Ecological Reserve, Lemoore Wetlands preserve, Coles Levee Ecological Preserve, Kern fan water recharge area, Kern National Wildlife Refuge, and Kern Lake. Several areas of fragmented private lands may support small numbers of this species also (USFWS 2010). As of 2020, there were fifteen sites believed to be occupied: the eight listed in 2010, NAS Lemoore, Pixley National Wildlife Refuge, Poso Creek, Kern River overflow canal at Highway 5 and Highway 46, Kern River overflow canal at Semitropic Canal crossing, Wind Wolves Preserve (Twin Fawns site), and Wind Wolves Preserve (Willow site). Coles Levee is potentially occupied, but the species was not found during recent surveys. Surveys have not been conducted recently at Lemoore Wetland Reserve, Goose Lake, or Kern Lake. Abundance information was not presented (USFWS 2020a).

When the Buena Vista Lake ornate shrew was listed as endangered in 2002, the primary threat to its survival and recovery was habitat loss through diversion and impoundment of rivers, lake draining, and destruction of wetlands for agriculture and urban development. Since then, industrial and agricultural development and urbanization have continued to reduce suitable habitat and lack of allocation of water to riparian and wetland areas was identified as a potential new threat. Shrews are generally unpalatable to predators due to an offensive odor in their flank glands and feces, but several species of owls are known to feed on shrews. Pesticides, including carbaryl, were identified as a likely stressor, although no studies have been conducted to investigate their effects on the shrew (USFWS 2010). The species could be exposed to pesticides sprayed on nearby crops, including herbicides, and their prey base could be affected by pesticide use (USFWS 2020a).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

We expect 100% of the species range will overlap with carbaryl use sites or is likely to be exposed through off-site transport within the action area (Table 15). Other orchards and other crops are the most prevalent use sites within the species' range, with 40% and 36.1% of the range, respectively.

Table 15. Agricultural use overlap and annual usage data (% Range Treated) for the Buena Vista Lake ornate shrew.

Use Layer	Use Site Overlap (% range)	Off-field Overlap (% range)	Total Overlap (% range)
Alfalfa	6.4	4.2	10.6
Citrus	2.9	1.7	4.6
Corn[22]	8.8	4.7	13.5
Grapes	4.2	1.3	5.5
Other Crops	26.4	9.7	36.1
Other Grains	13.6	8.1	21.7
Other Orchards[23]	30.4	9.6	40.0
Other Row Crops	<0.1	<0.1	<0.1
Soybeans	0	0	0
Vegetables and Ground Fruit	6.7	3.5	10.2
Total[24]	**92.3**	**39.9**	**100**

Usage

Mandatory reporting data from the state of California indicates that, between 2013-2022, the maximum yearly overlap between the species' range and agricultural areas reporting any

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

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

[24] Total overlap is calculated by aggregating all use data layers that are not highly redundant (i.e., all data layers plus corn or soy plus citrus or other orchards). Total overlap is capped at 100%.

pesticide usage was 51.3%. Of those areas reporting pesticide usage, up to 44.2% reported use of any insecticide. Based on this reporting data, we expect 1.4% of the species' range is likely to be treated with carbaryl, specifically (Table 16). This pesticide usage data is based on data reported by more than 7,993 growers within the species' range. The high number of reporters suggests that these usage metrics will be stable over time.

Table 16. Overlap between areas treated with any pesticide, any insecticide, and carbaryl with the Buena Vista Lake ornate shrew's range as reported by the California Department of Pesticide Regulation.

% overlap with all pesticide usage areas	% overlap with all insecticide usage areas	% overlap with carbaryl usage areas
51.3	44.2	1.4

Additional Exposure Considerations

The Bueno Vista Lake ornate shrew occurs in remnant patches of wetland or moist-soil vegetation, most of which are surrounded by agricultural development. They may move into surrounding agricultural land on occasion, but there is little data on their movements.

Non-agricultural Uses

Based on available information on the species, we can infer that functional habitat for the Buena Vista Lake ornate shrew does not contain non-agricultural carbaryl use sites, including developed, open space developed, nursery, managed forests, rangeland, or rights of way areas. As such, we do not expect non-agricultural uses of carbaryl will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

There is a high extent of overlap between the action area and the species' range, with nearly the entire species' range overlapping with the action area. Mandatory pesticide usage reporting data from the state of California indicates that only a small portion of the species' range has been treated with carbaryl in the past (up to 1.4% range treated annually). While this is a low level of past carbaryl usage, the high level of insecticide usage suggests that there may still be a high likelihood of exposure to occur, particularly if pest pressures change or require growers to switch to carbaryl. Furthermore, additional information on the current distribution of the species suggests that remaining populations of the species are highly fragmented and likely to occur near agricultural areas, indicating an increased likelihood of exposure. While non-agricultural uses are not likely to expose more than a small number of individuals, given the close proximity of the species to agricultural areas we anticipate a large number of individuals will be exposed.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

The Buena Vista Lake ornate shrew feeds indiscriminately on aquatic and terrestrial insects, spiders, centipedes, slugs, snails, and earthworms. As such, we anticipate individuals are likely to consume contaminated prey on- and off-field. EPA's exposure modeling predicts individuals that feed on-field are likely to accumulate levels of carbaryl up to 70.2-234.1 mg/kg-bw depending on the application rate, which can cause up to 44-94% mortality of exposed individuals. Dietary exposure to carbaryl in areas off-field (up to 30 meters from the edge of field) will result in 1.1-2.5 mg/kg-bw, which will not cause any mortality or sublethal adverse effects.

Indirect Effects:

The Buena Vista Lake ornate shrew is a generalist invertivore and can consume a wide variety of invertebrates, including arthropods and non-arthropods. Available toxicity data indicate that arthropod species are highly sensitive to carbaryl and are likely to experience high levels of mortality even at low levels of exposure. As such, we anticipate carbaryl use will reduce the abundance of arthropod prey resources for individuals. However, available toxicity data indicate that non-arthropod invertebrates, including mollusks and annelids, are not likely to experience any adverse effects to survival, growth, or reproduction at predicted levels of carbaryl exposure. Thus, while we anticipate a large reduction in the availability of sensitive arthropod prey species, we expect there will be sufficient prey resources to support individuals in the form of non-sensitive prey species like slugs, snails, and worms.

Toxicity Summary

While we do not expect more than low levels of indirect effects, given that known populations likely occur in the vicinity of agricultural areas, we expect individuals are likely to die as a result of consuming invertebrate prey that have recently been exposed to carbaryl on-field. As such, the toxicity ranking for this species is high.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Buena Vista Lake ornate shrew has a high exposure ranking. While past usage data from the state of California show a low level of carbaryl usage (up to 1.4% range treated annually), the high level of all insecticide usage (up to 44% of the range treated annually with an insecticide) and the high level of overlap (up to 51.3% according to CalPUR data) indicate a large number of individuals may still be exposed, particularly if changes in pest pressures force growers to switch to carbaryl from a different insecticide. We do not anticipate non-agricultural uses will expose more than a small number of individuals.

The Buena Vista Lake ornate shrew has a high toxicity ranking. While we do not expect more than low levels of indirect effects are likely (given that individuals can switch to prey species that are not sensitive to carbaryl), given the proximity of known populations to agricultural areas, we expect there is a high likelihood that individuals will consume prey species that have recently been exposed on carbaryl use sites. This consumption of recently exposed prey will result in high concentrations of carbaryl, which will result in high levels of mortality.

Given that a large number of individuals are likely to be exposed and that exposed individuals are likely to experience high levels of adverse effects, we expect a large number of individuals will die or experience sublethal adverse effects. As such, we expect the overall risk of adverse effects to the species is high.

Conclusion

The Buena Vista Lake ornate shrew has high vulnerability based on its status (i.e., endangered), limited distribution, and declining trends, as described above. Their primary habitat includes riparian and wetland areas where abundant leaf litter and dense herbaceous cover are present, and they feed on aquatic and terrestrial invertebrates. The shrew can be affected by herbicides and other pesticide sprayed on nearby agricultural lands, and most of their remaining habitat areas are surrounded by agriculture. The species may occur on and likely feeds on invertebrates that occur on, to some extent, agricultural lands. Carbaryl use may occur on or near up to 100% of the species' range, but only 1.4% of the range was treated annually with carbaryl in the past (44.2% was treated annually with any insecticide). Even though carbaryl past usage is low, overlap is high, past insecticide usage is high, and future pest pressures may change and additional growers could respond to these pressures by using carbaryl on more allowable use sites. The species' fragmented habitat areas are likely to be affected by increased carbaryl use on nearby agricultural lands. Therefore, we anticipate a large number of individuals will be exposed throughout the duration of the proposed action. Because their habitats are so close to carbaryl use sites and their invertebrate prey are highly sensitive to carbaryl, we expect individual shrews are likely to experience high levels of mortality from consuming prey that was recently exposed to carbaryl on-field.

We expect impacts to be high and a large number of individuals will die. Because of the species high vulnerability, we expect the large number of individuals likely to die will cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Buena Vista Lake ornate shrew.

References

U.S. Fish and Wildlife Service. 2020a. Buena Vista Lake Ornate Shrew Species Status Assessment. Version 1.0. Sacramento, California. 102 pp.

U.S. Fish and Wildlife Service. 2020b. Buena Vista Lake Ornate Shrew (*Sorex ornatus relictus*) 5-Year Review: Summary and Evaluation. Sacramento, California. 6 pp.

U.S. Fish and Wildlife Service. 2011. Buena Vista Lake Ornate Shrew (*Sorex ornatus relictus*) 5-Year Review: Summary and Evaluation. Sacramento, California. 31 pp.

