Integration and Synthesis Summary for Plants

Monocot and dicot flowering plants that require outcrossing with biotic pollination vectors

Assessment Groups 5 & 9

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined would "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 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. All plants in this appendix (Plant assessment groups 5 & 9) require outcrossing (i.e., pollen transfer between individuals) facilitated by biotic vectors, such as bees or birds, to reproduce successfully and maintain their populations over time.

Vulnerability

For the plant species that we or EPA determined are "likely to be adversely affected" by the proposed action, we considered several factors for each listed plant 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 from species listing and recovery documents, or other sources as cited and considered in the *Status* section of this Opinion.

Our assessment of vulnerability focuses on seven 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, (6) if pollinator loss has been noted as a threat, and (7) 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 XX), overarching *Environmental Baseline* section of this Opinion, five-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 seven vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as

medium or high. We assigned a medium vulnerability ranking if a species' scores were a mix of high and low (though exceptions were allowed for species that have a low status score or have an uplisting recommendation). We assigned a low vulnerability ranking to species with only low or medium 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 to Agricultural Uses

We anticipate plants and their pollinators will be exposed to carbaryl primarily through direct contact, either as the result of exposure to pesticide applications on-field or through spray drift off-field. Carbaryl degrades quickly in the environment (i.e., within a few days) and as such is not likely to persist on surfaces or in the air for prolonged periods of time.

We characterize the expected level of exposure using overlaps between the species' ranges and agricultural land uses where carbaryl is registered for use (i.e., overlaps), 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, pollinator preferences), 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 carbaryl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with carbaryl use sites, we considered past carbaryl usage data within a species' range to determine how much of a species' range we expect to be treated with carbaryl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this Opinion. Species that data indicate will have a large portion of their range (>10%) treated with carbaryl each year are assigned a high usage score. Species that will have a medium portion of their range (5-10%) treated with carbaryl each year are assigned a medium usage score, and species that data indicate will have a low portion of their range (<5%) treated with carbaryl each year are assigned a low usage score. Agricultural uses of carbaryl in the state of Hawai`i are no longer registered; however, agricultural uses are still registered for other island territories.

We determine the overall exposure ranking by qualitatively considering both the total overlap and total usage, as well as any additional exposure considerations that might modify the level of exposure likely to occur. When overlap and usage scores are the same, we assign the overall exposure ranking the same score (e.g., if both overlap and usage is high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. As usage is a subset of overlap, the overlap score will always be greater than the usage score. In cases where overlap is high, but usage is low, we

anticipate a 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 CNMI, Guan, American Samoa, 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 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). 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 pollinators and seed dispersers 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. Briefly, we expect listed species are generally not likely to be exposed to non-agricultural uses of carbaryl as there are low levels of past usage and several existing mitigation measures are protective of listed species. Usage data summarized by the EPA indicate that all non-agricultural UDLs have very low levels of past usage (at most 2.5% treatable areas treated with carbaryl annually). Some use patterns, like rights of way, have particularly low usage, with less than 500 lbs. of carbaryl used nationally each year.

Additionally, based on application information, we anticipate carbaryl use in these UDLs are restricted to small application areas that are treated infrequently over long periods of time. Use patterns like forestry, rangeland, or rights of way may also be geographically restricted as available past usage data indicate carbaryl usage only occurs in certain areas of the country, such as the western conterminous U.S. Available usage data from the U.S. Forest Service indicate that, over a five year period (from 2016-2020), the Forest Service treated 322 acres of forests in California and 557 acres of forests across three Forest Service Regions (covering North Dakota,

Montana, South Dakota, Idaho, Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada), with the majority of applications taking place in small areas (less than 1 acre in size). Similarly, usage data from the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) show limited past carbaryl usage as well. From 2019-2023, APHIS treated 92,309 acres of rangeland in seven states (Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming) and 25 counties. While this represents a large area overall, when distributed across the areas within the seven states where usage occurs, we anticipate only a small percentage of any species' range is likely to be treated for this use pattern. Additionally, all but one of these applications were made using carbaryl bait, which we expect has a much lower risk profile as bait applications are not likely to cause off target exposures as there is no spray drift or contact exposure likely to occur.

Additionally, there are several existing conservation and mitigation measures for non-agricultural uses of carbaryl that will reduce the likelihood of exposure to listed species. For example, from the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl, residential treatments are limited to spot and crack treatments (defined as a 2 ft^2 area), crack-and-crevice treatment, or narrow perimeter bands around urban structures (from 1 inch to 6 feet). This limitation in application method renders off-site spray drift unlikely and greatly reduces the 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 the listed species' habitat (e.g., up to 750 feet for some ground applications and up to a mile for some aerial applications).

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

Toxicity

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

Available toxicity data indicate that plants will not experience any direct adverse effects to survival, growth, or reproduction with exposure to carbaryl. In contrast, available toxicity data indicate that insects, including those that act as pollinators and seed dispersers for listed plants, are sensitive to carbaryl at estimated environmental concentrations and are likely to experience mortality from exposure on both application sites and adjacent areas exposed via drift. However, we expect insect species to exhibit a range of sensitivities to carbaryl and do not anticipate the entire insect pollinator community will experience mortality. Plants that rely on a select few species of pollinators or seed dispersers (i.e., specialists) are likely to experience high levels of indirect effect as high mortality in a few insect pollinator species can significantly reduce pollination and seed dispersal. In contrast, generalist plants that can use a wide range of insect species are likely able to recover more quickly from temporary losses of some insect species, resulting in lower levels of indirect effects from the proposed action.

Bird and mammal pollinators/seed dispersers are less sensitive to carbaryl exposure than insects. While carbaryl exposure in birds and mammals can cause adverse effects under specific circumstances (e.g., by consuming exclusively contaminated food items on carbaryl use sites) we do not expect carbaryl use is likely to appreciably diminish the availability of bird or mammal pollinators or seed dispersers. For species where the relationship with pollinators and seed dispersers is unknown, we make the conservative assumption that the species has a specialist-type relationship exclusively with insect pollinators and seed dispersers.

We evaluate indirect effects by assessing (1) how critical biotic outcrossing is to the species, (2) the type of pollination vector required, (3) the type of seed dispersal vector required, and (4) how strict the pollinator and seed disperser requirement is for the species (e.g., can the species use a wide range of insect species or is the species a pollinator obligate or specialist?). Species that

[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 sometimes continue to use these terms to link back to the analysis in EPA's BE.

score the same on all toxicity factors are given the same overall toxicity ranking (e.g., species scores high on all factors has a high overall toxicity ranking). Species that only have medium or low scores are given a low overall toxicity ranking. Species that have a mix of high and low scores are given a medium overall toxicity ranking, and species with a mix of high and medium scores are given a high overall toxicity ranking.

Summary of Conclusions for Plants in Assessment Groups 5 & 9

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of carbaryl, and the cumulative effects, it is the Service's biological opinion that the registration of carbaryl, as proposed, is not likely to jeopardize the continued existence of the plant species in this appendix, except those listed in the next sentence. We expect the registration of carbaryl, as proposed, is likely to jeopardize the continued existence of the Spalding's catchfly, Price's potato bean, fragrant prickly-apple, Lakela's mint, black lace cactus, scrub blazingstar, wireweed, sandlace, scrub plum, sensitive joint-vetch, decurrent false aster, Pitcher's thistle, scrub buckwheat, rough-leaved loosestrife, Fassett's locoweed, Eastern prairie fringed orchid, wide-leaf warea, longspurred mint, lakeside daisy, Texas ayenia, Western prairie fringed orchid, Kincaid's lupine, Avon Park harebells, Short's bladderpod, whorled sunflower, slickspot peppergrass, prostrate milkweed, Ocmulgee skullcap, and sand dune phacelia in the wild.

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.

Species with low exposure (informed by low overlap with agriculture)

The species in Table 1 are grouped together as they all have low concern of adverse effects due to low exposure as informed by low overlap between the species' range and agricultural land uses where carbaryl is registered for use.

Table 1. Plant species in assessment groups 5 & 9 (outcrossers with biotic pollination vectors) with low exposure informed by low overlap with agricultural uses

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Acanthomintha obovata ssp. duttonii	San Mateo thornmint	High	Low	High	2.4	No Jeopardy
Agave eggersiana	No common name	High	Low	Medium	0	No Jeopardy
Amsonia kearneyana	Kearney's blue-star	High	Low	Medium	0	No Jeopardy
Arctostaphylos confertiflora	Santa Rosa Island manzanita	High	Low	Medium	2.9	No Jeopardy
Arctostaphylos glandulosa ssp. crassifolia	Del Mar manzanita	Medium	Low	Medium	1.6	No Jeopardy
Arenaria ursina	Bear Valley sandwort	Medium	Low	High	0.8	No Jeopardy
Argemone pleiacantha ssp. pinnatisecta	Sacramento prickly poppy	High	Low	Medium	0.7	No Jeopardy
Astragalus albens	Cushenbury milk-vetch	High	Low	High	1.3	No Jeopardy
Astragalus jaegerianus	Lane Mountain milk-vetch	High	Low	High	0	No Jeopardy
Astragalus lentiginosus var. coachellae	Coachella Valley milk-vetch	Medium	Low	High	4.1	No Jeopardy
Astragalus lentiginosus var. piscinensis	Fish Slough milk-vetch	High	Low	High	2.2	No Jeopardy
Astragalus magdalenae var. peirsonii	Peirson's milk-vetch	High	Low	High	0.7	No Jeopardy
Astragalus montii	Heliotrope milk-vetch	High	Low	High	1.0	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Astragalus osterhoutii	Osterhout milkvetch	High	Low	High	2.0	No Jeopardy
Baptisia arachnifera	Hairy rattleweed	Medium	Low	Medium	3.8	No Jeopardy
Berberis nevinii	Nevin's barberry	High	Low	Medium	2.1	No Jeopardy
Boechera serotina	Shale barren rock cress	Medium	Low	High	3.5	No Jeopardy
Calochortus tiburonensis	Tiburon mariposa lily	High	Low	High	1.4	No Jeopardy
Calystegia stebbinsii	Stebbins' morning-glory	High	Low	High	0.7	No Jeopardy
Castilleja cinerea	Ash-grey paintbrush	Medium	Low	High	0.5	No Jeopardy
Chamaecrista glandulosa var. mirabilis	No common name	High	Low	High	0	No Jeopardy
Chamaecrista lineata keyensis	Big Pine partridge pea	High	Low	High	0	No Jeopardy
Chamaesyce deltoidea serpyllum	Wedge spurge	High	Low	High	0	No Jeopardy
Chorizanthe pungens var. hartwegiana	Ben Lomond spineflower	High	Low	Medium	1.7	No Jeopardy
Cirsium fontinale var. fontinale	Fountain thistle	High	Low	High	2.3	No Jeopardy
Conradina verticillata	Cumberland rosemary	Medium	Low	High	3.0	No Jeopardy
Coryphantha ramillosa	Bunched cory cactus	High	Low	High	0.1	No Jeopardy
Coryphantha robbinsorum	Cochise pincushion cactus	High	Low	High	0.7	No Jeopardy
Crescentia portoricensis	Higuero de sierra	High	Low	Medium	1.7	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Cryptantha crassipes	Terlingua Creek cat's-eye	High	Low	High	0.5	No Jeopardy
Deinandra (=Hemizonia) conjugens	Otay tarplant	Medium	Low	Medium	1.1	No Jeopardy
Dodecahema leptoceras	Slender-horned spineflower	Medium	Low	Medium	3.5	No Jeopardy
Dudleya cymosa ssp. marcescens	Marcescent dudleya	High	Low	High	2.4	No Jeopardy
Dudleya cymosa ssp. ovatifolia	Santa Monica Mountains dudleyea	High	Low	High	1.4	No Jeopardy
Dudleya verityi	Verity's dudleya	High	Low	High	2.6	No Jeopardy
Echinocactus horizonthaloniu s var. nicholii	Nichol's Turk's head cactus	High	Low	High	0.4	No Jeopardy
Echinocereus arizonicus ssp. *arizonicus*	Arizona hedgehog cactus	High	Low	Low	0.1	No Jeopardy
Echinocereus chisoensis var. chisoensis	Chisos Mountain hedgehog cactus	High	Low	High	0.3	No Jeopardy
Echinocereus fendleri var. kuenzleri	Kuenzler hedgehog cactus	High	Low	High	0.9	No Jeopardy
Echinocereus viridiflorus var. davisii	Davis' green pitaya	High	Low	High	0	No Jeopardy
Echinomastus erectocentrus var. acunensis	Acuña cactus	High	Low	High	0.1	No Jeopardy
Enceliopsis nudicaulis var. corrugata	Ash Meadows sunray	Medium	Low	High	2.1	No Jeopardy
Eriastrum densifolium ssp. sanctorum	Santa Ana River woolly-star	Medium	Low	Medium	1.9	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Eriogonum codium	Umtanum desert buckwheat	High	Low	High	2.3	No Jeopardy
Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	Medium	Low	High	1.0	No Jeopardy
Eriophyllum latilobum	San Mateo woolly sunflower	Medium	Low	Medium	2.3	No Jeopardy
Eryngium aristulatum var. parishii	San Diego button-celery	High	Low	Medium	1.9	No Jeopardy
Erysimum teretifolium	Ben Lomond wallflower	High	Low	High	1.7	No Jeopardy
Escobaria minima	Nellie"s cory cactus	High	Low	High	0	No Jeopardy
Eugenia haematocarpa	Uvillo	Medium	Low	High	0.7	No Jeopardy
Eutrema penlandii	Penland alpine fen mustard	High	Low	High	0.1	No Jeopardy
Fremontodendron californicum ssp. decumbens	Pine Hill flannelbush	High	Low	High	0.8	No Jeopardy
Gesneria pauciflora	No common name	High	Low	Medium	1.7	No Jeopardy
Gilia tenuiflora ssp. hoffmannii	Hoffmann's slender-flowered gilia	High	Low	Medium	3.5	No Jeopardy
Goetzea elegans	Beautiful goetzea	Medium	Low	Medium	1.9	No Jeopardy
Helianthemum greenei	Island rush-rose	Medium	Low	High	1.9	No Jeopardy
Hibiscus dasycalyx	Neches River rose-mallow	Medium	Low	High	1.5	No Jeopardy
Ipomopsis polyantha	Pagosa skyrocket	High	Low	Medium	2.2	No Jeopardy
Ipomopsis sancti-spiritus	Holy Ghost ipomopsis	High	Low	Medium	0.6	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Ivesia webberi	Webber's ivesia	High	Low	Medium	2.0	No Jeopardy
Lasthenia burkei	Burke's goldfields	High	Low	High	3.5	No Jeopardy
Lepidium barnebyanum	Barneby ridge-cress	High	Low	High	1.8	No Jeopardy
Lesquerella congesta	Dudley Bluffs bladderpod	High	Low	High	3.6	No Jeopardy
Lessingia germanorum (=L.g. var. germanorum)	San Francisco lessingia	High	Low	High	3.2	No Jeopardy
Liatris helleri	Heller's blazingstar	Medium	Low	Medium	1.0	No Jeopardy
Lithophragma maximum	San Clemente Island woodland-star	High	Low	High	0.3	No Jeopardy
Lyonia truncata var. proctorii	No common name	High	Low	Medium	0	No Jeopardy
Macbridea alba	White birds-in-a-nest	Low	Low	High	3.5	No Jeopardy
Malacothrix indecora	Santa Cruz Island malacothrix	High	Low	High	2.4	No Jeopardy
Mirabilis macfarlanei	MacFarlane's four-o'clock	High	Low	Medium	3.0	No Jeopardy
Nervilia jacksoniae	No common name	High	Low	High	1.3	No Jeopardy
Pediocactus bradyi	Brady pincushion cactus	High	Low	High	0.1	No Jeopardy
Pediocactus despainii	San Rafael cactus	Medium	Low	High	3.4	No Jeopardy
Pediocactus peeblesianus ssp. fickeiseniae	Fickeisen plains cactus	Medium	Low	High	0	No Jeopardy
Pediocactus winkleri	Winkler cactus	Medium	Low	High	0.5	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Pentachaeta bellidiflora	White-rayed pentachaeta	High	Low	High	2.5	No Jeopardy
Phacelia argillacea	Clay phacelia	High	Low	High	1.1	No Jeopardy
Phacelia formosula	North Park phacelia	High	Low	High	1.3	No Jeopardy
Phlox nivalis ssp. texensis	Texas trailing phlox	High	Low	Medium	0.5	No Jeopardy
Physaria obcordata	Dudley Bluffs twinpod	High	Low	High	2.8	No Jeopardy
Plagiobothrys hirtus	Rough popcornflower	High	Low	High	3.6	No Jeopardy
Pogogyne abramsii	San Diego mesa-mint	Medium	Low	High	0.3	No Jeopardy
Purshia (=Cowania) subintegra	Arizona Cliffrose	High	Low	Medium	0.9	No Jeopardy
Schoenocrambe barnebyi	Barneby reed-mustard	High	Low	High	0.6	No Jeopardy
Sclerocactus brevihamatus ssp. tobuschii	Tobusch fishhook cactus	Low	Low	High	0.6	No Jeopardy
Sclerocactus mariposensis	Lloyd"s Mariposa cactus	High	Low	High	0.2	No Jeopardy
Sclerocactus wrightiae	Wright fishhook cactus	Medium	Low	High	0.9	No Jeopardy
Senecio layneae	Layne's butterweed	High	Low	High	0.5	No Jeopardy
Serianthes nelsonii	Hayun Iagu (=(Guam), Tronkon guafi (Rota))	High	Low	High	1.7	No Jeopardy
Solanum conocarpum	Marron bacora	High	Low	High	0.1	No Jeopardy
Tinospora homosepala	No common name	High	Low	High	1.2	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Townsendia aprica	Last Chance townsendia	Medium	Low	High	3.3	No Jeopardy
Trifolium trichocalyx	Monterey clover	High	Low	High	0.2	No Jeopardy
Trillium persistens	Persistent trillium	High	Low	High	0.9	No Jeopardy
Verbena californica	Red Hills vervain	High	Low	High	0.9	No Jeopardy
Zanthoxylum thomasianum	St. Thomas prickly-ash	High	Low	High	3.6	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, we determined that the vulnerabilities of the species in Table 1 are medium or high, with the exception of two species, the Tobusch fishhook cactus and white birds-in-a-nest, that have low vulnerabilities. Toxicity is expected to be medium or high for the plant species in this group, mainly due to their reliance on insect pollinators for outcrossing and successful reproduction. However, most of the plants in Table 1 use abiotic vectors for some or all seed dispersal and most plants in Table 1 can use a variety of insect species for pollination (i.e., pollinator generalists) and are likely to recover more quickly from temporary losses of a small portion of the pollinator community. A few species, Kearney's bluestar, beautiful goetzea, *Gesneria pauciflora*, and *Agave eggersiana* use birds for pollination, and one species, higuero de sierra, uses mammals, thus decreasing the likelihood of adverse effects to their reproduction as birds and mammals are less sensitive to carbaryl exposure as explained in the Toxicity section.