Integration and Synthesis Summary: Pygmy rabbit

Scientific Name:	Common Name:	Entity ID:
Brachylagus idahoensis	Pygmy Rabbit	1240

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 medium overlap of the action area with the species' range and medium past usage of carbaryl within the species' range, indicating a medium extent of exposure. We do not expect any exposed individuals are likely to die or experience indirect adverse effects. As such, we determine the risk of adverse effects to the 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 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 pygmy rabbit. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 6/8/2022; Columbia Basin DPS (WA-Douglas, Grant, Lincoln, Adams, Benton Counties); *States within the range:* WA

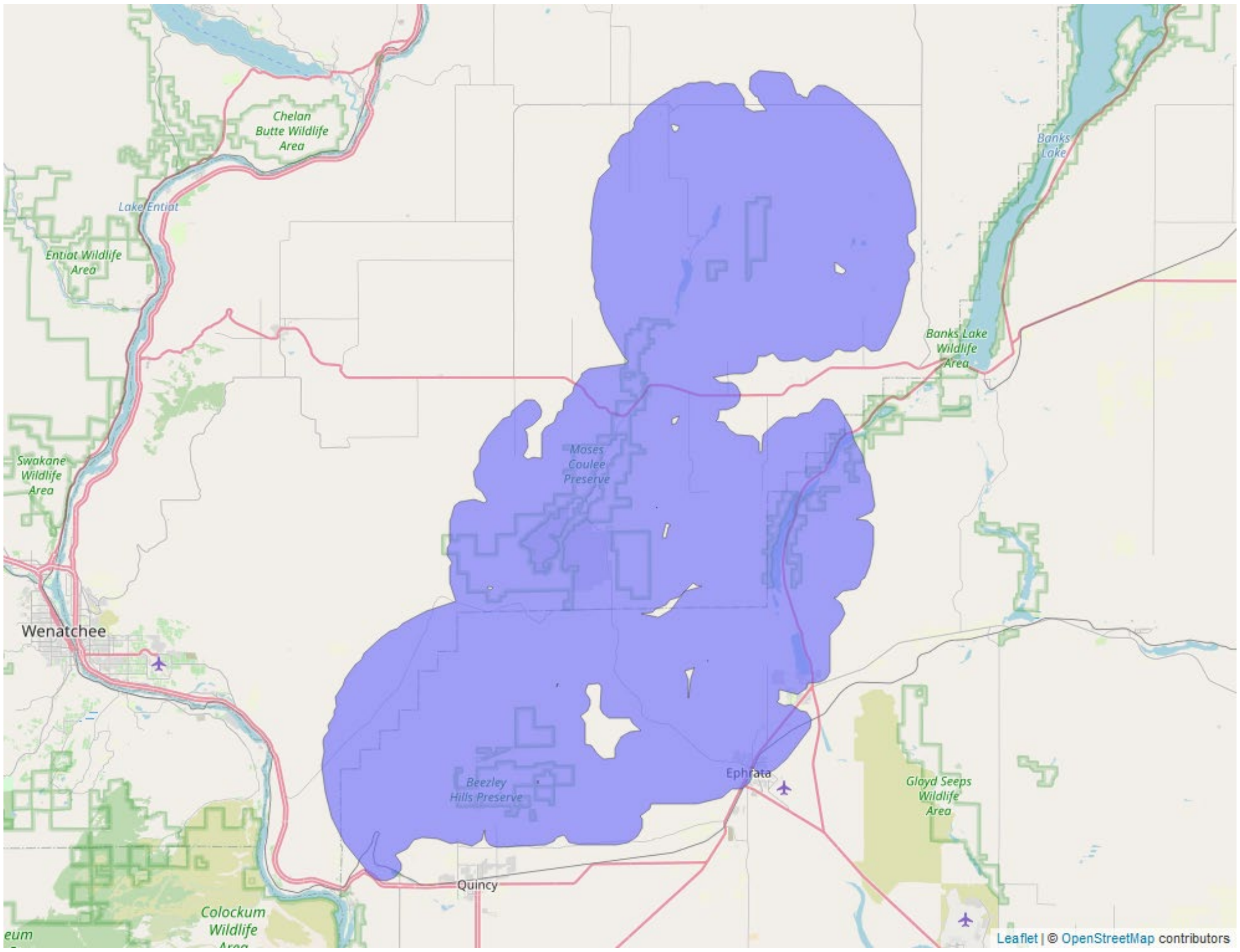

Figure 12. Range map of Pygmy Rabbit (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/1126.

Vulnerability

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

Listing status: Endangered

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

Most recently completed 5 Year Status Review: 5/15/2019

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

Number of populations: Multiple populations (few)

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The pygmy rabbit differs significantly from species within either the Lepus or Sylvilagus genera and is now generally considered to be Brachylagus idahoensis. Their winter diet includes mostly sagebrush. During spring and summer, their diets consist of up to 51% sagebrush, 39% grasses (particularly native bunch grasses, such as Agropyron spp. and Poa spp.), and 10% forbs. Population cycles are not known in pygmy rabbits, although local, rapid population declines were noted in several states. After initial declines, pygmy rabbit populations may not have the same capacity for rapid increases in numbers as other leporids due to their close association with specific components of sagebrush ecosystems, and the relatively limited availability of their preferred habitats (USFWS 2013). Historically, pygmy rabbits were found in central Washington, southeastern Oregon, southern Idaho, southwestern Montana, southwestern Wyoming, northern Nevada, western Utah, and northeastern California in shrub steppe and grassland habitats. The Columbia Basin distinct population segment of the pygmy rabbit is found over 125 miles from the nearest historic pygmy rabbit population in central Oregon. The last known wild subpopulation of pygmy rabbits in the Columbia Basin are believed to have been extirpated before 2004, though others may exist (USFWS 2019b). Captive breeding began in 2002 at Washington State University, the Oregon Zoo, and later at Northwest Trek Wildlife Park. Because of their low genetic diversity, captive Columbia Basin pygmy rabbits were interbred with pygmy rabbits from Idaho, but juvenile mortality remained high. In 2011, off-site captive breeding was transitioned to semi-wild breeding in large enclosures. Between fall 2011-spring 2013, 109 pygmy rabbits from Nevada, Utah, Oregon, and Wyoming were translocated to breeding enclosures. Since then, 2,200 kits have been produced and most were released into the Sagebrush Flats Wildlife Area. Some were also released at Beezley Hills Recovery Emphasis Area. Many rabbits released on Sagebrush Flats have migrated to adjacent shrub-steppe habitat enrolled in the Conservation Reserve Program. Annual survival of the released animals varies but has been as high as 30% and reproduction of fully wild animals has been documented. There are 250 rabbits estimated in the areas adjacent to Sagebrush Flats. The Sagebrush Flats population is located in a landscape mosaic of native shrub steppe and agriculture, and pygmy rabbits were observed using the agricultural lands and small drainages between them for dispersal (USFWS 2019a, 2019b). Large-scale loss and fragmentation of native shrub steppe habitats, primarily for agricultural development, likely played a primary role in the long-term decline of the pygmy rabbit. Once a population declines below a certain threshold, it is at risk of extirpation from several influences including chance environmental events (e.g., extreme weather), catastrophic habitat loss or resource failure (e.g., from wildfire or insect infestations), predation, disease, demographic limitations, loss of genetic diversity, and inbreeding. When emergency listed in 2003, the pygmy rabbit was imminently threatened by its small population size, loss of genetic diversity, and inbreeding depression, coupled with a lack of suitable, protected habitats in the wild. Annual mortality rates of adult pygmy rabbits may be as high as 88%, and over 50% of juveniles may die within 5 weeks of birth. Mortality rates vary considerably between years, and even between juvenile cohorts within years. Starvation and environmental stress likely account for some mortality in wild pygmy rabbits, but predation is generally considered to be the main cause of mortality. Potential predators include fossorial and terrestrial mammals such as badgers, long-tailed weasels (Mustela frenata), coyotes (Canis latrans), bobcats (Felis rufus), great horned owls (Bubo virginianus), long-eared owls (Asio otus), ferruginous hawks (Buteo regalis), northern harriers (Circus cyaneus), and common ravens (Corvus corax) (USFWS 2013). Wildfires are also a threat; in 2017, a wildfire at Breezley burned 30,000 ac of shrub-steppe habitat and claimed 80 rabbits in net pens and enclosures (USFWS 2019a). In addition, many captive pygmy rabbits have died from diseases like coccidiosis and mycobacteriosis, a threat that is preventing the captive population from being able to support reintroduction efforts as of 2019 (USFWS 2019b).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 31.4% of the species' range overlaps with agricultural use sites and 6.7% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 17). In total, there is approximately 38.1% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 17. Agricultural use overlap and annual usage data (% Range Treated) for the pygmy rabbit.

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	0.9	0.6	1.5	0.9	0.6	1.5
Citrus	0	0	0.0	0	0	0.0
Corn[25]	0.5	0.3	0.7	0.5	0.3	0.7
Grapes	0.2	0.2	0.3	0.2	0.2	0.3
Other Crops	27.4	4.4	31.7	27.4	4.4	31.7

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

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	0.9	0.5	1.4	0.1	<0.1	0.2
Other Orchards[26]	1.2	0.6	1.9	1.2	0.6	1.9
Other Row Crops	<0.1	<0.1	0.2	<0.1	<0.1	0.2
Soybeans	0	0	0.0	0	0	0.0
Vegetables and Ground Fruit	0.5	0.3	0.8	0.5	0.3	0.8
Total	**31.4**	**6.7**	**38.1**	**30.6**	**6.3**	**36.9**

Usage

Past usage data indicate that up to 36.9% of the species' range has been treated with carbaryl annually from agricultural uses (Table 17).

Additional Exposure Considerations

Columbia basin pygmy rabbits are sagebrush obligates and, as such, are not likely to occur on agricultural carbaryl use sites. Within their broad geographic range, pygmy rabbits have a patchy distribution and are found where sagebrush occurs in tall, dense clusters and soils are sufficiently deep and friable to allow for burrowing. Populations of Columbia Basin pygmy rabbits are concentrated around recovery emphasis areas, including the Sagebrush Flat Wildlife Area (managed by the Washington Department of Fish and Wildlife) and adjacent Conservation Reserve Program lands, and the Beezley Hills area (managed by the Nature Conservancy). Given that these areas are specifically managed for conservation purposes, we do not anticipate carbaryl is likely to be used in these areas. The species uses drainages between agricultural areas and Conservation Reserve Program fields for dispersal. As such, we only consider off-field exposure and effects in this analysis.

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

Non-agricultural Uses

Based on available information on the pygmy rabbit's life history, we do not anticipate individuals are likely to occur in any non-agricultural carbaryl use sites. As such, we do not anticipate non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

Given that the pygmy rabbit is not likely to occur in agricultural use sites, we only consider off-field exposure in our assessment. There is a moderate extent of overlap between the species' range and agricultural off-site areas (6.7% off-site overlap) and a moderate level of past usage within the species' range (up to 6.3% range treated annually). We do not anticipate non-agricultural uses will expose more than a small number of individuals. However, based on the moderate overlap with agricultural areas and the moderate levels of past agricultural usage, we anticipate a moderate portion of the species range and a moderate number of individuals are likely to be exposed over the duration of the proposed action.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the Columbia basin pygmy rabbit. This species is an herbivore and primarily consumes brush leaves and grasses. Dietary exposure from foraging on agricultural use sites will result in dietary dosages ranging from 39.7-224.4 mg/kg-bw. In contrast, dietary dosages in off-field areas will be relatively lower than on-field areas (up to 2.4 mg/kg-bw). Given that we do not expect pygmy rabbits will occur on agricultural use sites, we anticipate individuals will only accumulate low levels of carbaryl through dietary exposure. Based on available toxicity data in mammals, we do not anticipate any mortality or sublethal adverse effects (including impaired motor activity and behavior, reduced growth, and reduced reproduction) are likely to occur at these low levels of exposure.

Indirect Effects:

The Columbia Basin pygmy rabbit is a generalist herbivore and can consume a wide variety of vegetative material. Available toxicity studies in plants indicate that carbaryl will not cause adverse effects to plant survival or growth. As such, we do not anticipate the species will experience any reductions in the abundance of its food or habitat resources. Therefore, we do not anticipate the species will experience any indirect adverse effects.

Toxicity Summary

Given that the pygmy rabbit is not likely to occur on agricultural use sites, we anticipate individuals will only accumulate low levels of carbaryl from off-field dietary exposure. We do not anticipate any direct adverse effects are likely to occur in exposed individuals as the exposure concentration will be low. Similarly, we do not anticipate any indirect adverse effects will occur as carbaryl will not cause adverse effects to the plant species that the pygmy rabbit relies on as food resources. Thus, the overall toxicity ranking for this species is low.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The pygmy rabbit has a medium exposure ranking. While we do not expect individuals will be exposed on-field and focus our analysis on off-field areas, there is still a medium extent of overlap between the species' range and agricultural off-site areas and a medium level of past usage within the species' range. Thus, we anticipate a moderate number of individuals are likely to be exposed over the duration of the proposed action. We do not anticipate non-agricultural uses of carbaryl will expose more than a small number of individuals.

The pygmy rabbit has a low toxicity ranking. We expect exposed individuals will accumulate no more than low levels of carbaryl in off-field areas and will not experience any direct adverse effects. Similarly, carbaryl is not likely to cause any adverse effects to the plant species that they pygmy rabbit relies on, indicating no indirect adverse effects are likely to occur.

While a moderate number of individuals are likely to be exposed, we anticipate only a small number of exposed individuals, at most, will die or experience sublethal adverse effects. As such, we anticipate the overall risk of adverse effects to the species is low.

Conclusion

The Columbia Basin pygmy rabbit has high vulnerability based on its status (i.e., endangered), limited distribution, few reintroduced populations (i.e., zero natural wild populations), and declining trends, as described above. Their primary habitat is shrub steppe, and the few reintroduced populations occur on lands protected or managed for conservation, particularly for the pygmy rabbit. Though the species is known to disperse through drainages between agricultural areas and Conservation Reserve Program fields, their preferred habitat remains shrub steppe, suggesting that individuals are not likely to occur on agricultural use sites. There is a moderate portion of the species' range that overlaps with areas near agricultural use sites (6.7% off-field overlap) and a moderate level of past usage (up to 6.3% range treated annually), suggesting a moderate number of individuals are likely to be exposed over the duration of the proposed action.

Individuals exposed in off-field areas are not likely to experience any direct adverse effects as exposure concentrations in these areas will be low. Similarly, we do not anticipate any indirect adverse effects are likely to occur as carbaryl will not cause adverse effects to the plant species that the pygmy rabbit relies on as a food resource.

While the species has a high vulnerability and a moderate number of individuals are likely to be exposed, we expect no more than a small number of individuals are likely to die or experience any indirect adverse effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 Columbia Basin pygmy rabbit.

References

U.S. Fish and Wildlife Service. 2019a. Amendment to the recovery plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*). Portland, Oregon. 12 pp.

U.S. Fish and Wildlife Service. 2019b. 5-Year Review Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*). Portland, Oregon. 54 pp.

U.S. Fish and Wildlife Service. 2013. Recovery Plan for the Columbia Basin Distinct Population Segment of the Pygmy Rabbit (*Brachylagus idahoensis*). Portland, Oregon. ix + 109 pp.

Integration and Synthesis Summary: Texas kangaroo rat

Scientific Name:	Common Name:	Entity ID:
Dipodomys elator	Texas kangaroo rat	4567

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 and high past usage of carbaryl within the species' range, indicating a high extent of exposure. We do not expect any exposed individuals are likely to die. As such, we determine the risk of adverse effects to the 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 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 Texas kangaroo rat. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 5/21/2021; Wherever found; *States within the range:* OK, TX

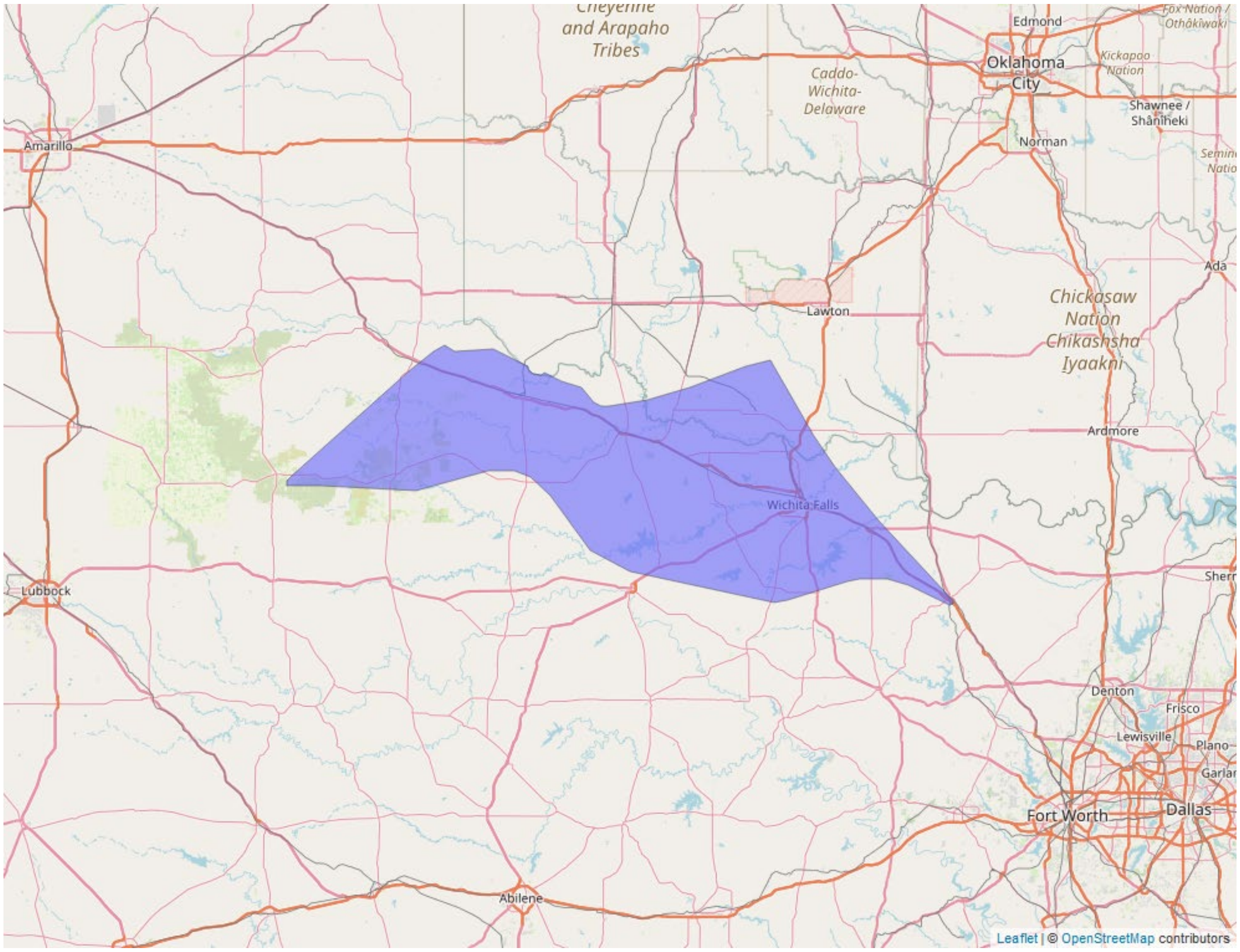

Figure 13. Range map of Texas kangaroo rat (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/2985.

Vulnerability

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

Listing status: Proposed 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: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Texas kangaroo rat is a nocturnal rodent found in Clay County, Texas. Their habitat generally has (1) loose, friable soils associated with mounds or physical supports like shrub and cactus roots, rocks, upturned rootballs, or manmade structures, (2) bare ground, and (3) short grasses. The rat digs a subterranean burrow system within loam/clay-loam soils that are used for shelter, reproduction, and food storage. They are granivores that use their long hind feet and long tail to jump and escape predators. They were historically found in 11 counties in Texas (i.e., Archer, Baylor, Childress, Clay, Cottle, Foard, Hardeman, Montague, Motley, Wichita, Wilbarger) and 2 counties in Oklahoma (Comanche and Cotton). As of 2021, the Texas kangaroo rat is considered extirpated from Oklahoma. During surveys between 2015-2018, they were found across four analysis units (111,000 ha) of habitat in Texas. The current condition of all occupied areas is low or moderate (USFWS 2021).

The primary threat to Texas kangaroo rats is habitat loss and degradation. Their preferred habitat is associated with disturbance, which used to occur from the presence of American bison, black-tailed prairie dogs, and periodic wildfires. Historically, domestic cattle often replaced bison and prairie dogs and changed the disturbance regime. Conversion of native rangeland to row crops also causes direct loss of habitat. Paved roads may create a barrier to rat movement, but unpaved roads provide non-traditional habitat where the species is often found. Woody plant encroachment threatens the persistence of grassland and savanna ecosystems required by this species. Effects of climate change and fire suppression may also affect the species and its habitat (USFWS 2021).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 12.6% of the species' range overlaps with agricultural use sites and 12.9% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 18). In total, there is approximately 25.5% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 18. Agricultural use overlap and annual usage data (% Range Treated) for the Texas kangaroo rat.

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	0.4	0.5	0.8	0.2	0.3	0.5
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn[27]	1	0.8	1.7	1	0.8	1.7
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	4.2	5.1	9.3	4.2	5.1	9.3
Other Grains	6.6	6	12.6	6.4	5.9	12.3
Other Orchards[28]	<0.1	0.2	0.2	<0.1	0.2	0.2
Other Row Crops	<0.1	<0.1	0.2	<0.1	<0.1	0.2
Soybeans	<0.1	<0.1	0.1	<0.1	<0.1	0.1
Vegetables and Ground Fruit	0.4	0.3	0.7	0.4	0.3	0.7
Total	**12.6**	**12.9**	**25.5**	**12.4**	**12.6**	**25**

Usage

Past usage data indicate that up to 25% of the species' range has been treated with carbaryl annually from agricultural uses (Table 18).

Additional Exposure Considerations

The Texas kangaroo rat typically occupies areas with loose soil and its burrows are usually associated with a minor topographic uplift (e.g., prairie mounds) or physical support, including

[27] 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.

[28] 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.

woody vegetation (roots of shrubs and cacti) and other natural (e.g., rocks, upturned rootballs) or manmade structures. Common characteristics of habitat include the presence of bare ground and short grasses (often expressed as a lack of dense vegetation) and structures to support burrows, which are predominantly mesquite and lotebush as well as manmade structures (e.g., fence rows, brush piles, abandoned equipment, artificial terraces, and buildings with loose soil at the foundation). As such, we do not anticipate individuals are likely to occur on agricultural use sites as cultivated agricultural areas do not likely provide the necessary habitat features to support individuals. Thus, we only consider off-field exposures in our analysis for this species.

Non-agricultural Uses

We anticipate the Texas kangaroo rat is likely to occur in some non-agricultural carbaryl use sites, including developed, open space developed, rangeland, and rights of way areas. While anticipated usage rates are low in these areas and existing conservation measures limit off-site transport, exposure may occur in developed areas due to kangaroo rat's propensity to burrow within or near manmade structures such fence rows, brush piles, abandoned equipment, artificial terraces, and buildings with loose soil at the foundation.