While most species listed in Table 1 have medium or high vulnerability and medium or high toxicity rankings, the risk of indirect adverse reproductive effects to these plants from loss of pollinators and/or seed dispersers is low. All the species in this group have a low extent of overlap between agricultural use sites and their ranges (including associated off-site transport areas). Furthermore, the total agricultural overlap metric we use is a conservative estimate of exposure as it does not fully account for redundancy between use site layers, assumes exposure is occurring in all possible overlapping areas, and does not consider information on past carbaryl usage. As such, we expect that exposure of these species and their pollinators to carbaryl will occur in an even smaller portion of the species' ranges. Thus, while these species' vulnerability and toxicity rankings may be high or medium, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to carbaryl from agricultural usage, and exposure will be limited to small portions of the species' ranges.

For non-agricultural uses of carbaryl, we qualitatively evaluated the potential for carbaryl exposure from use sites to individual species based on their preferred habitat and current known locations within the context of our expectation that overall, species will experience minimal exposure from non-agricultural carbaryl use sites (described in the "Exposure to Non-

Agricultural Uses" section, above). Based on individual reviews of available life history information for each of the 96 species in Table 1, we expect that most of these species and their pollinator communities are unlikely to occur on or near non-agricultural use sites of carbaryl. There are 40 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, threats, and conservation measures in place as described above. For example, Monterey clover is found in the understory of Monterey pine forest. However, most of the forested areas where the species exists are protected lands (USFWS 2020a), little carbaryl has been used on federal forest lands in the state of California in the past, and we expect carbaryl exposure is unlikely where Monterey clover is found.

The few species that use a specialized pollinator and thus may be more sensitive to the loss of pollinators within their range, include the Cochise pincushion cactus, Chisos Mountain hedgehog cactus, Pine Hill flannelbush, bunched cory cactus, Davis' green pitaya, and Acuña cactus, have agricultural overlaps of less than 1%. In addition, Pine Hill flannelbush and Acuña cactus occur primarily on protected lands (USFWS 2024, 2023). Bunched cory cactus, Davis' green pitaya, and Acuña cactus occur in areas where both agricultural and non-agricultural uses of carbaryl are uncommon and unlikely (i.e., deserts, outcrops; USFWS 2023, 2018a, 2012). Cochise pincushion cactus occurs on lands grazed by livestock (USFWS 2020b); Arizona is included in the USDA APHIS biological assessment for grasshopper and Mormon cricket suppression on rangelands, but past usage has been very low across the state and carbaryl has not been used on rangelands in the county where Cochise pincushion cactus occurs (i.e., Cochise County). Carbaryl applications made through or in association with this program require the implementation of numerous conservation measures for the protection of listed species. For the Cochise pincushion cactus, 1-mi aerial and ground buffers between March and April and 50-ft aerial and ground buffers from the species range or habitat for bait applications are required. Pine Hill flannelbush on unprotected lands and Chisos Mountain hedgehog cactus may occur on rights of way or roadsides (USFWS 2024, 2018b). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. As each of these species is expected to occur in a variety of habitats, we anticipate that if small amounts of carbaryl usage did occur in rights of way within the species' ranges, it would result in no more than minimal loss of the pollinator community and resultant low levels of reproductive effects to each of these species. As such, even though these species cannot rely on multiple pollinator species, we expect the extent of exposure from both agricultural and non-agricultural carbaryl usage to be very small and not likely to cause appreciable reductions in the pollinator communities of these species and not more than low levels of resultant adverse reproductive effects to the species.

In summary, while many species listed in Table 1 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect all of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of

agricultural overlap within these species' ranges and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure. We do not expect that these adverse effects will cause species-level adverse effects due to low expected exposure to carbaryl, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. 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 in Table 1.

References:

U.S. Fish and Wildlife Service. 2024. 5-Year Review Stebbins' morning-glory (*Calystegia stebbinsii*), Pine Hill ceanothus (*Ceanothus roderickii*), Pine Hill flannelbush (*Fremontodendron decumbens*), El Dorado bedstraw (*Galium californicum* ssp. *sierrae*), and Layne's butterweed (*Packera layneae*). Sacramento, California. 21 pp.

U.S. Fish and Wildlife Service. 2023. Acuña Cactus (*Echinomastus erectocentrus* var. *acunensis*) 5-Year Status Review: Summary and Evaluation. Tucson, Arizona. 9 pp.

U.S. Fish and Wildlife Service. 2020a. Monterey Clover (*Trifolium trichocalyx*) 5-Year Review: Summary and Evaluation. Ventura, California. 14 pp.

U.S. Fish and Wildlife Service. 2020b. Cochise pincushion cactus (*Coryphantha robbinsorum*) 5-Year Review: Summary and Evaluation. Tucson, Arizona. 21 pp.

U.S. Fish and Wildlife Service. 2018a. Bunched Cory Cactus *Coryphantha ramillosa* Cutak ssp. *ramillosa 5*-Year Review: Summary and Evaluation. Austin, Texas. 37 pp.

U.S. Fish and Wildlife Service. 2018b. Chisos Hedgehog Cactus *Echinocereus chisoensis* W.T. Marshall ssp. *chisoensis 5*-Year Review: Summary and Evaluation. Austin, Texas. 35 pp.

U.S. Fish and Wildlife Service. 2012. Davis's Green Pitaya *Echinocereus viridiflorus* var. *davisii* Houghton and Nellie's Cory Cactus *Escobaria minima* (Baird) D.R. Hunt (Syn. *Coryphantha minima* Baird) 5-Year Review: Summary and Evaluation. Austin, Texas. 37 pp.

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

The species in Table 2 are grouped together because they all occur completely within California and they all have low exposure determined by low levels of past carbaryl usage within their ranges (% range treated), as informed by the California Department of Pesticide Regulation Pesticide Use Reporting (CalPUR) data.

Table 2. Plant species in groups 5 & 9 (outcrossers with biotic pollination vectors) with low exposure informed by low past usage from California Department of Pesticide Regulation Pesticide Use Reporting data.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Amsinckia grandiflora	Large-flowered fiddleneck	High	Low	High	0.13	No Jeopardy
Arctostaphylos morroensis	Morro manzanita	High	Low	Medium	0.04	No Jeopardy
Arctostaphylos myrtifolia	Ione manzanita	High	Low	Medium	0.03	No Jeopardy
Arctostaphylos pallida	Pallid manzanita	High	Low	Medium	0	No Jeopardy
Astragalus pycnostachyus var. *lanosissimus*	Ventura Marsh Milk-vetch	High	Low	High	0.03	No Jeopardy
Blennosperma bakeri	Sonoma sunshine	High	Low	High	0.02	No Jeopardy
Castilleja affinis ssp. *neglecta*	Tiburon paintbrush	High	Low	Medium	0.03	No Jeopardy
Cordylanthus mollis ssp. *mollis*	Soft bird's-beak	High	Low	Medium	0	No Jeopardy
Cordylanthus palmatus	Palmate-bracted bird's beak	High	Low	Medium	1.15	No Jeopardy
Cordylanthus tenuis ssp. *capillaris*	Pennell's bird's-beak	High	Low	Medium	0.03	No Jeopardy
Deinandra increscens ssp. *villosa*	Gaviota Tarplant	High	Low	Medium	0	No Jeopardy
Diplacus vandenbergensis	Vandenberg monkeyflower	High	Low	High	0.10	No Jeopardy
Eremalche kernensis	Kern mallow	High	Low	High	0.76	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Erysimum capitatum var. *angustatum*	Contra Costa wallflower	High	Low	High	0.64	No Jeopardy
Hesperolinon congestum	Marin dwarf-flax	Medium	Low	High	0.00	No Jeopardy
Holocarpha macradenia	Santa Cruz tarplant	High	Low	Medium	0.52	No Jeopardy
Lasthenia conjugens	Contra Costa goldfields	High	Low	High	0.02	No Jeopardy
Layia carnosa	Beach layia	High	Low	Medium	0	No Jeopardy
Limnanthes vinculans	Sebastopol meadowfoam	High	Low	Medium	0.02	No Jeopardy
Lupinus nipomensis	Nipomo Mesa lupine	High	Low	High	0.79	No Jeopardy
Oenothera deltoides ssp. *howellii*	Antioch Dunes evening-primrose	High	Low	High	0.64	No Jeopardy
Opuntia treleasei	Bakersfield cactus	High	Low	High	0.71	No Jeopardy
Pentachaeta lyonii	Lyon's pentachaeta	Medium	Low	Medium	0.01	No Jeopardy
Phlox hirsuta	Yreka phlox	High	Low	Medium	0.01	No Jeopardy
Potentilla hickmanii	Hickman's potentilla	High	Low	High	0	No Jeopardy
Pseudobahia bahiifolia	Hartweg's golden sunburst	High	Low	Medium	0.49	No Jeopardy
Pseudobahia peirsonii	San Joaquin adobe sunburst	Medium	Low	High	0.60	No Jeopardy
Streptanthus albidus ssp. *albidus*	Metcalf Canyon jewelflower	High	Low	High	0.07	No Jeopardy

The species listed in Table 2 have medium or high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capability of individuals through a reduction in the pollinator and seed disperser communities from carbaryl exposure. Toxicity is expected to be medium or high for the plant species in Table 2, mainly due to their reliance on insect pollinators for outcrossing and successful reproduction. However, most of the plants in Table 2 use abiotic vectors for some or all seed dispersal and most plants in Table 2 can use a variety of insect species for pollination (i.e., pollinator generalists) and are likely to recover more quickly from temporary losses of a small portion of the pollinator community.

While the species listed in Table 2 have high or medium vulnerability rankings and high or medium toxicity rankings, we anticipate only a small portion of the insect pollinator and seed disperser communities are likely to be exposed to carbaryl from agricultural use. CalPUR carbaryl usage data indicates that very little carbaryl has been used from 2010-2021 within the sections where these species' ranges occur. Given that this usage reporting is mandated by the state of California and that these data are provided regularly at a relatively high spatial resolution, we have high confidence that only a small percentage of the species' ranges are likely to be exposed to agricultural use of carbaryl.

For non-agricultural uses of carbaryl, we qualitatively evaluated the potential for carbaryl exposure from use sites to individual species based on their preferred habitat and current known locations within the context of our expectation that overall, species will experience minimal exposure from non-agricultural carbaryl use sites (described in the "Exposure to Non-Agricultural Uses" section, above). Based on individual reviews of available life history information for each of the 28 species in Table 2, we expect that most of these species and their pollinator communities are unlikely to occur on or near non-agricultural use sites of carbaryl. There are 12 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species, see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, threats, and conservation measures in place as described above in the non-agricultural use section. For example, while the palmate-bracted bird's beak can occur on grazing lands, there is a formal grazing program in place that is compatible with the species' needs and has been shown to stimulate reproduction in the species (USFWS 2023). Therefore, we expect carbaryl exposure is unlikely to result in adverse effects where palmate-bracted bird's beak is found. In addition, CalPUR data include all agricultural usage and certain non-agricultural uses, such as those performed by professional commercial applicators. While these data do not capture all non-agricultural usage, such as residential applications by consumers, given our broad understanding of carbaryl usage, general information on non-agricultural use practices, and existing conservation measures, we expect limited exposure from these uses of carbaryl. Overall, while these species' vulnerability and toxicity rankings may be medium or high, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to carbaryl from agricultural or non-agricultural uses.

For the few species that use a specialized pollinator (the Bakersfield cactus and Kern mallow) and thus may be more sensitive to pollinator losses within their range, less than 1% of their ranges have been treated with carbaryl according to CalPUR data, which is inclusive of all agricultural and certain non-agricultural uses. The Bakersfield cactus occurs on flood plains, ridges, bluffs, and rolling hills in saltbush scrub plant communities, and occasionally in blue oak woodland or riparian woodland. Some of these areas are affected by sheep grazing (USFWS 2011). The Kern mallow is found in valley saltbush scrub and disturbed areas like roadsides and grazed areas (USFWS 2013, 2020). While both these species may occur in grazed areas, neither species was included in the USDA APHIS biological assessment for grasshopper and Mormon

cricket suppression, indicating that rangelands in the species' ranges are unlikely to be treated with carbaryl. In addition, individuals of both species may occur near roadsides. However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. As both these species are expected to occur in a variety of habitats, we anticipate that if small amounts of carbaryl usage did occur in rights of way within the species' ranges, it would result in no more than minimal loss of the pollinator community and resultant low levels of reproductive effects to these species. As such, even though these two species cannot rely on multiple pollinator species, the extent of agricultural and non-agricultural carbaryl exposure is very small and not likely to cause appreciable reductions in the pollinator communities of these species and not more than low levels of resultant reproductive effects to the species.