In contrast, we do not anticipate exposure to this species from rangeland or rights of way uses. Available past usage data from USDA APHIS indicate that, from 2019-2023, no rangeland areas within the Texas kangaroo rat's range have been treated with carbaryl. In addition, 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 programs (USFWS 2024), which include many conservation measures that are meant to protect listed species from exposure. 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 on an annual basis. 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 Texas kangaroo rat's range for rights of way use.

However, given that the Texas kangaroo rat burrows within or near manmade structures, which are a registered carbaryl use site, we anticipate an unknown but substantial number of individuals will be exposed through non-agricultural uses of carbaryl.

Exposure Summary

While we do not anticipate the Texas kangaroo rat is likely to occur on agricultural use sites, there is still a high extent of overlap between the species' range and agricultural off-field areas (12.9% off-field overlap) and a medium level of past usage (up to 12.6% range treated annually). Furthermore, given that the species is known to establish burrows in manmade structures, including around building, we anticipate individuals may also be exposed to non-agricultural uses of carbaryl, including developed and open space developed uses. As such, we anticipate a large number of individuals are likely to be exposed over the duration of the proposed action.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the Texas kangaroo rat. The Texas kangaroo rat is an opportunistic seed gatherer. Consumption of seeds on use sites recently treated with carbaryl (i.e., within the last 24 hours) can result in dietary doses up to 3.1 mg/kg-bw, depending on the rate of application used (which varies by use type). In contrast, individuals in off-field areas that consume food items exposed to carbaryl through spray drift will likely accumulate only low levels of carbaryl (up to 0.1 mg/kg-bw). Given that the species is unlikely to occur on agricultural use sites, we anticipate individuals will only accumulate low levels of carbaryl through dietary exposure. Based on available toxicity data in mammals, we do not anticipate any individuals will experience direct adverse effects (i.e., reduced survival, impaired motor activity or behavior, reduced growth, reduced reproduction) at this level of exposure.

Indirect Effects:

The Texas kangaroo rat is an obligate herbivore that primarily consumes seeds. Based on available toxicity data in plants, we do not anticipate any adverse effects to plant growth or survival are likely to occur. Thus, we do not anticipate any reductions in the abundance of the kangaroo rat's primary food source are likely to occur with carbaryl use. As such, we do not expect any indirect adverse effects are likely to occur.

Toxicity Summary

We expect the Texas kangaroo rat will only accumulate low levels of carbaryl through dietary exposure in and around use sites. We do not anticipate any direct adverse effects are likely to occur to individuals exposed as predicted dietary doses are low. We anticipate no indirect adverse effects are likely to occur as we do not anticipate any adverse effects to plant food resources will occur. Thus, the species' overall toxicity ranking is low.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The Texas kangaroo rat has a high exposure ranking. While we do not expect individuals are likely to occur on agricultural use sites, there is still a medium extent of overlap between the species' range and agricultural off-field areas that are likely to be exposed through spray drift and runoff. There is a high level of past usage within the species' range, indicating that a significant portion of the species' range is likely to be treated each year. Furthermore, since the species is known to occasionally use manmade structures to support their burrows, including at the base of buildings, we anticipate individuals are also likely to be exposed to non-agricultural uses of carbaryl. While existing label mitigation measures reduce the extent of off-target exposure, we anticipate a large number of individuals are likely to be exposed to carbaryl.

The Texas kangaroo rat has a low toxicity ranking. We do not anticipate individuals will accumulate more than low levels of carbaryl from off-field dietary exposure and will not experience any direct adverse effects. Similarly, we do not anticipate any indirect adverse effects will occur as we do not expect carbaryl will cause any adverse effects to the plant species that provide food resources for the species.

Thus, while a large number of individuals that are likely to be exposed over the duration of the proposed action, we do not anticipate more than a small number of individuals will die or experience sublethal adverse effects. As such, we anticipate the overall risk of adverse effects to the species will be low.

Conclusion

The Texas kangaroo rat is a proposed endangered, nocturnal rodent species that historically ranged throughout Texas and Oklahoma, but now is found only in Clay County, Texas. The Texas kangaroo rat is a granivore that creates a subterranean burrowing system for shelter, reproduction and food storage. The primary threat to the species is habitat loss and degradation, as they depend on landscapes with occasional disturbances from wildfire, and the movement of bison and prairie dogs. This disturbance regime has been changed by the conversion of rangelands to cow pastures and row crops. The Texas kangaroo rat has an overall vulnerability ranking of high.

We do not expect the Texas kangaroo rat to occupy agricultural use sites due to the species' habitat requirements, therefore agricultural off-field areas are considered when determining overlap with the species' range (12.9%). Past usage data indicates that a medium amount of carbaryl (12.6%) has been used in these areas. The Texas kangaroo rat is likely to occupy non-agricultural sites including developed, open space developed, rangeland and rights of way areas; however, past usage data indicate a low level of carbaryl usage on federal lands, which we believe can be extrapolated to carbaryl use levels on privately managed land. Though we do not anticipate the species is likely to occur on agricultural use sites, there remains a high overlap between the species range and agricultural off-field areas and a medium level of past usage. Given this, and the species tendency to establish burrows in and around human structures, we expect that it may be exposed to non-agricultural uses of carbaryl. Therefore, we expect a large number of individuals to be exposed over the duration of the proposed action. Because the Texas kangaroo rat is an obligate herbivore that primarily consumes seeds, we expect that individuals will accumulate only low levels of carbaryl through dietary exposure, with no direct or indirect adverse effects.

While the Texas kangaroo rat has a high vulnerability ranking due to its limited range and small population size, and we expect a large number of individuals to be exposed through off-field and non-agricultural uses, the feeding behavior of the species suggests low accumulations of carbaryl will result through dietary exposure. We do not expect more than a small number of individuals are likely to die or experience any sublethal or indirect adverse effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 Texas kangaroo rat.

References

U.S. Fish and Wildlife Service. 2021. Species Status Assessment Report for Texas Kangaroo Rat (*Dipodomys elator*). Version 1.1. Arlington, Texas. 122 pp.

Integration and Synthesis Summary: Mammals - Florida bonneted bat

Scientific Name:	Common Name:	Entity ID:
Eumops floridanus	Florida bonneted bat	9725

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 and high past usage of carbaryl within the species' range, indicating a high extent of exposure. Most exposed individuals are likely to die. As such, 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 Florida bonneted bat. We discuss our rationale for this conclusion for the species in the sections below.

Species range

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

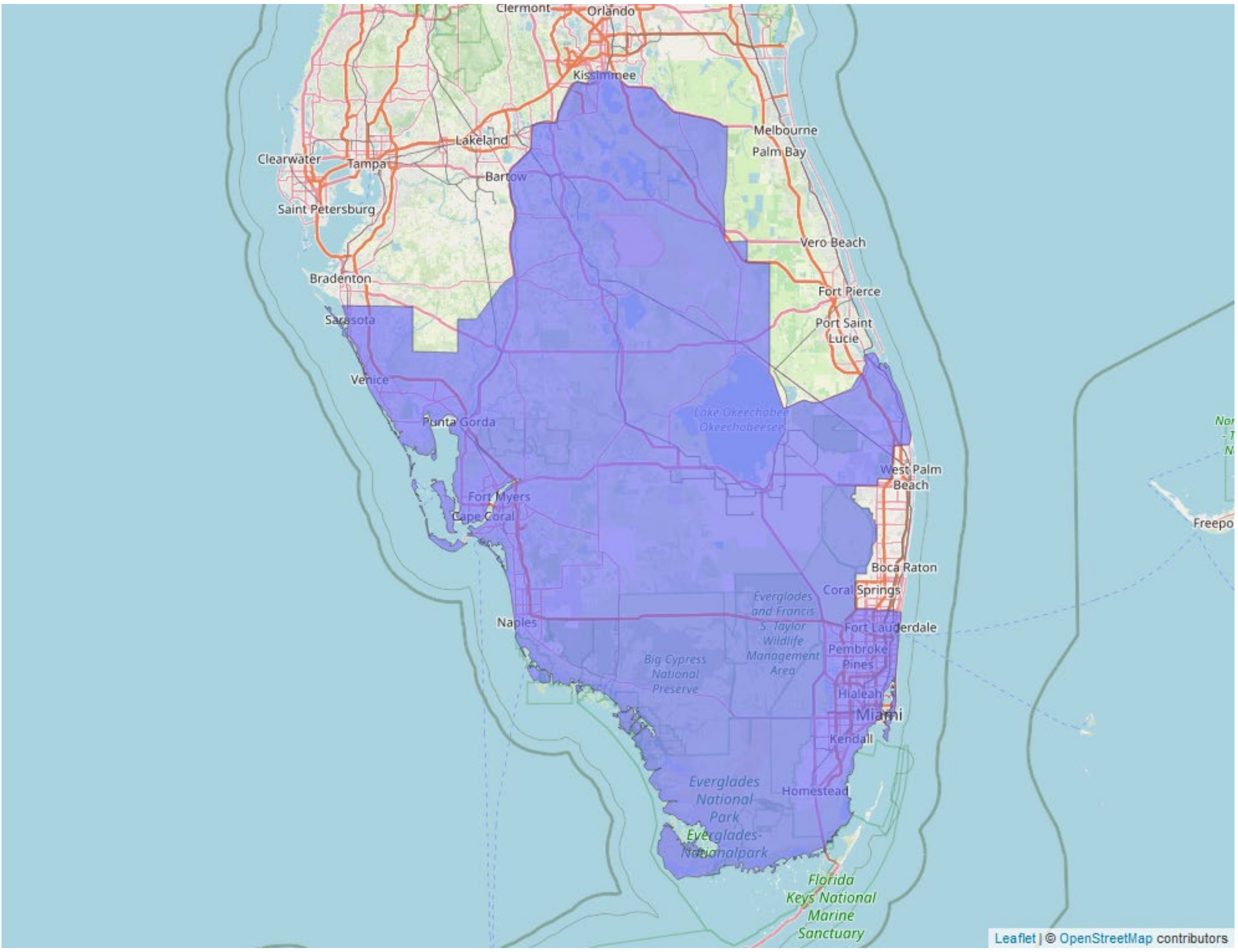

Figure 14. Range map of Florida bonneted bat (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/8630.

Vulnerability

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

Listing status: Endangered

Most recent 5 Year Status Review recommendation:

Most recently completed 5 Year Status Review:

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

Number of populations: Single population

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

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

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The Florida bonneted bat is the largest bat in Florida. They roost singly or in colonies of one male and several females and they do not hibernate or migrate. They primarily eat insects (e.g., beetles, flies, true bugs, and moths). Florida bonneted bat habitat consists of mainly open, fresh water and wetlands (for foraging) and trees (e.g., pines, palms) and manmade structures for roosting; protective tree cover may be important for predator avoidance around roosts, but specifics are unknown. They have been found in forested, suburban, and urban areas. Historically, they were found in the southern half of Florida. Florida bonneted bats now occur in a very restricted portion of their historical range in southern Florida and their abundance seems to be low. Actual population size is not known, and no population viability analyses are available (USFWS 2013). The Florida bonneted bat is threatened by habitat loss, fragmentation, and degradation, and associated pressures from increased human population (i.e., interactions due to roosting in or near houses, roosts, culverts, bridges, and utility equipment). The species' use of conservation areas tempers some impacts, yet the threats of major losses of habitat remains. In natural or undeveloped areas, the Florida bonneted bat may be impacted when forests are converted to other uses or when old trees with cavities are removed. Routine land management activities (e.g., thinning, prescribed fire) may also impact unknown roost sites. In urban areas, suitable roost sites may also be lost when buildings are demolished or when structures are modified to exclude bats (USFWS 2013, 2018).