In summary, while species listed in Table 2 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect the pollinators of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of past carbaryl usage indicated by CalPUR data and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects to the species due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure. We do not expect that these adverse effects will cause species-level adverse effects due to low expected exposure to carbaryl, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. 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 in Table 2.

References:

U.S. Fish and Wildlife Service. 2023. 5-Year Review Palmate-bracted bird's-beak (*Cordylanthus palmatus* = *Chloropyron palmatum*). Sacramento, California. 13 pp.

U.S. Fish and Wildlife Service. 2020. 5-Year Review Kern mallow (*Eremalche kernensis* = *Eremalche parryi* ssp. *kernensis*). Sacramento, California. 7 pp.

U.S. Fish and Wildlife Service. 2013. *Eremalche kernensis* (Kern mallow) 5-Year Review: Summary and Evaluation. Sacramento, California. 73 pp.

U.S. Fish and Wildlife Service. 2011. Bakersfield cactus (*Opuntia treleasei* = *Opuntia basilaris* var. *treleasei*) 5-Year Review: Summary and Evaluation. Sacramento, California. 42 pp.

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

The species in Table 3 are grouped together as they all have low exposure (% range treated) informed by low levels of past insecticide usage within their ranges, as informed by USDA's Census of Agriculture (CoA) data.

Table 3. Plant species in groups 5 & 9 (outcrossers with biotic pollination vectors) with low exposure informed by low past usage from USDA's Census of Agriculture (CoA)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Abronia macrocarpa	Large-fruited sand-verbena	High	Low	Medium	2.4	No Jeopardy
Agalinis acuta	Sandplain gerardia	Low	Low	High	1.0	No Jeopardy
Amorpha crenulata	Crenulate lead-plant	High	Low	High	2.7	No Jeopardy
Arabis georgiana	Georgia rockcress	High	Low	High	3.3	No Jeopardy
Argythamnia blodgettii	Blodgett's silverbush	High	Low	High	1.4	No Jeopardy
Astragalus ampullarioides	Shivwits milk-vetch	High	Low	High	0.8	No Jeopardy
Astragalus bibullatus	Guthrie's (=Pyne's) ground-plum	High	Low	High	1.7	No Jeopardy
Astragalus holmgreniorum	Holmgren milk-vetch	High	Low	High	1.4	No Jeopardy
Astragalus humillimus	Mancos milk-vetch	High	Low	High	0.2	No Jeopardy
Astragalus robbinsii var. *jesupii*	Jesup's milk-vetch	High	Low	High	0.5	No Jeopardy
Brickellia mosieri	Florida brickell-bush	High	Low	High	2.7	No Jeopardy
Callirhoe scabriuscula	Texas poppy-mallow	High	Low	High	3.9	No Jeopardy
Chamaesyce deltoidea pinetorum	Pineland sandmat	High	Low	High	2.7	No Jeopardy
Chromolaena frustrata	Cape Sable Thoroughwort	High	Low	Medium	1.4	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Cirsium wrightii	Wright's marsh thistle	High	Low	High	1.1	No Jeopardy
Conradina etonia	Etonia rosemary	Medium	Low	High	1.7	No Jeopardy
Conradina glabra	Apalachicola rosemary	High	Low	Medium	4.2	No Jeopardy
Cucurbita okeechobeensis ssp. *okeechobeensis*	Okeechobee gourd	High	Low	Medium	0.9	No Jeopardy
Deeringothamnus pulchellus	Beautiful pawpaw	High	Low	Medium	2.6	No Jeopardy
Eryngium sparganophyllum	Arizona eryngo	High	Low	High	1.4	No Jeopardy
Galactia smallii	Small's milkpea	High	Low	High	2.7	No Jeopardy
Hackelia venusta	Showy stickseed	High	Low	High	2.9	No Jeopardy
Harrisia (=Cereus) aboriginum (=gracilis)	Aboriginal Prickly-apple	High	Low	High	2.5	No Jeopardy
Helenium virginicum	Virginia sneezeweed	Medium	Low	High	0.8	No Jeopardy
Linum carteri carteri	Carter's small-flowered flax	High	Low	Medium	2.7	No Jeopardy
Lupinus aridorum	Scrub lupine	High	Low	High	4.6	No Jeopardy
Lupinus constancei	Lassics lupine	High	Low	High	0.1	No Jeopardy
Marshallia mohrii	Mohr's Barbara's buttons	Medium	Low	Medium	1.9	No Jeopardy
Pedicularis furbishiae	Furbish lousewort	High	Low	High	3.2	No Jeopardy
Phacelia submutica	DeBeque phacelia	Medium	Low	High	2.0	No Jeopardy
Physaria douglasii ssp. *tuplashensis*	White Bluffs bladderpod	High	Low	High	3.7	No Jeopardy
Physaria filiformis	Missouri bladderpod	Low	Low	High	0.8	No Jeopardy
Sarracenia rubra ssp. *alabamensis*	Alabama canebrake pitcher-plant	High	Low	Medium	3.8	No Jeopardy
Sclerocactus brevispinus	Pariette cactus	High	Low	High	0.6	No Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Sclerocactus glaucus	Colorado hookless Cactus	Medium	Low	Medium	2.3	No Jeopardy
Sclerocactus mesae-verdae	Mesa Verde cactus	Medium	Low	High	0.3	No Jeopardy
Sclerocactus wetlandicus	Uinta Basin hookless cactus	High	Low	High	0.3	No Jeopardy
Sidalcea oregana var. *calva*	Wenatchee Mountains checkermallow	High	Low	High	2.3	No Jeopardy
Solidago houghtonii	Houghton's goldenrod	Low	Low	Medium	1.4	No Jeopardy
Solidago shortii	Short's goldenrod	High	Low	Medium	4.8	No Jeopardy
Spiranthes diluvialis	Ute ladies'-tresses	Medium	Low	Medium	2.7	No Jeopardy
Thymophylla tephroleuca	Ashy dogweed	High	Low	High	0.8	No Jeopardy
Xyris tennesseensis	Tennessee yellow-eyed grass	High	Low	Medium	1.8	No Jeopardy

Many species listed in Table 3 have medium or high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capability of individuals through a reduction in the pollinator and seed disperser communities from carbaryl exposure. Toxicity is expected to be medium or high for the plant species in this group, mainly due to their reliance on insect pollinators for outcrossing and successful reproduction. However, all of the plants in Table 3 use abiotic vectors for some or all seed dispersal and most plants in Table 3 can use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists). As such, they are likely to recover more quickly from temporary losses of a small portion of their pollinating insect species.

While many species listed in Table 3 have medium or high vulnerability rankings and toxicity is high or medium, we anticipate only a small number of individuals are likely to be exposed to carbaryl given the agricultural insecticide usage in the past across their ranges. Low CoA usage indicates that very little insecticide usage occurred in agricultural crops in the past in the counties where these species' ranges occur. Given that this reporting broadly includes all insecticide usage on agriculture, we consider CoA data to be conservative estimates of carbaryl usage that indicate very little of the species' ranges are likely to be treated. As such, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to carbaryl through agricultural uses.

For non-agricultural uses of carbaryl, we qualitatively evaluated the potential for carbaryl exposure from use sites to individual species based on their preferred habitat and current known locations within the context of our expectation that overall, species will experience minimal exposure from non-agricultural carbaryl use sites (described in the "Exposure from Non-Agricultural Uses" section, above). Based on individual reviews of available life history information for each of the 43 species in Table 3, we expect that many of these species and their pollinator communities are unlikely to occur on or in close proximity to non-agricultural use sites of carbaryl. There are 26 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species, see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, threats, and conservation measures in place as described above in the non-agricultural use section. For example, the Short's goldenrod occurs in dry, upland, mostly open habitats with full sun or partial shade, including non-agricultural use sites like pastures, old fields, power line rights of way, and rock ledges along highways (USFWS 2023). The species was not included in the USDA APHIS BA for grasshopper and Mormon cricket suppression, indicating that rangelands in the area are not treated with carbaryl. Available usage information indicates that carbaryl is used infrequently in rights of ways, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. As the Short's goldenrod is expected to occur in a variety of habitats, we anticipate that if small amounts of carbaryl usage did occur in rights of way within its range, it would result in no more than minimal loss of the pollinator community and resultant low levels of reproductive effect to this species. Therefore, we expect, at most, a low level of adverse reproductive effects from the minimal carbaryl exposure expected for Short's goldenrod.

For the one species that uses a specialized pollinator, Jesup's milk vetch, less than 1% of its range has been treated with agricultural insecticides. Jesup's milk vetch inhabits bedrock outcrops of chlorite or phyllite schist along high-water marks of the Connecticut River. Some logging occurs near these ledges (USFWS 2021), but no carbaryl has been used for federal forestry efforts in the past in this location, indicating that forests in the species' range are not likely treated with carbaryl. Even though the species cannot rely on multiple pollinators, we expect the extent of exposure from agricultural and non-agricultural usage of carbaryl to be very small and not likely to cause appreciable reductions in the pollinator community of the species.

In summary, while many species listed in Table 3 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect all of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of general insecticide usage within these species' ranges and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure. We do not expect that these adverse effects will cause adverse species-level effects due to low expected exposure, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. 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 in Table 3.

References:

U.S. Fish and Wildlife Service. 2023. Short's Goldenrod (*Solidago shortii*) 5-Year Status Review: Summary and Evaluation. Frankfort, Kentucky. 16 pp.

U.S. Fish and Wildlife Service. 2021. Jesup's milk-vetch (*Astragalus robbinsii* var. *jesupii*) 5-Year Status Review: Summary and Evaluation. Concord, New Hampshire. 22 pp.

Species with Individual Integration and Synthesis Summaries

For the species in Table 4, our preliminary vulnerability, exposure, and toxicity rankings indicate that the proposed action may result in moderate to high adverse effects. As such, we discuss each species in more detail in individual Rationales for Conclusion. In some cases, we modified the initial exposure and toxicity rankings due to additional information regarding exposure and effects for individual species, as described below.

Table 4. Plant species in groups 5 & 9 (outcrossers with biotic pollination vectors) with moderate to high adverse effects anticipated from the proposed action.

Scientific Name	Common Name	Determination
Astrophytum asterias	Star cactus	No Jeopardy
Silene spaldingii	Spalding's catchfly	Jeopardy
Apios priceana	Price's potato-bean	No Jeopardy
Asimina tetramera	Four-petal pawpaw	No Jeopardy
Cereus eriophorus var. fragrans	Fragrant prickly-apple	Jeopardy
Dicerandra immaculata	Lakela's mint	Jeopardy
Echinocereus reichenbachii var. albertii	Black lace cactus	Jeopardy
Liatris ohlingerae	Scrub blazingstar	Jeopardy
Polygonella basiramia	Wireweed	Jeopardy
Polygonella myriophylla	Sandlace	Jeopardy
Prunus geniculate	Scrub plum	Jeopardy
Aeschynomene virginica	Sensitive joint-vetch	Jeopardy
Boltonia decurrens	Decurrent false aster	Jeopardy
Cirsium pitcheri	Pitcher's thistle	Jeopardy
Eriogonum longifolium var. gnaphalifolium	Scrub buckwheat	Jeopardy
Lysimachia asperulaefolia	Rough-leaved loosestrife	Jeopardy
Oxytropis campestris var. chartacea	Fassett's locoweed	Jeopardy
Platanthera leucophaea	Eastern prairie fringed orchid	Jeopardy
Warea amplexifolia	Wide-leaf warea	Jeopardy
Dicerandra cornutissima	Longspurred mint	Jeopardy
Hymenoxys herbacea	Lakeside daisy	Jeopardy
Ayenia limitaris	Texas ayenia	Jeopardy
Platanthera praeclara	Western prairie fringed orchid	Jeopardy
Lupinus sulphureus ssp. kincaidii	Kincaid's lupine	Jeopardy
Crotalaria avonensis	Avon Park harebells	Jeopardy
Leavenworthia crassa	Fleshy-fruit gladecress	Jeopardy
Physaria globosa	Short's bladderpod	Jeopardy

C-B2. Flowering Plants Outcrossers with Biotic Pollination vectors (Groups 5&9)

Scientific Name	Common Name	Determination
Helianthus verticillatus	Whorled sunflower	Jeopardy
Lepidium papilliferum	Slickspot peppergrass	Jeopardy
Dalea carthagenensis floridana	Florida prairie-clover	No Jeopardy
Asclepias prostrata	Prostrate milkweed	Jeopardy
Scutellaria ocmulgee	Ocmulgee skullcap	Jeopardy
Phacelia argentea	Sand dune phacelia	Jeopardy

Rationale for Species Conclusion: Star cactus

Scientific Name:	Common Name:	Entity ID:
Astrophytum asterias	Star cactus	513

Conclusion

The star cactus is endemic to a small area of southern Texas along the Mexican border (encompassing approximately 125 square km). The 2019 Recovery Plan Amendment reports that a recent study found low levels of genetic differentiation among the sub-populations in Texas, indicating cacti in Texas are likely a single population. All twenty-four known occurrence sites exist on unprotected private lands, except one owned by The Nature Conservancy. Threats include habitat loss and hydrologic alterations mainly due to energy development and a decline of the bees this species depends on for pollination, especially cactus-specialist bees.

Like all species in this appendix, the star cactus relies on pollen transfer between individual plants for successful reproduction and therefore needs sufficient pollinator populations within its range. While the star cactus depends on a few specific pollinator species (cactus specialist bees of the *Diadasia* genus) for outcrossing and successful reproduction, it relies on a variety of seed dispersers to maintain populations and colonize new sites in its range. Given that this species can rely on a variety of seed dispersal vectors, we do not anticipate adverse effects to its insect or avian seed dispersers to cause appreciable adverse effects to the reproductive capacity of this species.

While data indicates there is significant overlap of agricultural use sites with the range of this species (70%) and high past usage (48.5%) from agricultural uses, occupied sites are likely restricted to the Catahoula and Frio soil formations in Starr County. These soil types are saline and sodic, and completely unsuitable for row crop farming. As a result, we do not anticipate that agricultural use sites will be found in the vicinity of star cactus occurrences or would be close enough to cause appreciable mortality to pollinator populations used by this species (Chris Best, pers. comm., Austin Ecological Services Field Office 2021). The species can be found in the vicinity of roadside rights of way and on rangelands used for grazing, meaning there may be some exposure from carbaryl use on these areas (USFWS 2003). However, it is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside the Western U.S. In addition, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in rights of way within the species' range, we would expect no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the star cactus. Thus, we anticipate minimal exposure of the species' pollinators to agricultural and non-agricultural uses of carbaryl.

While carbaryl usage may result in insect pollinator mortality where it is used in the range, we do not anticipate this loss will cause species-level adverse reproductive effects due to the anticipated lack of agricultural use sites in the vicinity of star cactus occurrences (i.e., there will not be

appreciable losses in the insect pollinator community near occurrences of the star cactus), low expected exposure from non-agricultural use sites, and the species' ability to rely on a variety of seed dispersers. 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 star cactus

References:

U.S. Fish and Wildlife Service. 2003. Star cactus (*Astrophytum asterias*) Recovery Plan. Albuquerque, New Mexico. 75 pp.