Overall Vulnerability: High

Effects of the Action: Exposure

Overlap

Data indicate that 16.5% of the species' range overlaps with agricultural use sites and 5.7% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 19). In total, there is approximately 22.2% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 19. Agricultural use overlap and annual usage data (% Range Treated) for the Florida bonneted bat.

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[29]	6.3	2.7	9	0.9	0.4	1.3
Corn[30]	<0.1	0.1	0.2	<0.1	0.1	0.2
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	4.1	1.7	5.8	4.1	1.7	5.8
Other Grains	5.5	0.7	6.2	<0.1	<0.1	<0.1
Other Orchards	0.7	0.4	1.1	0.7	0.4	1.1
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	0.5	0.4	0.9	0.1	0.1	0.2
Total	**16.5**	**5.7**	**22.2**	**5.2**	**2.3**	**7.6**

Usage

Past usage data indicate that up to 7.6% of the species' range has been treated with carbaryl annually from agricultural uses (Table 19).

Non-agricultural Uses

In addition to agricultural uses of carbaryl, we anticipate individuals may be exposed to non-agricultural uses of carbaryl, specifically uses in managed forests and developed areas, as the species is known to nest in and along the edges of forested and residential areas. However, we do

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[29] 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.

[30] 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.

not anticipate these uses will significantly contribute to the overall exposure of the species. U.S. Forest Service information indicates that no carbaryl has been used by them in the range of the Florida bonneted bat from 2016 - 2020. Similarly, past carbaryl usage data indicate a low usage rate of developed uses nationally, suggesting that only a small portion of the Florida bonneted bat’s range is likely to be treated with carbaryl for developed areas. In addition, most residential and developed area uses of carbaryl 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 in the developed and nurseries UDLs. As such, we do not expect non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

There is a high extent of overlap between the Florida bonneted bat’s range and agricultural use areas. While there is only a moderate level of past usage within the species’ range (up to 7.6% range treated annually), we anticipate this will result in a large number of individuals exposed over the duration of the proposed action. We expect non-agricultural exposure will not expose more than a small number of individuals. However, based on the high overlap with agricultural use areas and the medium level of past usage, we assign the species a high exposure ranking.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

The Florida bonneted bat primarily consumes flying insect species as its source of food. As such, we anticipate individuals are likely to consume contaminated prey on- and off-field. EPA’s exposure modeling predicts individuals that feed on-field are likely to accumulate levels of carbaryl up to 33.9-44.09 mg/kg-bw depending on the application rate, which can cause up to 44-99% mortality of exposed individuals. Dietary exposure to carbaryl in areas off-field (up to 30 meters from the edge of field) will result in 0.9 mg/kg-bw, which will not cause any mortality or sublethal adverse effects.

Indirect Effects:

The Florida bonneted bat is considered an obligate insectivore. Based on available toxicity data in insect species, we anticipate there will be a high level of insect mortality. However, we expect the level of mortality will vary across species as a result of natural variability in physiology, exposure, and other factors. As such, we do not expect the entire insect community is likely to experience complete mortality and that individual bats will still have sufficient food resources available, particularly in areas away from carbaryl use sites. As such, we do not anticipate more than low levels of indirect adverse effects are likely. Additionally, we anticipate individuals can find alternative food sources in areas that are not near carbaryl use sites as individuals are highly mobile and can forage in a wide array of habitats.

Toxicity Summary

The Florida bonneted bat is likely to experience a high level of direct adverse effects. We anticipate most individuals that forage over agricultural use sites will accumulate a high level of carbaryl, resulting in a high level of mortality (up to 44-99% of exposed individuals). We do not anticipate individuals that are only exposed to carbaryl off-field (up to 30 m) are likely to experience any mortality or sublethal adverse effects.

The Florida bonneted bat is likely to experience low levels of indirect effects. While the species primarily consumes flying insects, we do not anticipate the entire insect community will experience complete mortality with carbaryl exposure and that there will still be some prey available for individuals to consume. Additionally, as a highly mobile species, we expect individuals are likely to find other sources of prey away from use sites that are not likely to experience large reductions in insect abundance.

While we anticipate only low levels of adverse indirect effects are likely to occur, the high level of mortality of individuals that forage on-field result in a high toxicity ranking for the species.

Overall Toxicity Ranking: High

Effects of the Action Summary

The Florida bonneted bat has a high exposure ranking. There is a high extent of overlap between the action area and the species' range and a moderate level of past usage, indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We do not anticipate non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action.

The Florida bonneted bat has a high toxicity ranking as a large percentage of individuals foraging on recently treated agricultural fields are likely to experience mortality. We do not anticipate any direct adverse effects are likely to occur off-field. We anticipate only a low level of indirect adverse effect as we do not anticipate the entire insect prey community will die and there will be sufficient food resources available, especially in areas far from use sites.

Given that we expect a large number of individuals are likely to be exposed, that we anticipate individuals exposed on-field are likely to die, we expect a large number of individuals will die, indicating the overall risk of adverse effects to the species is high.

Conclusion

The Florida bonneted bat has high vulnerability based on its status (i.e., endangered), single population, and declining trends, as described above. They primarily eat insects and forage in open, fresh water and wetlands, but are also known to feed on insects associated with agricultural crops. They roost in pine and palm trees and man-made structures across urban, suburban, and forested areas. Agricultural use sites overlap 22.2% of the species range, 16.5% of which is on-field. A medium portion (7.6%) of the range has been treated annually with carbaryl in the past (5.2% on-field and 2.3% off-field), therefore the Florida bonneted bat has a high exposure ranking and we expect that a large number of individuals will be exposed throughout the duration of the action.

Even though individuals have large home ranges, given the prevalence of agriculture within the species' range, portions of occupied areas are anticipated to be near agriculture. In addition, agricultural use of pesticides, particularly insecticides, is noted as a potential threat to the species. Excessive pesticide use may not support an adequate food base for this species given its high metabolic requirements due to year-round activity and breeding. Thus, even though we expect low levels of indirect adverse effects from prey reduction, given the species' need for a constant source of prey, even small reductions in prey availability could lead to a loss of fitness of individual bats within a moderate portion of the range.

Over the duration of the action, we anticipate that a large number of foraging bats will consume contaminated prey over agricultural use sites, particularly given the species is known to forage near or over agricultural crops, resulting in the death of those individuals. Given that the species has low fecundity and is slow to reproduce, along with its restricted range and small, single population, we expect this level of on-field mortality will significantly impede species recovery.

We expect a large number of individuals to be exposed and die. While we anticipate indirect adverse effects are generally low, given the species' high metabolic needs for prey, high vulnerability due to low fecundity, slow reproduction, restricted range, and low population numbers, we expect even a small loss of prey and loss of a individuals will result in species-level effects 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 Florida bonneted bat.

References

U.S. Fish and Wildlife Service. 2024. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Endangered Florida Bonneted Bat. Final Rule. Federal Register 89: 16624-16681.

U.S. Fish and Wildlife Service. 2019. Recovery outline for Florida bonneted bat (*Eumops floridanus*). Vero Beach, Florida. 5 pp.

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Endangered Species Status for the Florida Bonneted Bat. Final Rule. Federal Register 78(191): 61003-61043.

Integration and Synthesis Summary: Mammals - Northern long-eared bat

Scientific Name:	Common Name:	Entity ID:
Myotis septentrionalis	Northern long-eared bat	10043

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 medium. 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 and medium past usage of carbaryl within the species' range, indicating a high extent of exposure. Only a few exposed individuals are likely to die as we do not anticipate individuals are likely to forage on carbaryl use sites. As such, we determine the risk of adverse effects to the species is low. We expect a small number of individuals are likely to die from the proposed action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 northern long-eared bat. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 3/28/2024; Wherever found; *States within the range:* AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV, WY

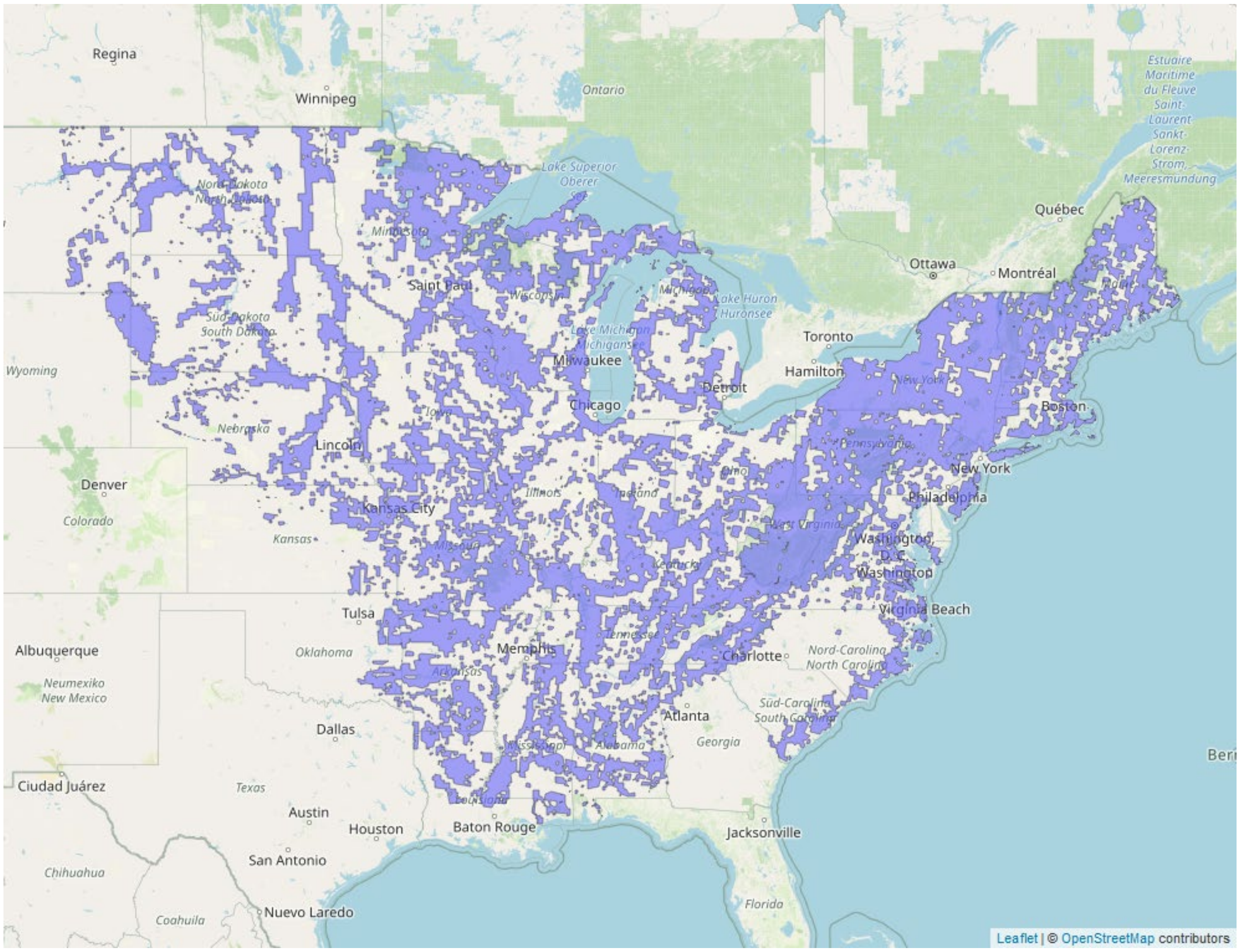

Figure 15. Range map of Northern long-eared bat (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/9045.

Vulnerability

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

Listing status: Endangered

Most recent 5 Year Status Review recommendation: Uplist to E

Most recently completed 5 Year Status Review: 11/30/2022

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: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

The northern long-eared bat is a wide-ranging insectivorous bat species that overwinter in caves and abandoned mines and use forests otherwise. They are found in 37 states and 8 Canadian provinces across North America (i.e., eastern and north central U.S., all Canadian provinces west to the southern Yukon Territory and eastern British Columbia). The U.S. range includes the District of Columbia and the following 39 states: Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. Historically, northern long-eared bats were most frequently observed in the northeastern U.S. and in Canadian Provinces Quebec and Ontario. Throughout most of the species' range, it is patchily distributed and often found in low numbers in inconspicuous roosts. They feed on moths, flies, leafhoppers, caddisflies, and beetles, primarily within 5 hours after sunset and 8 hours after sunset. They forage in mature forests under the canopy and 1-3m above the ground and will occasionally forage along riparian areas, over small forest clearings and water, and along roads. They prefer intact mixed forests to fragmented habitat or areas that have been clear cut. Northern long-eared bats are typically found roosting in small crevices or cracks on cave or mine walls or ceilings, thus are easily overlooked during surveys and usually observed in small numbers. More than 780 hibernacula have been identified throughout the species' range in the U.S., although many hibernacula contain only a few (1 to 3) individuals. They migrate in spring (mid-March to mid-May) and fall (mid-August to mid-October), and migratory movements are often between 35-55 miles. Range-wide summer occupancy declined by 80% between 2010-2019, and colonies appear to be declining with a 96-100% decline in the number of large hibernacula (≥100 individuals). The maximum historical abundance estimate was 38,131 individuals across 737 hibernacula. The estimated 2020 abundance was 19,356 individuals across 139 hibernacula (USFWS 2022b).

The primary threat to the species is White-Nose Syndrome (white-nose), a disease caused by the fungus Geomyces destructans that is known to kill bats. White-nose has led to dramatic and rapid population declines in northern long-eared bats of up to 99% in some areas and it has spread rapidly throughout the East and Midwest. Other sources of mortality to the species include wind-energy development (i.e., 49% of the bat's range includes wind energy mortality risks), habitat modification, habitat destruction (e.g., vandalism to hibernacula, roost tree removal), climate change (i.e., changes in temperature or precipitation), and contaminants. Although no significant decline due to these factors has been observed, they may have cumulative effects to the species in addition to white-nose (USFWS 2022a).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

Data indicate that 25.4% of the species' range overlaps with agricultural use sites and 11.7% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 20). In total, there is approximately 37.1% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 20. Agricultural use overlap and annual usage data (% Range Treated) for the northern long-eared bat.

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	2.2	2.4	4.6	0.1	0.2	0.3
Citrus	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Corn	17.3	5.2	22.5	0.7	0.2	1
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	2.6	2.3	4.9	1.8	1.6	3.5
Other Grains	0.9	1	1.9	<0.1	<0.1	<0.1
Other Orchards[31]	0.2	0.2	0.3	<0.1	<0.1	0.1
Other Row Crops	0.4	0.2	0.6	<0.1	<0.1	<0.1
Soybeans[32]	18.4	5.1	23.5	2.3	0.6	2.9

[31] 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.

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

Use Layer	Use Site Overlap (% range)	Off-Site Overlap (% range)	Total Overlap (% range)	% Range Treated On-Site	% Range Treated Off-Site	% Total Range Treated
Vegetables and Ground Fruit	0.7	0.5	1.2	0.2	0.1	0.3
Total	**25.4**	**11.7**	**37.1**	**4.6**	**2.7**	**7.3**

Usage

Past usage data indicate that up to 7.3% of the species' range has been treated with carbaryl annually from agricultural uses (Table 20).

Additional Exposure Considerations

Northern long-eared bats forage in mature forests and occasionally along riparian areas, over small forest clearings and water, and along roads. They prefer intact mixed forests to fragmented habitat. While the species seems to be a habitat generalist, much of its habitat is fragmented with agricultural lands, and so we cannot rule out the possibility that an individual may occur in and forage on agricultural use sites. However, we anticipate that this scenario will occur infrequently as individuals likely have an expansive home range that covers different habitat types. We expect that most individuals are not disproportionately reliant on agricultural areas as habitat and are thus not likely to spend large amounts of time on-field. As such, we anticipate only a small number of individuals are likely to be exposed to carbaryl on-field.

Non-agricultural Uses

We anticipate the northern long-eared bat is likely to occur in some non-agricultural carbaryl use sites, including open space developed, rangeland, and forestry areas. While exposure through these use types is possible, we do not anticipate exposure is likely to occur, primarily due to the fact that we anticipate low usage rates of non-agricultural applications within the bat's habitat.

For instance, available usage data on open space developed uses of carbaryl (such as turf or gold course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or entirely within the species' range, we expect this is highly unlikely to occur. Rather, we expect open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the northern long-eared bat's range.

Similarly, past usage data from the U.S. Forest Service indicate that only small areas of managed forests within the northern long-eared bat's range have been treated with carbaryl between 2016-2020. The Forest Service estimates 415 acres of managed forests have been treated with carbaryl over a five-year period within the states that the northern long-eared bat's range occurs in with most treatments less than 1 acre in size. Given the expansive range of this species, even if we assume all treated managed forests occurred within the bat's range (which we do not expect is likely), we anticipate usage will only occur in a small portion of the range and will be scattered throughout the landscape as small treatment areas. Given this low level of treatment and sporadic treatment locations, we anticipate there is a low likelihood of individuals being exposed to carbaryl through this specific use. Past usage data from USDA APHIS indicate that no carbaryl has been used on rangelands within the northern long-eared bat's range from 2019-2023. If applications did occur for either of these uses, we would expect them to be in small areas only (<1 acre) or include conservation measures in accordance with the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024).

In summary, given the low level of usage expected, we do not expect non-agricultural uses will expose more than a small number of individuals over the duration of the proposed action.

Exposure Summary

There is a high extent of overlap between the species' range and agricultural use areas (37.1% total overlap) and a medium level of past usage within the species' range (up to 7.3% range treated annually). While the species may occur in non-agricultural use sites, we do not anticipate more than a small number of individuals will be exposed through these uses given the low level of past usage within these uses. However, given the high level of overlap and moderate usage in agricultural areas, we anticipate a large number of individuals are likely to be exposed over the duration of the proposed action.

Overall Exposure Ranking: High

Effects of the Action: Toxicity

Direct Effects:

The northern long-eared bat primarily consumes flying insect species as its source of food. As such, we anticipate individuals are likely to consume contaminated prey on- and off-field. EPA's exposure modeling predicts individuals that feed on-field are likely to accumulate levels of carbaryl up to 32.6-108.5 mg/kg-bw depending on the application rate, which can cause up to 38-99% mortality of exposed individuals. Dietary exposure to carbaryl in areas off-field (up to 30 meters from the edge of field) will result in 1.2 mg/kg-bw, which will not cause any mortality or sublethal adverse effects.

However, we anticipate that these high levels of exposure will only occur infrequently as northern long-eared bats are not likely to occur in or forage on agricultural fields as individuals likely have an expansive home range that covers different habitat types. We expect that most individuals will consume both prey that has recently been exposed to carbaryl on-field and prey that has not. As such, we anticipate only a small number of individuals are likely to accumulate high levels of carbaryl and experience adverse effects but that the majority of individuals are likely to accumulate lower levels of carbaryl that are not likely to cause mortality or sublethal effects.

Indirect Effects:

The northern long-eared bat is considered an obligate insectivore. Based on available toxicity data in insect species, we anticipate there will be a high level of insect mortality. However, we expect the level of mortality will vary across species as a result of natural variability in physiology, exposure, and other factors. As such, we do not expect the entire insect community is likely to experience complete mortality and that individual bats will still have sufficient food resources available, particularly in areas away from carbaryl use sites. As such, we do not anticipate more than low levels of indirect adverse effects are likely. Additionally, we anticipate individuals can find alternative food sources in areas that are not near carbaryl use sites as individuals are highly mobile and can forage in a wide array of habitats.

Toxicity Summary

The northern long-eared bat is likely to experience only low levels of direct adverse effects. While some individuals that only consume insects that have recently been exposed to carbaryl on-field are likely to accumulate high levels of carbaryl and die, we expect this will be limited to a small number of individuals as the species' diverse foraging habitats indicate that individuals are unlikely to only consume prey that have come from on single source (i.e., a carbaryl use site).

We expect the northern long-eared bat will not experience more than low levels of indirect adverse effects. While we anticipate sensitive insect species that the bat feeds on will experience high levels of mortality with carbaryl use, we expect there will be a variation of response to carbaryl exposure across the insect community and that there will not likely be complete mortality of the entire insect community. As such, we anticipate there will likely be sufficient food resources remaining even if sensitive prey species experience high levels of mortality.

Given that we anticipate the species will only experience low levels of direct and indirect adverse effects, the northern long-eared bat has a low toxicity ranking.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The northern long-eared bat has a high exposure ranking. There is a high extent of overlap between the action area and the species' range and a moderate level of past usage, indicating a large number of individuals are likely to be exposed over the duration of the proposed action. We expect non-agricultural uses of carbaryl will expose only small numbers of individuals.

The northern long-eared bat has a low toxicity ranking. While individuals that forage on agricultural use sites are likely to die, we expect this will occur infrequently and be limited to a small number of individuals as the species' diverse foraging habitats indicate that individuals are unlikely to only consume prey that have come from on single source (i.e., a carbaryl use site). Similarly, while we anticipate sensitive insect species that the bat feeds on will experience high levels of mortality with carbaryl exposure, we do not anticipate the entire insect community will die as we expect there are natural variations in sensitivity to carbaryl across insect taxa. As such, we anticipate there will likely be sufficient food resources remaining even if sensitive prey species experience high levels of mortality.

While we anticipate a large number of individuals are likely to be exposed to carbaryl, we expect exposed individuals are not likely to experience more than low levels of mortality, not likely to experience any sublethal adverse effects, and will only experience minor losses in prey availability. As such, we anticipate only a small number of individuals are likely to die or experience sublethal adverse effects from the proposed action. We therefore expect the overall risk of adverse effects to the species is low.