U.S. Fish and Wildlife Service. 2019. Star cactus (*Astrophytum asterias*) Recovery Plan Amendment. Albuquerque, New Mexico. 3 pp.

Rationale for Species Conclusion: Spalding's catchfly

Scientific Name:	Common Name:	Entity ID:
Silene spaldingii	Spalding's catchfly	613

Conclusion

The Spalding's catchfly is a threatened species endemic to the Palouse region of southeast Washington, adjacent Oregon and Idaho, and northwestern Montana and British Columbia, Canada. It is a long-lived, herbaceous, perennial plant found in bunchgrass grasslands, sagebrush-steppe, and occasionally open pine communities. They are found in deep, productive loess soils and glacial soils, typically in swales or on northwest- to northeast-facing slopes where soil moisture is higher. Since 2009, increased survey effort has resulted in discoveries of additional populations and higher population estimates. Across Idaho, Montana, Oregon, and Washington, we estimate that there are about 110,000 individuals across about 224 occurrences; genetic studies showed that occurrences represented potentially 4 population groups. The species has been outplanted in several areas to increase its recovery potential. The Palouse Grasslands region is highly fragmented, so populations and occurrences are isolated, and pollinators may have difficulty traveling among occurrences. Lack of seed production and vigor has been attributed to insufficient pollination. As such, availability of pollinators is noted as a potential limiting factor for seed production at several sites and insecticides are specifically mentioned as a threat to the species. In addition to pollinator declines, other threats to the species include rodent predation, invertebrate predation, invasive and non-native plants, fire suppression, land conversion associated with urban and agricultural development, grazing, herbicide, and insecticide spraying (USFWS 2020).

Apios priceana flowers from mid-July through mid-August and produces fruit from August through September. Flowers are pollinated by bumble bees and honey bees among other arthropods. The species is the only species of Apios in which the keel bends backwards after tripping rather than coiling, which prevents self-pollination (USFWS 2020). *Bombus fervidus* (golden northern bumble bee) is the species' primary pollinator, but two other *Bombus* spp. have been observed on Spalding's catchfly. Seeds are dispersed abiotically. Like all species in this appendix, the Spalding's catchfly relies on pollen transfer between individual plants for successful reproduction and therefore needs sufficient pollinator populations within its range (USFWS 2020). Because their grassland habitats are highly productive, many of them have been converted or affected by agriculture.

The species' range overlaps carbaryl agricultural use sites in a total of 57.3% of the range and we expect up to 30.2% of the species range to be treated based on past carbaryl usage data, resulting in high agricultural exposure. In addition to agricultural land uses, Spalding's catchfly is found on livestock pasturelands, where carbaryl may be used. However, a 1-mile ground and aerial buffer from appropriate habitat for rangeland use between July and October for this species is in place through the USDA-APHIS grasshopper and Mormon cricket program (USFWS 2024). As

such, we don't anticipate that rangeland use of carbaryl will add meaningfully to the overall level of anticipated exposure of pollinators of this species.

Pre-existing limitations on the species' reproductive capacity are likely to be exacerbated by loss of insect pollinators from exposure to agricultural uses of carbaryl. As this species only relies on a relatively narrow spectrum of pollinator species (*Bombus fervidus* and potentially two other *Bombus* spp.), a reduction in the number of individuals of these species in the range of the Spalding's catchfly from carbaryl use is likely to have a disproportionately large effect on the reproductive capacity of the species because it cannot use other members of the local pollinator community. In addition, a decline in the pollinator community will make it even more difficult for the remaining pollinator individuals to travel among populations of the species and find individuals to pollinate. Given the high agricultural exposure and medium toxicity for this species, we anticipate high adverse effects to this species due to the reduction in pollinating insects that would result in reduced reproductive success.

We anticipate that adverse effects to pollinators will cause species-level adverse effects to the Spalding's catchfly over the duration of the action. The species is a narrow endemic whose reproductive success depends upon the presence of insect pollinators for reproduction (outcrossing), its range is restricted and highly fragmented, and it relies on relatively few species of pollinators. 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 Spalding's catchfly

References:

U.S. Fish and Wildlife Service. 2024. Letter of Concurrence for the APHIS Rangeland Grasshopper and Mormon cricket Suppression Program. Falls Church, Virginia. 26pp.

U.S. Fish and Wildlife Service. 2020. 5-Year Review Spaldings catchfly (*Silene spaldingii*). Boise, Idaho. 48 pp.

Rationale for Species Conclusion: Price's potato-bean

Scientific Name:	Common Name:	Entity ID:
Apios priceana	Price's potato-bean	628

Conclusion

Price's potato-bean is a twining, herbaceous perennial vine in the pea family (Fabaceae) endemic to the southeastern United States (Alabama, Kentucky, Mississippi, Tennessee; and historically occurred in southern Illinois). It is often found in open, low areas near streams or along the banks of streams and rivers. There are now 57 extant populations distributed among 27 counties in four states. The species continues to have a limited distribution with isolated populations. Threats to the species, including excessive shading by canopy trees and competing ground cover, right of way maintenance for roads and utilities, competition with exotic, invasive plants, insect herbivory, and climate change, still overwhelmingly affect many populations. While none of the 27 protected populations (which contain the majority of individuals) are necessarily subject to all the above threats, insect herbivory and competition via invasive species continue to be ubiquitous, adverse influences. Furthermore, emerging threats—including feral hogs and herbicide overspray (applicable in the 4 populations that occur near agricultural fields)—have been observed near or directly impacting several populations (USFWS 2022).

A recent study found multiple bee species (such as bumble bees and resin bees) were equally effective pollinators for Price's potato-bean, indicating pollinator redundancy provides resilience from the species perspective (USFWS 2022). Like all species in this appendix, the potato-bean requires pollen transfer between individual plants to reproduce successfully, and therefore relies on healthy pollinator communities within its range. Considering reports of widespread declines in North American bumble bee populations, reliance of Price's potato-bean upon a suite of pollinating bees might buffer potential impacts of individual bumble bee population declines.

Little is known about seed dispersal vectors, but like many beans, the seeds burst from the seed pod to disperse. As such, adverse effects to reproduction from loss of seed dispersers are not anticipated (USFWS 2022).

This species has a large percent overlap (20.5%) between the agricultural uses of carbaryl and the species range, but past usage data indicates a moderate portion, 9.6% of the species' range, has been treated with carbaryl annually from agricultural uses. While there is a medium level of usage expected, given the uncertainties associated with this usage data and the high percent overlap, we determined the species has high agricultural exposure. The species can be found in road and utility rights of way, meaning there may be additional exposure from carbaryl in these areas (USFWS 2022). However, available non-agricultural usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in rights of way within the species' ranges, we expect no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the Price's

potato-bean. As such, we expect most exposure to occur from agricultural uses for this species. Price's potato-bean has medium toxicity as it likely uses abiotic vectors (gravity) for all or a portion of its seed dispersal and can rely on multiple insect species for pollination (such as bees, beetles, wasps, etc.).

While we anticipate adverse effects to the species in the form of reduced reproductive success due to the reduction in pollinating insects that is likely to occur from carbaryl exposure, we do not anticipate these adverse effects will cause species-level effects. We arrive at this conclusion because the majority of individuals occur on protected lands where carbaryl exposure is unlikely, only four of 57 populations occur in the vicinity of agricultural fields, the species relies on a diverse group of pollinators for reproduction and uses gravity for a portion of its seed dispersal. 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 Price's potato bean.

References:

U.S. Fish and Wildlife Service. 2022. Price's potato-bean (*Apios priceana*) 5-year Review, Summary and Evaluation. Jackson, Mississippi. 14 pp.

Rationale for Species Conclusion: Four-petal pawpaw

Scientific Name:	Common Name:	Entity ID:
Asimina tetramera	Four-petal pawpaw	637

Conclusion

The four-petal pawpaw is found on the Atlantic Coastal Ridge in Florida. There are an estimated 1,400 individuals across nine extant or potentially extant populations (14 sub-populations), with three naturally occurring populations believed to be extirpated and three unsuccessful introduced populations. The species declined since the last review, which described 1,800 plants across 21 extant sites. The largest population is stable and found on Jonathan Dickinson State Park but shows low recruitment. Several other populations were described with stable or decreasing trends; nine of fourteen extant subpopulations are on protected or managed lands (e.g., Juno Dunes Natural Area, Pawpaw Preserve) and the other five are on private lands (e.g., Florida Power and Light Juno Beach). Threats to the species include continued habitat loss and fragmentation, fungal infections, heavy herbicide spraying, fire suppression, invasive plants and imprecise methods used in their removal, and climate change. The 2022 5-Year Review does not specifically mention loss of pollinators or effects of other pesticides as threats. The four-petal pawpaw is State-listed, so individuals on State lands are protected from removal, destruction, or damage. However, the species is not provided any direct habitat protection by this listing (USFWS 2022).

Four-petal pawpaw flower from March to June. Four-petal pawpaw are primarily outcrossers but can self-pollinate with limited success and vigor. They are pollinated by beetles, primarily from the Cerambycidae, Scarabaeidae, and Tenebrionidae families. Like all species in this appendix, the four-petal pawpaw relies on pollen transfer between individual plants for successful reproduction and therefore needs sufficient pollinator populations within its range. Because their sand pine scrub habitats on coastal dunes are on higher elevations that the surrounding areas, many of them have been converted to development. Remaining habitat is highly fragmented, and pollinators may have a hard time traveling among populations. In the 2009 5-Year Review, we mentioned that genetic diversity may be decreasing due to a lack of cross pollination across sites. Little is known about pollinator trends and in our latest review, we suggested determining the status of insect pollinator populations associated with the four-petal pawpaw (USFWS 2009).

While there is overlap of agricultural use sites within the range of this species (there is a large percent overlap, 53%, between agricultural use sites and range, and past usage data indicate that up to 26% of the species' range has been treated with carbaryl annually from agricultural uses), occupied sites are likely restricted to the sand pine scrub habitats on coastal dunes in Martin and Palm Beach counties (Kern et al. 2023). Insecticides may be used on privately-owned lands, but the agricultural areas in the species' range are relatively far away from the small pockets of sand pine scrub habitat found along the coast where the species is likely to be found. Even though usage data indicate that a high percent of the range has been treated annually in the past, agricultural use sites are not anticipated to overlap with areas of four-petal pawpaw occurrence

(Heather Hitt, pers. comm., Florida FWS Field Office 2024), leading to a very low likelihood of carbaryl exposure to the beetles this species relies on for pollination and successful reproduction. As a result, we do not anticipate that agricultural use sites will be found in the vicinity of four-petal pawpaw occurrences or would be close enough to cause appreciable mortality to pollinator populations used by this species and result in more than low levels of adverse reproductive effects. Additionally, the species is not expected to occur on carbaryl non-agricultural use sites including rangeland, rights of way, or in forests.

This plant relies on birds and mammals for seed dispersal. As explained in the Toxicity section, it is not likely that carbaryl exposure from the proposed action would appreciably diminish the availability of bird or mammal seed dispersers.

While we anticipate minimal adverse effects from losses of insect pollinators, including the beetles this species relies upon, we do not anticipate these adverse effects will cause adverse species-level reproductive effects due to the lack of agricultural and non-agricultural overlap with species occurrences and its ability to rely on a variety of seed dispersers. 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 four-petal pawpaw.

References:

Kern, M., Kay, S., Christian, D., and Tandy, E. 2023. Methomyl Effects Assessment of the Four-Petal Pawpaw (*Asimina tetramera*) for Risk Management of Methomyl Agricultural Uses. TKI-2023-EAM-027. 35 pp.

U.S. Fish and Wildlife Service. 2022. Four-petal pawpaw (*Asimina tetramera*) 5-Year Review: Summary and Evaluation. Vero Beach, FL. 34 pp.

U.S. Fish and Wildlife Service. 2009. Four-petal pawpaw (*Asimina tetramera*) 5-Year Review: Summary and Evaluation. Vero Beach, FL. 22 pp.

Rationale for Species Conclusion: Fragrant prickly-apple

Scientific Name:	Common Name:	Entity ID:
Cereus eriophorus var. *fragrans*	Fragrant prickly-apple	661

Conclusion

The fragrant prickly-apple is an endangered cactus endemic to the Atlantic Coastal Ridge of Florida in an area approximately 10 miles long and half a mile wide. They prefer early-successional sand pine scrub habitat (USFWS 1999). There are only ten known sites where this species exists, six of which occur on protected lands and another three are partially protected (USFWS 2019), though populations at all sites require active management to persist including periodic burns and removal of exotic plant species. The Atlantic Coastal Ridge is attractive for both commercial and residential development, and suitable habitat for this species is greatly reduced, fragmented, and under intense threat from continued development.

While the fragrant prickly-apple's pollinators are not known with certainty, it has night-blooming flowers, and we suspect it uses hawk moths and possibly beetles as pollinators. Like all species in this appendix, the fragrant prickly-apple requires pollen transfer between individual plants in order to reproduce successfully, and therefore relies on sufficient pollinator populations within its range. Given the highly fragmented nature of suitable habitat for this species, populations and occurrences have become more isolated, making it harder for pollinators to make the journey between plants. As a result, isolated populations may experience decreased recruitment of new plants into the population and result in inbreeding depression that may reduce fitness of the plants and reduce genetic diversity (USFWS 2021).

This pre-existing limitation on the species' reproductive capacity is likely to be exacerbated by loss of insect pollinators from exposure to carbaryl. As this species only relies on a relatively narrow spectrum of pollinator species (sphynx moths and possibly beetles), a decline in these pollinator species from exposure to carbaryl is likely to have a disproportionately large effect on the reproductive capacity of the fragrant prickly-apple as it cannot use other members of the local pollinator community for pollination and therefore successful reproduction. In addition, fewer pollinators on the landscape will make it even more difficult for pollinators to successfully travel among and locate isolated plants.

The species has high agricultural exposure due to overlap of carbaryl agricultural use sites with 56% the range and up to 41% of the range treated annually in the past. The species is not expected to occur in non-agricultural use sites and therefore we expect most exposure will occur from agricultural uses. From a visual comparison of some agricultural UDLs and potentially suitable habitat for the fragrant prickly-apple, agricultural (primarily corn and vegetables and ground fruit) land uses occur near or on habitat for the species; citrus is also a registered use for carbaryl and likely contributes to the high level of overlap for this species (Kern et al. 2024). As such, we anticipate high adverse effects to this species due to the reduction in pollinating insects

from carbaryl exposure that would result in reduced reproductive success for the fragrant prickly-apple.

This plant relies on birds, mammals, and gopher tortoises for seed dispersal. As explained in the *Effects of the Action* section, it is not likely that carbaryl exposure from the proposed action would appreciably diminish the availability of bird, mammal, or reptile seed dispersers.

We anticipate that the adverse effects to pollinators will cause adverse species-level reproductive effects to the fragrant prickly-apple over the duration of the action. This species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction (outcrossing), especially given its restricted and highly fragmented range that may currently limit its reproductive capacity, and its reliance on relatively few species of pollinators. 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 fragrant prickly-apple.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2024. Methomyl Effects Assessment of the Fragrant Prickly-Apple (*Cereus eriophorus* var. *fragrans*) for Risk Management of Methomyl Agricultural Uses. Tessenderlo Kerley, Inc. TKI-2024-EAM-070. 40 pp.

U.S. Fish and Wildlife Service. 2021. Fragrant prickly-apple (*Cereus eriophorus* var. *fragrans*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 28 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan Amendment for fragrant prickly-apple (*Cereus eriophorus* var. *Fragrans*). Vero Beach, Florida. 7 pp.

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

Rationale for Species Conclusion: Lakela's mint

Scientific Name:	Common Name:	Entity ID:
Dicerandra immaculata	Lakela's mint	696

Conclusion

Lakela's mint is a narrow endemic found along the Atlantic Coastal Ridge region of southeast Florida. The geographic range of the five remaining natural populations of Lakela's mint is a 0.5-mile-wide by 3-mi-long area in southern Indian River County and northern St. Lucie County, Florida. This distribution has been expanded by nine introduced populations, and the species now occurs along 59 miles of the Atlantic Coastal Ridge. However, the range is still extremely limited.

The primary threat to the species is habitat destruction and fragmentation from high rates of development. Of the 14 populations, 11 occur on lands protected from development, while the three populations on private land are either extirpated or are under immediate threat of development. The limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining sand pine scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of this species.

Lakela's mint relies on insects for pollination, mainly native bumble bees and non-native honey bees. Like all the species in this assessment group, they require pollen transfer between individual plants to reproduce successfully and therefore rely on healthy pollinator populations within their range. A recent study found that individual Lakela's mint plants pollinated by native bumble bees produce more viable seed than those pollinated by non-native honey bees. Plants pollinated by honey bees tend to self-pollinate instead of outcross which lowers seed viability and may influence the genetic structure of the populations. This finding emphasizes the importance of healthy native bumble bee populations for successful reproduction of Lakela's mint (USFWS 2019, 2021). Furthermore, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lennartson 2002, Lienert 2004, Spira 2001, Setsuko et al. 2013).

Seed dispersal is very limited for Lakela's mint, but dispersal vectors are not documented. Given that seeds have dispersed no more than 2m from parent plants in introduced colonies, seed dispersal by gravity is likely. As such, adverse effects to reproduction from loss of seed dispersers are not anticipated (USFWS 1999).

The Lakela's mint has a medium percent overlap (6.37%) between agricultural uses of carbaryl and its range, and past usage data indicate that up to 6.37% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of some agricultural UDLs and potentially suitable habitat for the Lakela's mint, most agriculture occurs inland from

the species' potential habitat (Kern et al. 2024). However, citrus is a registered use for carbaryl not included in our visual comparison and likely contributes to the medium level of overlap for this species. The species is not expected to occur in non-agricultural use sites and therefore we expect most exposure will occur from agricultural uses. As such, we determined the species has medium exposure. As a result, we anticipate a moderate reduction in the community of pollinating insects within the range of this species.

The species is a narrow endemic whose survival is dependent upon the presence of insect pollinators for reproduction. A moderate loss of pollinators within its range is likely to exacerbate existing reproductive deficiencies of this species due to its highly fragmented and restricted range, which limits the ability of pollinators to find and transport pollen between genetically distinct individuals. For these reasons, we anticipate adverse, species-level effects in the form of moderate loss of reproductive success from pollinator mortality due to carbaryl exposure that would be expected to occur over the duration of the 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 Lakela's mint. **References:**

Kern, M., S. Kay, D. Christian, and E. Tandy. 2024. Methomyl Effects Assessment of the Lakela's Mint (*Dicerandra immaculata*) for Risk Management of Methomyl Agricultural Uses. Tessenderlo Kerley, Inc. TKI-2024-EAM-071. 41 pp.

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology 83(11): 3060-3072.

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented *Magnolia stellate* populations. BMC Ecology 13:10.

Spira, T. P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal 21(1): 78-88.

U.S. Fish and Wildlife Service. 2021. Lakela's mint (*Dicerandra immaculata*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 24 pp.

Rationale for Species Conclusion: Black lace cactus

Scientific Name:	Common Name:	Entity ID:
Echinocereus reichenbachii var. albertii	Black lace cactus	702

Conclusion

The black lace cactus is endangered and endemic to three populations across south Texas, none of which is on protected lands. They are found in or near dense brush habitat on flat coastal plains. Black lace cacti flower between March and July. The Kleberg County population was last counted in 2002 when there were an estimated 824 individuals; an anecdotal note from 2006 suggested the population may include only dozens of individuals, but an official survey was not conducted. The Jim Wells County population was last surveyed in 1989 when the population was estimated to include 16,000 individuals across two subpopulations. The Refugio County population was last surveyed in 2004 when there were an estimated 1,527 individuals. These three populations occur on private land. The Kleberg and Refugio populations are believed to be declining and the Jim Wells population has not been surveyed recently. In 2014, a population of 1,800-2,000 individuals was discovered along San Miguel Creek in northern McMullen County, a smaller population in McMullen County was removed (i.e., translocated to the larger McMullen population and donated to the South Texas Botanical Gardens and Nature Center) to avoid being destroyed by a mining operation, and another with several hundred individuals was discovered in nearby Atascosa County. Though propagation efforts have been largely unsuccessful, several seeds were sent to Germany where they have been propagated, flowered, and produced several thousand seeds (USFWS 2019). Across the species' range, habitat is fragmented due to large areas being converted to row crop agriculture and/or planted to pasture using non-native invasive grasses. In addition to fragmentation and habitat loss, threats to this species include brush clearing, rooting and displacement of cacti by feral hogs and cattle, competition with non-native grasses, mound-building activities by non-native fire ants, fire, and insecticide use. Efforts to eradicate ants using pesticides may have unknown consequences for cactus pollinators and was identified for further study (USFWS 2009). Additional threats include effects of small population sizes, effects of climate change, and parasitism by an unidentified moth and *Chelinidea vittiger*, a leaf-footed bug (USFWS 2019). We consider the black lace cactus to have high vulnerability.

The black lace cactus relies on a variety of insect pollinators, including bumble bees, ants, wasps, beetles, and small bees. Like all species in this appendix, the black lace cactus relies on pollen transfer between individual plants for successful reproduction and therefore needs sufficient pollinator populations within its range (USFWS 2009, 2019). Remaining habitat is highly fragmented, but the species' pollinators are believed to be able to traverse large areas (i.e., at least several hundred meters up to a few kilometers) (USFWS 2019). In the 2009 5-Year Review, we mentioned that drift of broad-spectrum insecticides used on nearby cotton fields may cause mortality of the pollinators and seed dispersers (i.e., bees and ants) needed by black lace cacti (USFWS 2009).

Black lace cacti may require ants for seed dispersal; in the 2019 recovery plan amendment, we mentioned that the spiny fruits did not attract birds or mammals and remained attached to stems until they ripened, split open, and ants carried the seeds into their refuse mounds (USFWS 2019). There may also be some abiotic seed dispersal, but this was not mentioned in the recovery plan amendment.

The black lace cactus has a large percent overlap (25.3%) between the agricultural uses of carbaryl and its range, and past usage data indicate that up to 15.2% of the species' range has been treated with carbaryl annually from agricultural uses. The species is not expected to occur in non-agricultural use sites and therefore we expect most exposure will occur from agricultural uses. As such, we determined the species has high agricultural exposure resulting in a large loss of insect pollinators within the range and resultant loss of reproductive success of the black lace cactus. The black lace cactus also has high toxicity because it primarily uses insect vectors (ants) for its seed dispersal and relies on insects for pollination (such as bees, beetles, wasps, and ants).

We anticipate high adverse effects to the species due to the reduction in pollinating and seed dispersal insects that would result in reduced reproductive success. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators and ant seed dispersers for reproduction. A large loss of insects within a significant portion of its range is likely to exacerbate existing reproductive deficiencies of this species due to its highly fragmented and restricted range and mostly unsuccessful propagation efforts. For these reasons, we anticipate adverse, species-level effects in the form of a large loss of reproductive success from pollinator mortality due to carbaryl exposure that would be expected to occur over the duration of the 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 black lace cactus. **References:**

U.S. Fish and Wildlife Service. 2019. Recovery Plan Amendments for Eleven Southwest Species. Albuquerque, New Mexico. 19 pp.

U.S. Fish and Wildlife Service. 2009. Black lace cactus (*Echinocereus reichenbachii* var. *albertii*) 5-Year Review: Summary and Evaluation. Corpus Christi, Texas. 32 pp.

Rationale for Species Conclusion: Scrub blazingstar

Scientific Name:	Common Name:	Entity ID:
Liatris ohlingerae	Scrub blazingstar	752

Conclusion

Scrub blazingstar is a long-lived, deciduous perennial herb endemic to the Lake Wales Ridge region of central and northern Florida. It is listed as endangered and occurs in rosemary scrub and scrubby flatwoods. It thrives in lightly shaded areas and relies on fire to prevent woody vegetation encroachment. Scrub blazingstar occurs in 45 extant populations, a decline from 91 occurrences in the 2010 5-Year Review. Some of the extant locations are now considered one population due to new occurrences being discovered between other populations (USFWS 2021). Forty-five of these occurrences are in managed areas. The primary threat is habitat destruction and fragmentation from high rates of development. The limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of the species (USFWS 2019). In addition, rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lennartson 2002, Lienert 2004, Spira 2001, Setsuko et al. 2013).

After fire, scrub blazingstar relies on resprouting from their corm (i.e., belowground storage organ), though resprouting rates (47%) are low compared to other Florida scrub plants (USFWS 2021). The species is self-incompatible and relies on insects for pollination meaning they require pollen transfer between individual plants to reproduce successfully. Their primary pollinators are believed to be butterflies, especially skippers (Hesperiidae), though other insects may pollinate them as well. Seeds disperse short distances via wind, with bristles and hairs that assist in "planting" seeds correctly for germination. The species exhibits high survival rates among germinated seeds (USFWS 1999), but seedling recruitment rates are low (0.02% annually) for unknown reasons. As of 2021, scrub blazingstar was not showing signs of in-breeding, but the species may be sensitive to inbreeding from decreasing population sizes and pollinator-mediated gene flow (USFWS 2021).

The overlap of carbaryl agricultural use sites with the species range is 25.6% and past usage data indicate that up to 12.1% of the species' range has been treated with carbaryl annually from agricultural uses. Citrus is a registered use for carbaryl, and much of the range overlaps with or is adjacent to rangelands and citrus agricultural lands (Kern et al. 2022). It is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside of the Western U.S. Thus, most exposure is anticipated from agricultural uses of carbaryl and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects that is likely to occur from this exposure.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators. A significant loss of pollinators within potentially a quarter of its range is likely to exacerbate existing reproductive deficiencies due to habitat loss and fragmentation and low seedling recruitment. We anticipate adverse reproductive, species-level effects due to the carbaryl exposure and resultant pollinator loss that is expected to occur over the duration of the 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 scrub blazing star. **References:**

Kern, M., S. Kay, D. Christian, and E. Tandy. 2022. Carbaryl Effects Assessment of Wireweed (*Polygonella basiramia*) for Risk Management of Carbaryl Agricultural and Rangeland Uses. Tessenderlo Kerley, Inc. 2022-ENV-004. 38 pp.

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology 83(11): 3060-3072.

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented Magnolia stellate populations. BMC Ecology 13:10.

Spira, T. P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal 21(1): 78-88.

U.S. Fish and Wildlife Service. 2021. Scrub blazing star (*Liatris ohlingerae*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 26 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for *Conradina brevifolia* (short-leaved rosemary), Crotalaria avonensis (Avon Park harebells), *Dicerandra christmanii* (Garrett's mint), *Dicerandra frutescens* (scrub mint), *Eryngium cuneifolium* (snakeroot), *Hypericum cumulicola* (Highlands scrub hypericum*), Liatris ohlingerae* (scrub blazing star), *Polygala lewtonii* (Lewton's polygala), *Polygonella basiramia* (wireweed), *Polygonella myriophylla* (sandlace), *Warea carteri* (Carter's mustard), and *Ziziphus celata* (Florida ziziphus). Vero Beach, Florida. 23 pp.

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

Rationale for Species Conclusion: Wireweed

Scientific Name:	Common Name:	Entity ID:
Polygonella basiramia	Wireweed	804

Conclusion

Wireweed is a short-lived, herbaceous, perennial plant endemic to the Lake Wales Ridge region of central and northern Florida. They occur in rosemary scrub or scrubby flatwoods where they prefer canopy gaps and bare sand microhabitats. Wireweed declined from 119 occurrences in the 2010 5-Year Review to 69 in 2021, some of which is attributed to changes in Florida Natural Areas Inventory definitions. Forty-four occurrences (64%) are protected and managed. Population sizes vary annually and seasonally, and the species responds well to prescribed fires in its habitat (USFWS 2023). The primary threat is habitat destruction and fragmentation from high rates of development. The limited geographic range of these species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of the Lake Wales Ridge species (USFWS 2019). In addition, rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lennartson 2002, Lienert 2004, Spira 2001, Setsuko et al. 2013).

Wireweed is dioecious (i.e., there are separate male and female plants) and both males and females produce seeds. A high percentage of seeds germinate immediately after production, leaving few seeds in a seed bank. The species is believed to be dispersed through abiotic means, and dispersal is necessary from outside burn areas for recolonization after fire, which may take several years. Wireweed relies on insects for pollination, and like all the species in this assessment group, they require pollen transfer between individual plants to reproduce successfully. This is particularly important for a dioecious species where pollen must be transported between separate male and female plants for reproduction. Known pollinators include halictid bees, *Perdita polygonellae*, Eumenidae wasps, and potentially *Glabellula* spp (USFWS 1999).

The overlap of carbaryl agricultural use sites with the species range is 25.6% and past usage data indicate that up to 12.1% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of some agricultural UDLs and potentially suitable habitat for the wireweed provided for carbaryl, agricultural (primarily citrus) land uses and rangeland occur near or on habitat for the species (Kern et al. 2022). It is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside of the Western U.S. Thus, most exposure is anticipated from agricultural uses of carbaryl and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects that is likely to occur from this exposure.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators. A significant loss of pollinators within potentially a quarter of its range is likely to exacerbate existing reproductive deficiencies. We anticipate adverse, species-level reproductive effects due to the carbaryl exposure and resultant pollinator loss that is expected to occur over the duration of the 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 wireweed.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2022. Carbaryl Effects Assessment of Wireweed (*Polygonella basiramia*) for Risk Management of Carbaryl Agricultural and Rangeland Uses. Tessenderlo Kerley, Inc. 2022-ENV-004. 38 pp.

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology 83(11): 3060-3072.

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented Magnolia stellate populations. BMC Ecology 13:10.

Spira, T. P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal 21(1): 78-88.

U.S. Fish and Wildlife Service. 2021. Wireweed (*Polygonella basiramia*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 21 pp.

2019. Recovery Plan for *Conradina brevifolia* (short-leaved rosemary), Crotalaria avonensis (Avon Park harebells), *Dicerandra christmanii* (Garrett's mint), *Dicerandra frutescens* (scrub mint), *Eryngium cuneifolium* (snakeroot), *Hypericum cumulicola* (Highlands scrub hypericum*), Liatris ohlingerae* (scrub blazing star), *Polygala lewtonii* (Lewton's polygala), *Polygonella basiramia* (wireweed), *Polygonella myriophylla* (sandlace), *Warea carteri* (Carter's mustard), and *Ziziphus celata* (Florida ziziphus). Vero Beach, Florida. 23 pp.

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

Rationale for Species Conclusion: Sandlace

Scientific Name:	Common Name:	Entity ID:
Polygonella myriophylla	Sandlace	805

Conclusion

Sandlace is a sprawling, clonal shrub that occurs in open sand gaps of yellow sand scrub or sandhill habitat. It is a narrow endemic found in and around the Lake Wales Ridge region of central and northern Florida. They are slow-growing and long-lived. Sandlace declined from 113 occurrences in 2010 to 72 in 2015, 39 of which are on protected lands (USFWS 2019). The species is protected at about half (32 of 58) of the extant occurrences through state forests, state parks, county parks, and conservation easements (USFWS 2021). The primary threat is habitat destruction and fragmentation from high rates of development. The limited geographic range of these species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of the Lake Wales Ridge species (USFWS 2019). In addition, rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lennartson 2002, Lienert 2004, Spira 2001, Setsuko et al. 2013).