Conclusion

The northern long-eared bat has medium vulnerability based on its status (i.e., endangered), wide-ranging distribution, and declining trends, as described above. They eat insects (e.g., moths, flies, leafhoppers, caddisflies, and beetles), mostly at night. They forage in mature forests and occasionally along riparian areas, over small forest clearings and water, and along roads. They prefer intact mixed forests to fragmented habitat or areas that have been clear cut. Agricultural carbaryl use sites overlap 37.1% of the species range, 25.4% of which is on-field. A medium portion (7.3%) of the range has been treated annually with carbaryl in the past (4.6% on-field and 2.7% off-field). However, while the northern long-eared bat has a high exposure ranking and we expect that a large number of individuals will be exposed if present, the species feeding preferences likely prevent individuals from accumulating more than low levels of carbaryl, reducing the risk of adverse effects to individuals. Thus, we do not anticipate more that very infrequent exposure to on-field levels of carbaryl to a small number of individuals from consumption of contaminated insects throughout the duration of the action.

Even though individuals have large home ranges, given the prevalence of agriculture within the species' range, portions of occupied areas are anticipated to be near agriculture. Despite this we expect no more than low levels of indirect adverse effects from prey reduction and a small number of individuals will experience high levels of direct adverse effects as the species is known to primarily feed in forested habitats. While an individual foraging bat could gorge themselves on an agricultural use site and accumulate high levels of carbaryl, we anticipate that this will be a rare occurrence given that individuals are likely to feed from a wide variety of locations and habitats. As such, we expect most individuals will not accumulate more than low levels of carbaryl and thus are not likely to experience more than low levels of adverse effects.

Therefore, while we expect a large number of northern long-eared bats will be exposed to carbaryl, only a small number will die or experience sublethal adverse effects from consumption of contaminated insect prey. We expect the overall risk to the species to be low, and the proposed action will not lead to species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 northern long-eared bat.

References

U.S. Fish and Wildlife Service. 2022a. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Northern Long-eared Bat. Final Rule. Federal Register 87(229):73488-73504.

U.S. Fish and Wildlife Service. 2022b. Species Status Assessment Report for the Northern Long-eared Bat (*Myotis septentrionalis*). Version 1.2. Bloomington, Minnesota. 169 pp.

Integration and Synthesis Summary: Mammals - Tricolored bat

Scientific Name:	Common Name:	Entity ID:
Perimyotis subflavus	Tricolored bat	11365

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 medium. 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 and low past usage of carbaryl within the species' range, indicating a medium extent of exposure. We expect no exposed individuals are likely to die as individuals are not likely to accumulate more than low levels of carbaryl. As such, we determine the risk of adverse effects to the 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 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 tricolored bat. We discuss our rationale for this conclusion for the species in the sections below.

Species range

Based on range map dated: 7/2/2024; Wherever found; *States within the range:* AL, AR, CO, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NE, NH, NJ, NM, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WI, WV, WY

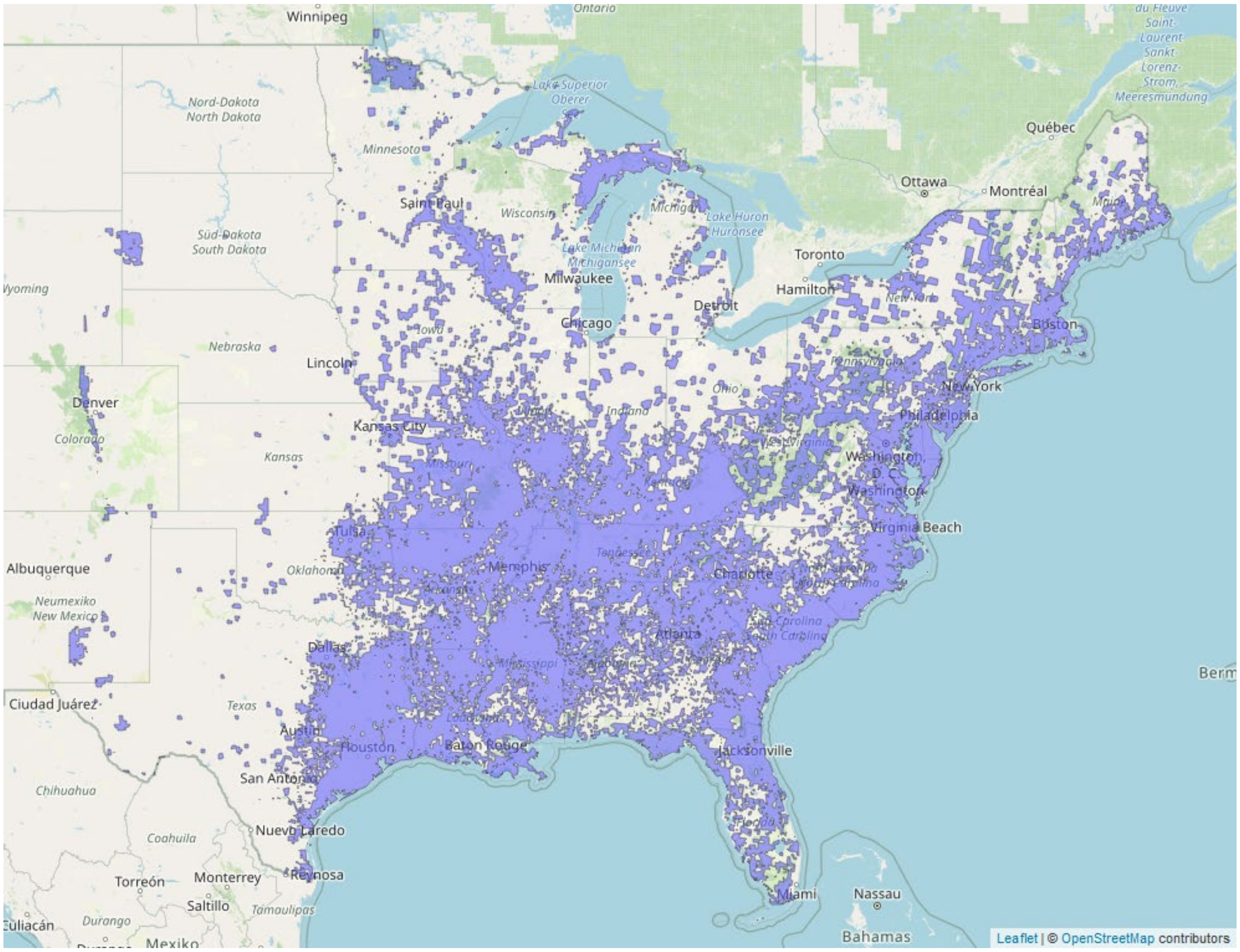

Figure 16. Range map of tricolored bat (blue polygons). Range map accessed at https://ecos.fws.gov/ecp/species/10515.

Vulnerability

Vulnerability of the species considers the status of the species, environmental baseline, and cumulative effects, as summarized below.

Summary of status

Listing status: Proposed Endangered

Most recent 5 Year Status Review recommendation: N/A

Most recently completed 5 Year Status Review: N/A

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: no

Environmental Baseline/Cumulative Effects (EB/CE) Summary

Tricolored bats are one of the smallest bats in eastern North America and are distinguished by their unique tricolored fur that appears dark at the base, lighter in the middle, and dark at the tip. They are opportunistic feeders and consume small insects including caddisflies (Trichoptera), flying moths (Lepidoptera), small beetles (Coleoptera), small wasps and flying ants (Hymenoptera), true bugs (Homoptera), and flies (Diptera). They are known from 39 states (Alabama, Arkansas, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, Wisconsin, West Virginia, Wyoming), Washington D.C., four Canadian Provinces (Ontario, Quebec, New Brunswick, Nova Scotia), and Guatemala, Honduras, Belize, Nicaragua and Mexico. The species current distribution in New Mexico, Colorado, Wyoming, South Dakota, and Texas is the result of westward range expansion in recent decades as well as into the Great Lakes basin. This expansion is largely attributed to increases in trees along rivers and increases in suitable winter roosting sites, such as abandoned mines and other human-made structures. During spring, summer, and fall (i.e., non-hibernating seasons), tricolored bats primarily roost among live and dead leaf clusters of live or recently dead deciduous hardwood trees. They will also roost in Spanish moss (*Tillandsia usneoides*) in the southern portions of their range, *Usnea trichodea* lichen in the northern portions of the range, and during summer in pine needles, eastern red cedar (*Juniperus virginiana*), within artificial roosts (e.g., barns, beneath porch roofs, bridges, concrete bunkers), and rarely within caves. Females exhibit high site fidelity and form maternity colonies and switch roost trees regularly. Males roost individually. In winter, tricolored bats hibernate (i.e., reduce their metabolic rates, body temperatures, and heart rate) in caves and mines. Where caves are sparse in the southern U.S., tricolored bats often hibernate in road-associated culverts, tree cavities, and abandoned water wells. They exhibit high site fidelity to hibernacula across years. Hibernating tricolored bats typically roost individually or in small clusters of both sexes away from other bats, as opposed to forming large clusters. They often roost on cave walls and ceilings and are rarely found in cave crevices. Tricolored bats are known to use smaller caves and mines that are not suitable hibernacula for other bat species. All three representation units have shown declining abundance. Abundance has declined 89%, 57%, and 24% in the eastern, northern, and southern units, respectively. The number of winter colonies (i.e., occupied hibernacula) have also decreased 46%, 24%, and 34% in the eastern, northern, and southern units, respectively. Lastly, across all RPUs, the potential for population growth is currently undetectable, i.e., (λ) >1 is 0%.

There has also been a noticeable shift towards smaller colony sizes. The magnitude of the winter declines, although widespread, varies spatially (USFWS 2021).

Threats to the tricolored bat include white-nose syndrome, wind-related mortality, climate change, and habitat loss. White-nose syndrome is the foremost stressor, a disease caused by the fungal pathogen Pd. The fungal pathogen is spread primarily via bat-bat and bat-environment-bat movement and interactions. The effect of white-nose syndrome on tricolored bats has been extreme, such that most summer and winter colonies experienced severe declines following the arrival of white-nose syndrome. Just 4 years after the discovery of white-nose, for example, tricolored bats experienced a 75% decline in winter counts across 42 sites in Vermont, New York and Pennsylvania. Similarly, the arrival of white-nose led to a 10–fold decrease in tricolored bat colony size. Most recently, data from 27 states and 2 provinces was used to conclude white-nose syndrome caused estimated population declines of 90–100% across 59% of tricolored bat range. There appear to be differences in how severe effects of white-nose are to tricolored bats in culverts vs. caves. The remarkable potential for bat mortality at wind facilities became known around 2003, when post-construction studies at the Buffalo Mountain, Tennessee, and Mountaineer, West Virginia wind projects documented the highest bat mortalities reported at the time (31.4 bats/MW and 31.7 bats/MW, respectively). Bat fatalities continue to be documented at wind power installations across North America and Europe. Bat fatality varies across facilities, between seasons, and among species. The effectiveness of curtailment at reducing species-specific fatality rates for tricolored bats, however, has not been documented. There is growing concern about impacts to bat populations in response to climate change from changes in hibernation, mortality from extreme drought, cold, or excessive rainfall, cyclones, loss of roosts from sea level rise, and impacts from human responses to climate change (e.g., wind turbines). Changes in landcover may be associated with losses in suitable roosting or foraging habitat, longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colonies, and direct injury or mortality. Adverse impacts of habitat loss are more likely in areas with little forest or highly fragmented forests (e.g., western U.S. and central Midwestern states), as there is a higher probability of removing roosts or causing loss of connectivity between roosting and foraging habitat (USFWS 2021).