Sandlace reproduces sexually through pollination and vegetatively through rooting of prostrate branches. We do not know if sandlace is self-compatible. Potential pollinators include insects from the orders Hymenoptera, Diptera, and Lepidoptera, including halictic bees (*Perdita polygonellae*), possibly Eumenidae wasps, *Glagellula* spp, shore flies (*Allotrichoma abdominalis*), and hairstreak butterflies (*Hemiargus ceraunus*). Floral visitors are not necessarily pollinators, and sandlace also reproduces by suckering and/or adventitious rooting of decumbent stems. Due to allelopathic effects of this species, seedlings do not survive near mature plants (USFWS 1999, 2021). The species has shown extremely low germination rates, seed production, and seedling survival. Seedling recruitment was observed in mechanically disturbed and burned areas and was rare on undisturbed sites. Seeds are primarily dispersed through gravity (USFWS 2021).

The overlap of carbaryl agricultural use sites with the species range is 17.1% and past usage data indicate that up to 7.79% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of agricultural UDLs and potentially suitable habitat provided for a similar species (wireweed) for carbaryl, both rangelands and citrus agricultural land uses are common throughout the species' range and potentially suitable habitat (Kern et al. 2022). It is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside of the Western U.S. Thus, most exposure is anticipated from agricultural uses of carbaryl and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects that is likely to occur from this exposure.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators. A significant loss of pollinators within a large portion of its range is likely to exacerbate existing reproductive deficiencies due to habitat loss, low germination, and seedling recruitment. We anticipate adverse, species-level reproductive effects due to the carbaryl exposure and resultant pollinator loss that is expected to occur over the duration of the 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 sandlace.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2022. Carbaryl Effects Assessment of Wireweed (*Polygonella basiramia*) for Risk Management of Carbaryl Agricultural and Rangeland Uses. Tessenderlo Kerley, Inc. 2022-ENV-004. 38 pp.

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology 83(11): 3060-3072.

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented Magnolia stellate populations. BMC Ecology 13:10.

Spira, T. P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal 21(1): 78-88.

U.S. Fish and Wildlife Service. 2021. Sandlace (*Polygonella myriophylla*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 20 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for *Conradina brevifolia* (short-leaved rosemary), Crotalaria avonensis (Avon Park harebells), *Dicerandra christmanii* (Garrett's mint), *Dicerandra frutescens* (scrub mint), *Eryngium cuneifolium* (snakeroot), *Hypericum cumulicola* (Highlands scrub hypericum*), Liatris ohlingerae* (scrub blazing star), *Polygala lewtonii* (Lewton's polygala), *Polygonella basiramia* (wireweed), *Polygonella myriophylla* (sandlace), *Warea carteri* (Carter's mustard), and *Ziziphus celata* (Florida ziziphus). Vero Beach, Florida. 23 pp.

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

Rationale for Species Conclusion: Scrub plum

Scientific Name:	Common Name:	Entity ID:
Prunus geniculata	Scrub plum	809

Conclusion

Scrub plum is a long-lived shrub endemic to the Lake Wales Ridge, a narrow ridge of ancient sand dunes that runs down the central peninsula of Florida and harbors a large diversity of endemic plants and animals. It occurs in high pine and oak scrub communities across five counties and is listed as endangered. There are 64 extant occurrences (out of 98 documented with 18 historical and 11 extirpated), 40 of which are on conservation lands. Many occurrences have not been surveyed in decades, especially the 24 on private lands. Only 12 populations have been observed since 2013 (USFWS 2023). Most individual scrub plum plants occur on protected lands, including the Lake Wales Ridge National Wildlife Refuge and Lake Wales Ridge Environmental Area. Threats include development (on private lands), which causes fragmentation and destruction of their already limited habitat, and fire suppression (on private and public lands) (USFWS 2023).

Bees, and potentially other insects, are the primary pollinators. Scrub plums require pollen transfer between individual plants to reproduce successfully. Seeds are believed to be dispersed by birds and possible mammals. Few seedlings have been found in the wild, and there is concern that the scrub plum is not successfully reproducing at least in part due to seed predation (USFWS 1999). Scrub plums also experience low seed germination and low seedling recruitment (USFWS 2023).

The overlap of carbaryl agricultural use sites with the species range is 41.7% and past usage data indicate that up to 41.7% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of agricultural UDLs and potentially suitable habitat provided for a similar species (wireweed) for carbaryl, both rangelands and citrus agricultural land uses are common throughout the species' range and potentially suitable habitat (Kern et al. 2022). It is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside of the Western U.S. Thus, most exposure is anticipated from agricultural uses of carbaryl and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects that is likely to occur from this exposure.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators, particularly bees. A significant loss of pollinators within potentially nearly half of its range is likely to exacerbate existing reproductive deficiencies due to habitat loss and low seed germination. We anticipate adverse, species-level reproductive effects from pollinator loss due to carbaryl exposure that would be expected to occur over the duration of the 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 scrub plum.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2022. Carbaryl Effects Assessment of Wireweed (*Polygonella basiramia*) for Risk Management of Carbaryl Agricultural and Rangeland Uses. Tessenderlo Kerley, Inc. 2022-ENV-004. 38 pp.

U.S. Fish and Wildlife Service. 2023. Scrub Plum (*Prunus geniculata*) -Year Status Review: Summary and Evaluation. Gainesville, Florida. 12 pp.

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

Rationale for Species Conclusion: Sensitive joint-vetch

Scientific Name:	Common Name:	Entity ID:
Aeschynomene virginica	Sensitive joint-vetch	875

Conclusion

The sensitive joint-vetch is a threatened annual legume native to the eastern U.S. It is found in tidal marshes, ditches, and agricultural fields. Populations currently exist in Maryland, New Jersey, North Carolina, and Virginia. It has been extirpated from Delaware and Pennsylvania since the 1800s. Annual population numbers are highly variable, and minimum numbers of plants counted annually between 1991-2010 fluctuated between 1,580-24,073. Plants likely occur in fewer locations than in 1991, but population trends are unknown. Sensitive joint-vetch is threatened by invasive marsh plants (e.g., *Phragmites australis*), changes in hydrology (e.g., water withdrawals), herbicide use, right of way mowing, habitat modification (e.g., dredging), development, non-native insect predators, and effects from climate change (e.g., sea level rise, changes to precipitation patterns, storms) (USFWS 2013).

In greenhouses, 13% of sensitive joint-vetch self-pollinated, but outcrossing also occurred and morphological and biological features typical of asexual reproduction were not observed for this plant. Bumble bees have been observed on sensitive joint-vetch, suggesting they are pollinators. Other pollinators are unknown. Fruits and flowers are produced between July and October, and seeds mature between August and October (USFWS 1995). Their seeds fall to the ground, many within 0.5 m of the parent plant. Most plants grow farther than 1.25 m from a stream edge, but 10% are within 0.5 m of a stream (33% are within 1 m of a stream), and many seeds that fall into water are transported away. Some seeds are transported for over 80 hours in water. About 60% of seeds are lost during the winter, either disappearing or becoming unviable by spring; therefore, the species is believed to have a small but persistent seed bank (USFWS 2013).

The sensitive joint-vetch has a high percent overlap (21.2%) between carbaryl agricultural use sites and its range and past usage data indicate that up to 10.5% of the species' range has been treated with carbaryl annually from agricultural uses. The species can occasionally be found in roadside ditches, meaning there may be some additional exposure from carbaryl use on roadside right of ways. However, because less than 500 pounds of carbaryl is applied annually to roadways nationally, we expect use within the species range is likely to be minimal. As such, we expect most exposure to occur from agricultural uses for this species. Thus, most exposure is anticipated from agricultural uses of carbaryl and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects that is likely to occur from this exposure.
. In addition, the species has high toxicity because it uses insects (i.e., bumble bees) for pollination that would be killed by carbaryl exposure. Sensitive joint-vetch relies on abiotic means for seed dispersal. Because the species relies on pollinators, is known to occur on and near agricultural fields, and we anticipate high carbaryl use to occur on the range, we expect adverse reproductive effects to the species from losses of insect pollinators to cause adverse species-level

reproductive 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 sensitive joint-vetch.

References:

U.S. Fish and Wildlife Service. 2013. Sensitive joint-vetch (*Aeschynomene virginica*) 5-Year Review: Summary and Evaluation. Gloucester, Virginia. 46 pp.

U.S. Fish and Wildlife Service. 1995. Sensitive joint-vetch (*Aeschynomene virginica*) Recovery Plan. White Marsh, Virginia. 60 pp.

Rationale for Species Conclusion: Decurrent false aster

Scientific Name:	Common Name:	Entity ID:
Boltonia decurrens	Decurrent false aster	891

Conclusion

The decurrent false aster is endemic to the banks and shores of the Illinois River System. It is a floodplain, moist-soil species dependent on seasonal (spring) floods to reduce competition with other species and disperse seeds. Since 1984, the species has been known from 68 sites in the Illinois River, Mississippi River, and southeastern Missouri and up to 78% of them are believed to be extant. The four isolated locations from Missouri have not been surveyed recently. Abundance trends are unknown and the number of plants at one site varies drastically. Primary threats include destruction or conversion of habitat to cropland, prolonged and late season flooding, herbicide use, and habitat loss from woody vegetation encroachment (USFWS 2020).

Decurrent false asters reproduce both vegetatively by producing basal shoots and sexually. The Illinois Department of Conservation monitored four populations and did not observe sexual reproduction in dense weedy areas. However, they found that vegetative regeneration ceased after 4-5 years (USFWS 1990). We assume insects are the primary pollinators given insect pollination is common in related species and that individuals require pollen transfer to reproduce successfully.

The overlap of carbaryl agricultural use sites with the species range is 67.3% and past usage data indicate that up to 17% of the species' range has been treated with carbaryl annually from agricultural uses. The species is not expected to occur in non-agricultural use sites and therefore we expect most exposure will occur from agricultural uses. Given the high overlap and usage from agricultural sites, we anticipate adverse effects to the species' reproduction due to the large reduction in pollinating insects exposed to carbaryl in a large portion of the range.

The species is a narrow endemic whose reproductive success is presumed to be dependent upon the presence of insect pollinators. A significant loss of pollinators within potentially more than half of its range is likely to exacerbate existing reproductive deficiencies. We anticipate adverse, species-level reproductive effects from pollinator loss due to carbaryl exposure that would be expected to occur over the duration of the 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 decurrent false aster.

References:

U.S. Fish and Wildlife Service. 2020. 5-Year Review Decurrent False Aster (Boltonia decurrens). Moline, Illinois. 14 pp.

U.S. Fish and Wildlife Service. 1990. Decurrent False Aster (Boltonia decurrens) Recovery Plan. Twin Cities, Minnesota. 31 pp.

Rationale for Species Conclusion: Pitcher's thistle

Scientific Name:	Common Name:	Entity ID:
Cirsium pitcheri	Pitcher's thistle	905

Conclusion

This distinctive dune plant, often referred to as dune thistle, is one of many rare or declining species inhabiting dunes of the Great Lakes region. Pitcher's thistle is endemic to the unforested dune systems of the western Great Lakes and requires active sand dune processes to maintain its early successional habitat. Pitcher's thistle is vulnerable to habitat loss from human development, recreation, climate change, and by erosion when lake levels are high. Its survival is also threatened by invasive non-native plants and insects. In addition, studies have consistently found low levels of genetic diversity, indicative of widespread isolation, resulting in loss of genetic variation. The low levels of genetic variation observed are likely due to small population sizes. There is no mention of pollinator loss or pesticides as threats to the species (USFWS 2023). However, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lienert 2004; Spira. 2001; Lennartson 2002; Setsuko et al. 2013). There are a total of 222 known occurrences or Pitcher's thistle: 182 in Michigan, 24 in Indiana, eleven in Wisconsin, and five in Illinois. Over the last ten years, this species has remained stable in Michigan, stable to slightly increased in Canada, declined >50% in Indiana, and stable to declined <25% in Wisconsin. The highest ranked occurrences are on large, intact, active dunes (USFWS 2023).

Pitcher's thistle relies on healthy pollinating insect communities for pollination, and like all species in this appendix, they require pollen transfer between individual plants to reproduce successfully. In one study, observers found 14 insect families visiting Pitcher's thistle plants. Of the observed families, only Apidae (bees) counts were significantly correlated with subsequent year seedling counts, indicating that Apidae species may be disproportionally valuable to Pitcher's thistle compared to other pollinator species (USFWS 2023). Seed dispersal is accomplished mainly by wind. As such, we do not anticipate adverse effects to reproduction from loss of seed dispersers (USFWS 2002).

The overlap of carbaryl agricultural use sites with the species range is 52.9% and past usage data indicate that up to 19.9% of the species' range has been treated with carbaryl annually from agricultural uses. The species is occasionally found along roads and rights of way, meaning there may be some additional exposure from carbaryl use in these areas (USFWS 2002). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in rights of way within the species' ranges, we expect no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the Pitcher's thistle. As such, we expect most exposure to occur from agricultural uses for this species. Because of the high agricultural overlap and usage, we

anticipate significant adverse effects to the species in the form of reduced reproductive success due to the reduction in pollinating insects that is likely to occur from this exposure.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators, particularly bees. A significant loss of pollinators within a large portion of its range is likely to exacerbate existing reproductive deficiencies due to habitat fragmentation and low genetic diversity, making it even more difficult for a diminished pollinator community to find and transport pollen between genetically distinct individuals. We anticipate adverse, species-level reproductive effects due to the carbaryl exposure and resultant pollinator loss that is expected to occur over the duration of the 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 Pitcher's thistle.

References:

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology, 83(11), 3060-3072.

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented *Magnolia stellate* populations. BMC Ecology 13:10.

Spira, T. P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal, 21(1), 78-88.

U.S. Fish and Wildlife Service. 2002. Pitcher's thistle (*Cirsium pitcheri)* Recovery Plan. Fort Snelling, Minnesota. 103 pp.

U.S. Fish and Wildlife Service. 2023. Pitcher's thistle (*Cirsium pitcheri*) 5-Year Review: Summary and Evaluation. East Lansing, Michigan. 16 pp.

Rationale for Species Conclusion: Scrub buckwheat

Scientific Name:	Common Name:	Entity ID:
Eriogonum longifolium var. *gnaphalifolium*	Scrub buckwheat	929

Conclusion

Scrub buckwheat is a long-lived herbaceous perennial endemic to the Lake Wales Ridge, a narrow ridge of ancient sand dunes that runs down the central peninsula of Florida and harbors a large diversity of endemic plants and animals. It occurs in high pine and turkey oak barrens across five counties and is listed as threatened. There are 67 extant populations of scrub buckwheat, 46 of which occur on conservation lands. Primary threats to scrub buckwheat include development (on private lands), which causes fragmentation and destruction of their already limited habitat, and fire suppression (on managed lands) (USFWS 2023).

We believe insects are the primary pollinators for scrub buckwheat, and they require pollen transfer between individual plants to reproduce successfully. Three species of Hymenoptera (wasps) have been observed visiting flowers, but it is unknown if they are pollinators (USFWS 1999). Specific seed dispersal mechanisms are unknown, though the plant may use biotic (potentially insects, birds, and/or mammals) and abiotic (wind) dispersal vectors. Scrub buckwheat does not appear to have a long-term persistent seed bank (USFWS 2023). Mature plants can persist for long periods in fire suppressed conditions, but flowering and seedling recruitment decline rapidly 2-3 years following fire (USFWS 2018).

The overlap of carbaryl agricultural use sites with the species range is 25.3% and past usage data indicate that up to 25.3% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of some agricultural UDLs and potentially suitable habitat for the species, agricultural (primarily citrus) land uses and rangeland occur near or on habitat for the species (Kern et al. 2022). It is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside of the Western U.S. Thus, most exposure is anticipated from agricultural uses of carbaryl, and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects from the high levels of agricultural usage that is likely to occur.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction. A significant loss of pollinators within potentially a quarter of its range is likely to exacerbate existing reproductive deficiencies due to habitat loss and effects of fire suppression (i.e., low flowering and seedling recruitment). We anticipate adverse, species-level reproductive effects from pollinator loss due to carbaryl exposure that would be expected to occur over the duration of the 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 scrub buckwheat.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2022. Carbaryl Effects Assessment of Wireweed (*Polygonella basiramia*) for Risk Management of Carbaryl Agricultural and Rangeland Uses. Tessenderlo Kerley, Inc. 2022-ENV-004. 38 pp.

U.S. Fish and Wildlife Service. 2023. Scrub Buckwheat (*Eriogonum longifolium* var. *gnaphalifolium*) Status Review: Summary and Evaluation. Gainesville, Florida. 13 pp.

U.S. Fish and Wildlife Service. 2018. Scrub Buckwheat (*Eriogonum longifolium* var. *gnaphalifolium*) Status Review: Summary and Evaluation. Jacksonville, Florida. 22 pp.

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

Rationale for Species Conclusion: Rough-leaved loosestrife

Scientific Name:	Common Name:	Entity ID:
Lysimachia asperulaefolia	Rough-leaved loosestrife	967

Conclusion

Rough-leaf loosestrife is a perennial herb endemic to the coastal plain and sandhills of southeastern North and South Carolina in widely scattered population clusters. There are currently ten metapopulations and portions of all ten are publicly owned or in conservation ownership. Species management plans are in place for five of the ten metapopulations and protect these populations from threats such as commercial and residential development. Plans are under development or consideration for the remaining five metapopulations. Additional threats include fire suppression and ecological succession remain significant. Preliminary population viability analysis results indicate that two metapopulations are increasing, two are stable, five are declining, and one has unknown trends due to lack of monitoring (USFWS 2021).

The rough-leaved loosestrife is pollinated by solitary bees, mainly of the genus *Dialictus*. Pollinators were found to be scarce and inefficient (USFWS 1995). Seed production of the rough-leaved loosestrife is low because populations are highly fragmented, reducing the chances of cross pollination (outcrossing) by the few pollinators that are present. Because flowers are self-incompatible (i.e., cannot self-fertilize) and there appear to be few pollinators available, there is generally low seed production. Low seed production within populations supports the conclusion that populations contain little to no genetic diversity. This may be the biological factor most likely to limit the species' ability to colonize new habitat and adapt to changes in the environment (USFWS 2021).

The rough-leaved loosestrife requires pollen transfer between individual plants to reproduce successfully over time, and therefore relies on healthy pollinator communities within its range. It can also reproduce using vegetative rhizomes.

This species has a large percent overlap (29.1%) between carbaryl agricultural uses and its range and past usage data indicate that up to 13.6% of the species' range has been treated with carbaryl annually from agricultural uses. The species is found in disturbed sites such as roadside depressions, powerline rights of way, and firebreaks, meaning there may be some additional exposure from carbaryl use on these sites (USFWS 2021). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in rights of way within the species' ranges, we expect no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the rough-leaved loosestrife. As such, we expect most exposure to occur from agricultural uses for this species. The rough-leaved loosestrife also has high toxicity as it requires specific solitary bees in the genus *Dialictus* for pollination and has a pre-existing deficiency in its pollinator community. As such, a large loss of the pollinator community from carbaryl exposure from

agricultural use sites is likely to exacerbate the pre-existing deficit of pollinators for this plant species.

Little is known about seed dispersal vectors, but other species in the *Lysimachia* genus disperse seeds through a variety of methods, including wind, water, and animals. The 2021 5-year review suggests dispersal may occur primarily through rhizomes thus, we anticipate minimal to no effects to reproduction through seed disperser loss (USFWS 2021).

We anticipate adverse effects to the species' reproduction due to the reduction in pollinating insects that is likely to occur from carbaryl exposure in a substantial portion of the range. We anticipate these adverse effects will cause species-level reproductive effects due to the anticipated loss of the species' already rare pollinator community, the species' primary dependence on one genus of pollinators, and the isolated and fragmented nature of populations. 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 rough-leaved loosestrife.

References:

U.S. Fish and Wildlife Service. 2021. Rough-leaved loosestrife (*Lysimachia asperulaefolia*) 5-year Review, Summary and Evaluation. Raleigh, North Carolina. 42 pp.

U.S. Fish and Wildlife Service. 1995. Recovery Plan for Rough-leaved loosestrife (*Lysimachia asperulaefolia).* Atlanta, Georgia. 37 pp.

Rationale for Species Conclusion: Fassett's locoweed

Scientific Name:	Common Name:	Entity ID:
Oxytropis campestris var. *chartacea*	Fassett's locoweed	977

Conclusion

Fassett's locoweed is a perennial legume endemic to three counties in Wisconsin: Portage, Waushara, and Bayfield. It primarily grows on sandy shorelines of shallow seepage lakes with highly fluctuating water levels. Water is a major driver of population size, which can vary dramatically depending in precipitation and local water use. They occur at up to nine sites, many of which experienced a water submersion event between 2017-2020. Though adults do not survive submersion, seeds in the seed bank may germinate once the water recedes. Seven of nine occupied sites are fully or partially protected, and landowners of remaining occupied habitat have provided some protections. All populations are believed to have declined since 2017 due to rises in water levels, among other threats. Primary threats to Fassett's locoweed include human use and shoreline development, livestock grazing, high water levels, duration of flooding, and invasive species. Though threats of development have been greatly reduced since listing, the threat has not been eliminated. (USFWS 2022). Agricultural pesticide use is noted as a concern for this species, particularly herbicides (USFWS 1991, USFWS 2009).

Fassett's locoweed appears reliant on seeds, and there is no evidence of vegetative reproduction. We believe insects are the primary pollinators for Fassett's locoweed, and they require pollen transfer between individual plants to reproduce successfully. A small, leaf-cutting bee (*Megachile melanophoea*) was seen foraging on the flowers and larger bees (*Bombus* spp.) have been observed visiting flowers. The change in petal color from purple to red as an individual flower ages may signal the level of receptivity to a potential pollinator (USFWS 1991). We believe a healthy pollinator population, mostly of bees, is important for this species (USFWS 2009). It relies on an extensive seed bank to recover from population crashes, and seed germination is much higher when seed coats have been cut or abrased (USFWS 2022). Seeds are small and have no evident adaptation for dispersal, suggesting they may disperse in a clumped manner around the parent plant. They may also disperse short distance by wind, rain, or lake water during periods of inundation. In an experiment, seeds were more likely to germinate if they were scarred. Seedling survival was very low, particularly due to fungal infections, and may require rhizobial bacteria to be successful (USFWS 1991).

The overlap of carbaryl agricultural use sites with the species range is 34.7% and past usage data indicate that up to 27.2% of the species' range has been treated with carbaryl annually from agricultural uses. The species is not expected to occur in non-agricultural use sites and therefore we expect most exposure will occur from agricultural uses. Due to the high agricultural overlap and usage, we anticipate adverse effects to the species' reproduction due to the large reduction in pollinating insects that are exposed to carbaryl.

The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction. A significant loss of pollinators within a large portion of its range is likely to exacerbate existing reproductive deficiencies due to low seedling survival and limited dispersal capabilities. We anticipate adverse, species-level reproductive effects from pollinator loss due to carbaryl exposure that would be expected to occur over the duration of the 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 Fassett's locoweed.

References:

U.S. Fish and Wildlife Service. 2022. Fassett's Locoweed (*Oxytropis campestris* var. *chartacea*) Status Review: Summary and Evaluation. Bloomington, Minnesota. 16 pp.

U.S. Fish and Wildlife Service. 2009. Fassett's Locoweed (*Oxytropis campestris* var. *chartacea*) Status Review: Summary and Evaluation. New Franken, Wisconsin. 29 pp.

U.S. Fish and Wildlife Service. 1991. Fassett's Locoweed Recovery Plan. Madison, Wisconsin. 51 pp.

Rationale for Species Conclusion: Eastern prairie fringed orchid

Scientific Name:	Common Name:	Entity ID:
Platanthera leucophaea	Eastern prairie fringed orchid	984

Conclusion

The eastern prairie fringed orchid is threatened and found in Illinois, Indiana, Iowa, Maine, Michigan, Missouri, Ohio, Virginia, and Wisconsin. Historically, it also occurred in New York, New Jersey, Pennsylvania, and Oklahoma. It is found in tallgrass silt-loam or sand prairies, sedge meadows, fens, and occasionally sphagnum bogs. Long-term population maintenance requires reproduction from seed, which is accomplished with hawkmoth (*Eumorpha pandorus*, *Eumorpha achemon*, and *Sphinx eremitis*) pollination. Other moth species may also pollinate eastern prairie fringed orchids. Reproduction by vegetative spread is rare. Thousands of lightweight seeds are then dispersed by the wind, and they rely on mycorrhizal fungi for seedling establishment. (USFWS 1999). There are 96 potentially extant populations across the range and over half of them are categorized with low viability. A few populations have been discovered recently due to increase in awareness and survey effort and they are not believed to be new populations. Outplantings occurred at Nachusa Grasslands, Illinois in 2020 from in vitro symbiotic seed germination. Threats include habitat loss and degradation from development, spread of exotic species, woody vegetation encroachment, and fire suppression (USFWS 2020). We mentioned that increasing pesticide use may impact both pollinators and fungi in the 1999 recovery plan (USFWS 1999).

Eastern prairie fringed orchids require moths for pollination and mycorrhizal fungi for seed establishment; seeds are dispersed abiotically by wind. Much of the species' range overlaps with carbaryl agricultural use sites (84.4%) and the past usage data indicate that up to 21.8% of the species' range has been treated with carbaryl annually from agricultural uses. The species can occasionally be found in abandoned railroad rights of way that are not maintained and therefore unlikely to be treated with carbaryl. Otherwise, we do not expect the species to occur on non-agricultural carbaryl use sites (USFWS 2021). Given past usage data and the high percent overlap of carbaryl agricultural use sites, we determined the species has high agricultural exposure that will lead to a large loss of the pollinator community and large resultant adverse reproductive effects to the species. The eastern prairie fringed orchid has high toxicity because it uses specialized biotic vectors for its pollination (i.e., hawkmoths).

We anticipate adverse effects to the species due to the reduction in pollinating insects that would result in reduced reproductive success. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators. A large loss of insects within its range is likely to exacerbate existing reproductive deficiencies of this species due to its highly fragmented and restricted range. We anticipate adverse, species-level reproductive effects due to the carbaryl exposure and resultant pollinator loss that is expected to occur over the duration of the 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 eastern prairie fringed orchid.

References:

U.S. Fish and Wildlife Service. 1999. Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) Recovery Plan. Fort Snelling, Minnesota. 63 pp.

U.S. Fish and Wildlife Service. 2020. 5-Year Review Eastern Prairie Fringed Orchid (*Platanthera leucophaea*). Chicago, Illinois. 20 pp.

Rationale for Species Conclusion: Wide-leaf warea

Scientific Name:	Common Name:	Entity ID:
Warea amplexifolia	Wide-leaf warea	1014

Conclusion

Wide-leaf warea is an endangered annual herbaceous species endemic to three counties in the Lake Wales Region of central Florida (Polk, Lake, and Marion). They are found in the sandhill habitats associated with longleaf pines, central ridges, and patchy summer fires, historically sparked by lightning. The seed bank appears resilient over time, and germination of seeds depends on open sandy areas, soil disturbance like fire, and rainfall. Since 2007, nine naturally occurring, extant populations have persisted and five have been extirpated. Of the remaining populations, several have fewer than 50 individuals. There are three introduced populations with unknown long-term viabilities; one introduced population only had one individual in 2017 (USFWS 2017). Four natural populations are on public land and five are on private land. Two naturally occurring populations (Florida Forest Service Warea Tract in Lake County and the Ocklawaha Corridor in Marion County under Duke Energy and private ownership) are the largest populations, accounting for ~95% of the plants range-wide (USFWS 2022). The species relies on wind for seed dispersal. The species flowers from mid-August through early October and fruits from late September to mid-November. Pollinators are unknown but presumed to be insects. Primary threats are continued habitat loss from development and conversion to agriculture, drought, fire suppression, and potentially effects of climate change (USFWS 2017, 2022).

The overlap of carbaryl agricultural use sites with the species range is e 41.1% and past usage data indicate that up to 41.1% of the species' range has been treated with carbaryl annually from agricultural uses. The species can be found on powerline rights of way, meaning there may be additional exposure from carbaryl use on these use sites (USFWS 2022). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. In addition, Duke Energy Corporation, that owns the right of ways where the species occurs, is working with the Service and other partners to implement management practices beneficial for this species. As such, we expect most exposure to occur from agricultural uses for this species (USFWS 2022).

The plant relies on wind for seed dispersal; thus, we do not anticipate effects from carbaryl exposure to the species seed dispersal capability.

Because of the species high vulnerability, limited distribution, documented declines, and reliance on pollinators for reproduction, large reductions in pollinators are likely to cause large adverse reproductive effects to the species. In addition, the high overlaps between the species' range and agricultural areas treated with carbaryl in the past indicate a high anticipated level of exposure to carbaryl. As such, we expect that these large adverse reproductive effects will rise to the level of

species-level reproductive 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 wide-leaf warea.

References:

U.S. Fish and Wildlife Service. 2022. Wide-leaf warea (*Warea amplexifolia*) Status Review: Summary and Evaluation. Gainesville, Florida. 8 pp.

U.S. Fish and Wildlife Service. 2017. Wide-leaf warea (*Warea amplexifolia*) 5-Year Review: Summary and Evaluation. Jacksonville, Florida. 21 pp.

Rationale for Species Conclusion: Longspurred mint

Scientific Name:	Common Name:	Entity ID:
Dicerandra cornutissima	Longspurred mint	1024

Conclusion

Longspurred mint is a strongly aromatic perennial shrub endemic to the Atlantic Coastal Ridge in coastal Florida (USFWS 1987). It is listed as endangered. It is found in sunny, open areas of sand pine scrub or oak scrub often surrounded by pine-turkey oak sandhill vegetation. It is also found in disturbed edges of sand roads adjacent to overgrown sand pine forests, under maintained powerlines and roadway shoulders, and abandoned pastures and fields that were formerly sandhill communities. There are six extant occurrences across the range, three of which are partially or fully on public land. Primary threats include fire suppression and habitat conversion to urban uses (USFWS 2023).

Longspurred mint is an obligate outcrosser that reproduces by seed, but it has been propagated by vegetative cutting in nurseries. Spurred anthers are triggered by insect pollen vectors, allowing pollen to be released and dispersed (USFWS 2023). Therefore, the species relies on biotic pollinators, specifically insects in the families Hymenoptera and Lepidoptera, making it generally more susceptible to adverse effects resulting from loss of pollinators. Details of seed dispersal is unknown, but we believe it may involve ants (USFWS 2008).