Overall Vulnerability: Medium

Effects of the Action: Exposure

Overlap

Data indicate that 26.9% of the species' range overlaps with agricultural use sites and 11.6% of the species' range overlaps with areas adjacent to use sites that are likely exposed through off-site transport (e.g., through spray drift or runoff) (Table 21). In total, there is approximately 38.5% overlap between the species' range and the agricultural footprint of carbaryl use.

Table 21. Agricultural use overlap and annual usage data (% Range Treated) for the tricolored bat.

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	1.7	1.6	3.3	<0.1	<0.1	0.1
Citrus	<0.1	<0.1	0.2	<0.1	<0.1	<0.1
Corn[33]	16.2	4.2	20.4	0.4	0.1	0.5
Grapes	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other Crops	4.3	2.7	7.1	3.2	1.8	5
Other Grains	3.1	1.9	5	<0.1	<0.1	<0.1
Other Orchards[34]	0.2	0.3	0.5	<0.1	<0.1	0.1
Other Row Crops	0.8	0.4	1.3	<0.1	<0.1	<0.1
Soybeans	15.1	3.8	18.8	1.3	0.3	1.6
Vegetables and Ground Fruit	0.6	0.4	1	0.1	<0.1	0.2
Total	**26.9**	**11.6**	**38.5**	**4.8**	**2.3**	**7.1**

Usage

Past usage data indicate that up to 7.1% of the species' range has been treated with carbaryl annually from agricultural uses (Table 21).

Additional Exposure Considerations

They are opportunistic feeders and consume small insects including caddisflies (Trichoptera), flying moths (Lepidoptera), small beetles (Coleoptera), small wasps and flying ants

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

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

(Hymenoptera), true bugs (Homoptera), and flies (Diptera). They emerge early in the evening and forage at treetop level or above but may forage closer to ground later in the evening. Maximal distance traveled from roost areas to foraging grounds was 4.3 km for reproductive (pregnant or lactating) adult females in Indiana and 24.4 km for males in Tennessee.

Tricolored bats are one of the first cave-hibernating species to enter hibernation in the fall and one of the last to leave in the spring. Numbers of hibernating bats peaks in caves and mines in December or later, suggesting some may use alternative hibernacula and move to caves and mines when it is colder (USFWS 2021).

Available information on the tricolored bat indicate that the species avoids agricultural areas. 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. To account for this difference in exposure potential, we only consider off-site exposure in our assessment, indicating that total overlap with agricultural areas is 11.6% and up to 2.3% of the range is likely to be treated annually.

Non-agricultural Uses

The tricolored bat is likely to occur in some non-agricultural use sites, including managed forests and developed areas as the species is known to roost in these areas. While carbaryl exposure in these non-agricultural sites is possible, we do not anticipate exposure is likely to occur given the low level of past usage and existing conservation measures within these areas. For instance, available usage data on open space developed uses of carbaryl (such as turf or gold course applications) at a national scale indicate that less than 2.5% of open space developed areas across the country have been treated with carbaryl. While this usage may result in a large treatment footprint if all treated areas were concentrated in one location or entirely within the species' range, we expect this is highly unlikely to occur. Rather, we expect open space developed usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the tricolored bat's range. In addition, most residential and developed area uses of carbaryl 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 in the developed and nurseries UDLs.

Similarly, past usage data from the U.S. Forest Service indicate that only small areas of managed forests within the northern long-eared bat's range have been treated with carbaryl between 2016-2020. The Forest Service estimates 415 acres of managed forests have been treated with carbaryl over a five-year period within the states that the northern long-eared bat's range occurs in with most treatments less than 1 acre in size. Given the expansive range of this species, even if we assume all treated managed forests occurred within the bat's range (which we do not expect is likely), we anticipate usage will only occur in a small portion of the range and will be scattered throughout the landscape as small treatment areas. Given this low level of treatment and sporadic treatment locations, we anticipate there is a low likelihood of individuals being exposed to carbaryl through this specific use.

In summary, given the available usage data and existing conservation measures for some non-agricultural uses, we anticipate no more than small numbers of individuals are likely to be exposed to carbaryl through non-agricultural uses over the duration of the proposed action.

Exposure Summary

While we do not anticipate individuals are likely to occur on agricultural use sites, there is still a high extent of overlap between the species' range and off-site transport areas (11.6% overlap with off-site areas) and a low level of past usage within the species' range (up to 2.3% off-site areas exposed annually). While we do not anticipate more than a small number of individuals will be exposed through non-agricultural uses, we still anticipate a medium number of individuals are likely to be exposed over the duration of the proposed action as there is still a high level of overlap with agricultural areas and moderate levels of past agricultural usage.

Overall Exposure Ranking: Medium

Effects of the Action: Toxicity

Direct Effects:

We anticipate dietary exposure is the most likely route of exposure for the tricolored bat, which primarily consumes flying insects. EPA's exposure modeling predicts individuals that feed on-field are likely to accumulate levels of carbaryl up to 108.5 mg/kg-bw, which can cause up to 99% mortality of exposed individuals. In contrast, individuals in off-field areas that consume prey exposed to carbaryl through spray drift in off-field areas will likely accumulate only low levels of carbaryl (up to 1.2 mg/kg-bw). Given that the species is unlikely to occur on agricultural use sites, we anticipate individuals will only accumulate low levels of carbaryl through dietary exposure. Based on available toxicity data in mammals, we do not anticipate any individuals will experience direct adverse effects (i.e., reduced survival, impaired motor activity or behavior, reduced growth, reduced reproduction) at this level of exposure.

Indirect Effects:

The tricolored bat is considered an obligate insectivore. Based on available toxicity data in insect species, we anticipate there will be a high level of insect mortality. However, we expect the level of mortality will vary across species as a result of natural variability in physiology, exposure, and other factors. As such, we do not expect the entire insect community is likely to experience complete mortality and that individual bats will still have sufficient food resources available, particularly in areas away from carbaryl use sites. As such, we do not anticipate more than low levels of indirect adverse effects are likely. Additionally, we anticipate individuals can find alternative food sources in areas that are not near carbaryl use sites as individuals are highly mobile and can forage in a wide array of habitats.

Toxicity Summary

The tricolored bat is likely to experience a low level of direct adverse effects. While on-field exposure can result in high levels of mortality, we anticipate individuals are not likely to occur on-field and thus are likely to only accumulate low levels of carbaryl through dietary exposure, which will not result in any direct adverse effects.

The tricolored bat is likely to experience low levels of indirect effects. While the species primarily consumes flying insects, we do not anticipate the entire insect community will experience complete mortality with carbaryl exposure and that there will still be some prey available for individuals to consume. Additionally, as a highly mobile species, we expect individuals are likely to find other sources of prey away from use sites that are not likely to experience large reductions in insect abundance.

Given the low level of direct and indirect adverse effects, we anticipate the overall risk of adverse effects to the species is low.

Overall Toxicity Ranking: Low

Effects of the Action Summary

The tricolored bat has a medium exposure ranking. While individuals are not likely to occur on agricultural use sites and while there are low levels of past usage, the high level of overlap suggests a moderate number of individuals are likely to be exposed over the duration of the proposed action. We do not anticipate non-agricultural uses of carbaryl will expose more than a small number of individuals.

The tricolored bat has a low toxicity ranking. While individuals that forage on agricultural use sites can accumulate high levels of carbaryl through dietary exposure, we anticipate most individuals will avoid agricultural areas. Thus, we expect individuals will only accumulate low levels of carbaryl and are not likely to experience any direct adverse effects. Similarly, while we anticipate sensitive insect species that the bat feeds on will experience high levels of mortality with carbaryl exposure, we do not anticipate the entire insect community will die as we expect there are natural variations in sensitivity to carbaryl across insect taxa. As such, we anticipate there will likely be sufficient food resources remaining even if sensitive prey species experience high levels of mortality.

While there is a moderate number of individuals likely to be exposed to carbaryl over the duration of the proposed action, we anticipate only a small number of exposed individuals will die or experience sublethal adverse effects. As such, we anticipate the overall risk of adverse effects to the species as a whole is low.

Conclusion

Tri-colored bats are a proposed endangered species, amongst the smallest bat species in eastern North America, and known for their unique tri-colored fur. They are insectivores, feeding primarily on small flying insects including moths, caddisflies, true bugs, wasps and flies. Tri-colored bats are opportunistic roosters, preferring leaf clusters in trees spring through fall, but will also utilize moss, lichen, pine needles and artificial, human-made roosts such as porch roofs, bridges, culverts and abandoned water wells. In winter, they hibernate in caves and mines, but will seek out tree cavities, culverts, and abandoned wells if caves are sparse. They exhibit high site fidelity across years. While the species has expanded its range westward into several new states in recent years, the overall population has experienced significant declines. The most serious threat to the tri-colored bat is white-nosed syndrome, which has been an extreme stressor to the point of reducing the species' population by 75-100% in some years. Additional threats include wind power installations and climate change.

While there is overlap between agricultural use sites and the species range, studies indicate that tri-colored bats avoid agricultural areas; therefore, we do not anticipate carbaryl exposure to the species from agricultural use sites and only consider off-field exposure. Tri-colored bat range overlap with off-field sites is high (11.6%), though past usage data suggests only 2.3% of this range is likely to be treated annually. We expect the tri-colored bat will occur on non-agricultural sites, including managed forests. However, U.S. Forest Service usage data indicates that only small areas of managed forests on federal property have been treated with carbaryl, and we expect this low level of use to be indicative of a similar low usage in privately managed forests. Given the high level of overlap and low past usage data, we anticipate a medium number of individuals will be exposed. As the tri-colored bat is an insectivore, dietary exposure is the likely route of exposure to carbaryl for this species. Given that EPA modeling indicates that bats consuming prey items on off-field sites will accumulate low levels of carbaryl, we do not anticipate any individuals will experience direct adverse effects. Similarly, we expect only low levels of indirect adverse effects, as even if prey items are impacted, tri-colored bats are highly mobile and should be able to find alternative food sources in areas not treated by carbaryl.

The tri-colored bat has a medium vulnerability ranking due to is decline in population size from threats such as white-nose syndrome and climate change, and a medium exposure ranking due to high overlap and low usage. Taken together with a low toxicity ranking because the species will likely feed off-field and in areas untreated by carbaryl, we do not expect more than a small number of exposed individuals will die or experience sublethal or indirect adverse effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not 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 tricolored bat.

References

U.S. Fish and Wildlife Service. 2021. Species Status Assessment (SSA) Report for the Tricolored Bat (*Perimyotis subflavus*), Version 1.1. Hadley, Massachusetts. 166 pp.