The overlap of carbaryl agricultural use sites with the species range is 29.4% and past usage data indicate that up to 26.5% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of some agricultural UDLs and potentially suitable habitat, agricultural (primarily citrus) land uses and rangeland occur near or on habitat for the species (Kern et al. 2022). It is unlikely carbaryl exposure will occur from rangeland uses as little carbaryl is applied on this use site outside of the Western U.S. Thus, most exposure is anticipated from agricultural uses of carbaryl and we expect significant adverse effects to the species reproductive success due to the reduction in pollinating insects due to the high overlap and usage.

Because of the species high vulnerability, limited distribution, and reliance on pollinators for reproduction, large reductions in pollinators from high exposure to carbaryl are likely to cause significant adverse reproductive effects to the species. As such, we expect that the anticipated adverse reproductive effects will rise to the level of adverse species-level reproductive 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 longspurred mint. **References:**

Kern, M., S. Kay, D. Christian, and E. Tandy. 2023. Methomyl Effects Assessment of the Longspurred Mint (*Dicerandra cornutissima*) for Risk Management of Methomyl Agricultural Uses. Tessenderlo Kerley, Inc. TKI-2023-EAM-040. 33 pp.

U.S. Fish and Wildlife Service. 2023. Longspurred mint (*Dicerandra cornutissima*) Status Review: Summary and Evaluation. Gainesville, Florida. 13 pp.

U.S. Fish and Wildlife Service. 2008. Longspurred mint (*Dicerandra cornutissima*) Status Review: Summary and Evaluation. Jacksonville, Florida. 22 pp.

U.S. Fish and Wildlife Service. 1987. Recovery Plan for three Florida mints. Atlanta, Georgia. 32 pp.

Rationale for Species Conclusion: Lakeside daisy

Scientific Name:	Common Name:	Entity ID:
Hymenoxys herbacea	Lakeside daisy	1059

Conclusion

The lakeside daisy is a threatened species found in Ontario, Canada, Illinois, Ohio, and Michigan on dry, limestone prairies and alvar habitat, which is flat limestone or dolostone bedrock with thin to no soil, few to no trees, and is subject to seasonal drought. The species also occurs on alvar habitat modified by quarry activities. The only natural populations are found at Marblehead Quarry and Lakeside Daisy State Nature Preserve in Ohio, two populations in Michigan, and along the coast of Manitoulin Island in Ontario, Canada. The species has been introduced to areas in Illinois, Ohio, and Michigan. The largest population range-wide is at Marblehead Peninsula (estimated 5.7 million individuals) and has been declining. Significant areas that previously had high densities of daisies are no longer suitable habitat. An additional 3 million plants are at risk from planned mining activities. The natural population at the 137-acre Lakeside Daisy State Nature Preserve was protected from the Marblehead quarry and is increasing. Castalia Quarry Metropark has over 60,000 individuals and Huntley-Beatty Preserve on Kelleys Island has over 130,000 plants. In three protected areas of Illinois (Lockport Prairie Nature Preserve, Romeoville Prairie Nature Preserve, and Manito Nature Preserve), populations have been declining since 2012 and have little evidence of recruitment. The plants there may be persisting through vegetative reproduction only and pollination may not be occurring. The other three populations in Illinois have low abundance and are believed to be declining. In Michigan, there are four known populations; one managed by Michigan Nature Association has over 1,900 individuals. Another population was introduced at an abandoned quarry with 400 plants, has been supplemented since with more individuals, and is increasing as of 2021. Another population has <200 individuals and a fourth was discovered in 2020 with between 200-2,000 individuals. Range-wide, habitat loss has continued due to ongoing quarry activities, succession, and competition from other vegetation. The species is also threatened by effects of climate change, like changes in wave-wash, ice buildup, storm intensity, and precipitation patterns (USFWS 2021).

Lakeside daisies are primarily pollinated by insects, including bumble bees (Apidae), small carpenter bees (Xylocopidae), and halictid bees (Halictidae). Additional potential pollinators include pearl crescents (*Phycoides tharos*), a small butterfly, and syrphid flies (Syrphidae) like transverse-banded flower flies (*Eristalis transversa*), tufted globetail (*Sphaerophoria contingua*), and margined calligrapher (*Toxomerus marginatus*). A larva wavy-lined emerald (*Synchlora aerate*) and multiple shining flower beetles have been observed on flower disks. The seeds are believed to be dispersed by wind. Lakeside daisies are believed to be self-incompatible, and studies have shown that some introduced populations suffer from reduced genetic diversity, increased asexual reproduction, and reduced seed production; populations need to have high abundance and genetic diversity to succeed, much of which is accomplished through pollination (USFWS 2021).

The lakeside daisy has a high percent overlap (57.5%) between agricultural uses of carbaryl and its range and past usage data indicate that up to 56.3% of the species' range has been treated with carbaryl annually from agricultural uses. From a visual comparison of some agricultural UDLs and potentially suitable habitat for the lakeside daisy, agricultural (primarily corn) land uses occur near or on known occupied locations across the species' range (Kern et al. 2023). The species can be found in rights of way, meaning there may be some additional exposure from carbaryl use on these sites (USFWS 2021). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in rights of way within the species' range, we expect no more than minimal loss of the pollinator community and resultant low levels of reproductive effects to the lakeside daisy from non-agricultural exposure to carbaryl.

The species has high agricultural exposure and a medium toxicity because it relies on insect species for pollination (i.e., bumble bees, carpenter bees, halictid bees, and possibly others). We do not anticipate agricultural land uses within the species' habitat (i.e., flat limestone or dolostone bedrock with thin to no soil), but pollinators that the species requires use nearby lands, including agricultural lands where carbaryl is used. Therefore, we anticipate significant adverse reproductive effects due to the extensive agricultural exposure of pollinators (and their mortality) that will contribute to the pre-existing lack of genetic diversity from insect pollinator loss across a large portion of the range. We anticipate these adverse reproductive effects will cause species-level reproductive 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 lakeside daisy.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2023. Methomyl Effects Assessment of the Lakeside Daisy (*Hymenoxys herbacea*) for Risk Management of Methomyl Agricultural Uses. Tessenderlo Kerley, Inc. TKI-2023-EAM-042. 38 pp.

U.S. Fish and Wildlife Service. 2021. Lakeside Daisy (*Tetraneuris herbacea*) 5-Year Review: Summary and Evaluation. Columbus, Ohio. 38 pp.

Rationale for Species Conclusion: Texas ayenia

Scientific Name:	Common Name:	Entity ID:
Ayenia limitaris	Texas ayenia	1077

Conclusion

Texas ayenia is a spineless shrub endemic to three counties in Texas, where only five populations exist. The species is also known from northeastern Mexico, but the status of those populations is unknown. The species is not protected by the government of Mexico. Occupied habitats are isolated fragments of Texas ebony - anacua/brasil woodlands and Texas ebony - snake-eyes shrublands in the deltas of rivers draining into the Gulf of Mexico. The primary threat to its existence is habitat loss due to agricultural and urban development, especially in the three unprotected populations on private lands. The 2016 Texas ayenia recovery plan identified pesticide use and resultant loss of pollinators as a "non-imminent and low magnitude" threat as pesticide drift and runoff from agriculture in and near the range of this species has the potential to cause declines in local pollinator populations. As a result, the recovery plan recommends minimizing impacts from pesticide drift and runoff to prevent significant decline in this species' status in the future (USFWS 2016).

The Texas ayenia relies on unknown insects for pollination, and like all species in this assessment group, requires pollen transfer between individual plants to reproduce successfully and therefore, it relies on sufficient pollinator populations within its range. Specific biotic seed dispersal species are unknown, though it may use a combination of biotic (insects, birds, and/or mammals) and abiotic (water) dispersal vectors. As explained in the *Effects of the Action* section above, it is not likely that carbaryl exposure from the proposed action would appreciably diminish the availability of bird or mammal seed dispersers. However, insect seed dispersers are expected to experience losses due to carbaryl exposure. Given that this species can rely on non-insect seed dispersers, we do not anticipate effects to its insect seed dispersers will cause appreciable adverse effects to the reproductive capacity of this species.

Overlap of agricultural use sites of carbaryl and the species range is high at 84.2% and based on past usage data we expect up to 39% of the species' range will be treated with carbaryl annually from agricultural uses, especially for populations that remain unprotected. From a visual comparison of some agricultural UDLs and potentially suitable habitat for the Texas ayenia, agricultural (primarily corn, cotton, others) land uses occur near or on habitat for the species (Kern et al. 2023). The species is not expected to occur in non-agricultural use sites; therefore, we expect most exposure will occur from agricultural uses. While there is uncertainty regarding the specific insect pollinators that are important to this species, the species' limited geographic distribution, anticipated threat to local pollinator populations from insecticide use, the high overlap and usage related to agricultural use sites necessitates a conservative evaluation of the likelihood of effects from carbaryl use.

We anticipate that carbaryl use will cause high levels of insect pollinator mortality across a large portion of the range of the species. Because insect pollinators are necessary for this species'

reproductive success, we anticipate the significant anticipated pollinator mortality from carbaryl exposure will result in species-level reproductive effects and diminished reproductive success of Texas ayenia. 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 Texas ayenia.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2023. Methomyl Effects Assessment of the Texas Ayenia (*Ayenia limitaris*) for Risk Management of Methomyl Agricultural Uses. Tessenderlo Kerley, Inc. TKI-2023-EAM-043. 41 pp.

U.S. Fish and Wildlife Service. 2022. Texas ayenia (*Ayenia limitaris*) 5-Year Review: Summary and Evaluation. Corpus Christi, Texas. 7 pp.

U.S Fish and Wildlife Service. 2016. Texas Ayenia (*Ayenia limitaris*) Recovery Plan. Albuquerque, New Mexico. 97 pp.

U.S Fish and Wildlife Service. 2010. Texas Ayenia (*Ayenia limitaris*) 5-Year Review. Albuquerque, New Mexico. 46 pp.

Rationale for Species Conclusion: Western prairie fringed orchid

Scientific Name:	Common Name:	Entity ID:
Platanthera praeclara	Western prairie fringed orchid	1080

Conclusion

Western prairie fringed orchids are listed as threatened and occur in Iowa, Kansas, Minnesota, Missouri, Nebraska, and North Dakota. They are known from areas where standing water is present and shallow soils over bedrock where standing water is not present. As of 2021, there are 299 extant populations across the species' range; it is considered extirpated from five counties where it was considered extant in 2009 (two in Iowa, two in Kansas, and one in Nebraska). Population trends vary across states; some are believed to be stable, and some are declining. Several populations, including Sheyenne National Grasslands in North Dakota and Valentine National Wildlife Refuge in Nebraska, are on federal lands. As of 2021, 82% of extant plants are on protected sites across the range. The main threats to the species are conversion of remnant prairie habitat to cropland, spread of non-native invasive plant species, woody encroachment and succession, and changes in hydrology, including drought. Habitat fragmentation and herbicide or pesticide use are listed as factors that may reduce the amount of suitable habitat for the species' sphinx moth pollinators (USFWS 2021).

The western prairie fringed orchid forms tubers and vegetative shoots from existing plants, but they do not produce seed capsules asexually or via self-fertilization; pollination is required for seed production. The western prairie fringed orchid is pollinated by a few species of sphinx moths (USFWS 2009, 2021), including wild cherry sphinx (*Sphinx drupiferarum*), Achemon sphinx (*Eumorpha achemoten*), bedstraw hawkmoth (*Hyles gallii*), Plebian sphinx (*Paratraea plebeja*), hermit sphinx (*Lintneria eremitus*), white-lined sphinx (*H. lineata*), and spurge hawkmoth (*H. euphorbiae*). Due to their nocturnal nature, moths pollinate western fringed prairie orchid at night. Seeds are wind-dispersed and may also be adapted for dissemination through the soil profile by water (USFWS 2021).

This species is primarily found on protected land (82% of known individuals) and pollination occurs at night when moths are most active. However, the western prairie fringed orchid has a high percent overlap (54.9%) between carbaryl agricultural use sites and its range and past usage data indicate that up to 19.8% of the species' range has been treated with carbaryl annually from agricultural uses. We expect high exposure and death of the pollinator community within the range due to past usage and overlap with potential carbaryl agricultural use sites. In addition, spurge hawkmoths, one pollinator of western prairie fringed orchids, can be found on rangelands, where additional exposure may occur. However, under the USDA APHIS grasshopper and Mormon cricket suppression program, there is a 1-mile aerial and ground buffer requirement from the range or habitat of the species for carbaryl use on rangelands from June to July that should ensure carbaryl exposure from rangeland use is minimal (USFWS 2024). We determined the species has medium toxicity because it uses insect species for pollination (i.e., sphinx moths) that would be killed by carbaryl exposure. We expect adverse reproductive effects to the species

from loss of insect pollinators due to high exposure from agricultural uses of carbaryl across its range, and we anticipate that these adverse reproductive effects will cause species-level reproductive effects because of their high magnitude. 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 western prairie fringed orchid.

References:

U.S. Fish and Wildlife Service. 2024. Letter of Concurrence for the APHIS Rangeland Grasshopper and Mormon cricket Suppression Program. Falls Church, Virginia. 26pp.

U.S. Fish and Wildlife Service. 2021. Western Prairie Fringed Orchid (*Platanthera praeclara*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 21 pp.

U.S. Fish and Wildlife Service. 2009. Western Prairie Fringed Orchid (*Platanthera praeclara*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 39 pp.

Rationale for Species Conclusion: Kincaid's lupine

Scientific Name:	Common Name:	Entity ID:
Lupinus sulphureus ssp. *kincaidii*	Kincaid's lupine	1126

Conclusion

Kincaid's lupine is a threatened perennial herb endemic to western Oregon and southwestern Washington. It is found primarily in dry upland prairies but also forests and forest edges. Overall abundance of the species appears to have increased across the range between 2010 and 2019, but specifics are not discernible due to differences in naming convention and survey methods over that time. Most of the species occurrences are on private lands. Primary threats are habitat degradation due to development, woody encroachment, invasive plant species, hybridization with other lupine species, and effects of climate change. Habitat maintenance is necessary for Kincaid's lupine due to loss of natural disturbance regimes (e.g., flooding, fire) in the Willamette Valley (USFWS 2019).

Kincaid's lupine reproduces through seeds and vegetative spread via rhizomes. Individual clones can be hundreds of years old and produce many flowering stems. Reproduction by seed is common in large populations where inbreeding depression is minimized; in small populations, seed production is lower, and this appears to be due, in part, to inbreeding depression. It flowers from April to June, experiences dormancy, then senesces by mid-August. Pollination is accomplished mostly by small native bumblebees (*Bombus mixtus* and *B. californicus*), solitary bees (*Osmia lignaria*, *Anthophora furcata*, *Habropoda* spp., *Andrena* spp., *Dialictus* spp.), and occasionally European honeybees (*Apis mellifera*). Insect pollination appears to be critical for successful seed production (USFWS 2010). Seed dispersal is likely through gravity or water.

Kincaid's lupine has a high percent overlap (41.1%) between agricultural use sites and its range, and past usage data indicate that up to 27.2% of the species' range has been treated with carbaryl annually from agricultural uses. The species is found in road rights of way and rangelands, meaning there may be additional exposure to carbaryl from these use sites (USFWS 2010). However, available usage information indicates that carbaryl is used infrequently in rights of way and use on rangelands is not expected within the range of the species based on data presented in the USDA APHIS grasshopper and Mormon cricket program (USFWS 2024). As such, we expect most exposure of the pollinator community for this species to occur from agricultural uses. We determined the species has high toxicity because it uses insect species for pollination (i.e., several species of bees) that would be killed by carbaryl exposure. We do not believe Kincaid's lupine relies on insects for seed dispersal. Because the species relies on insect pollinators, agriculture occurs on or near suitable habitat areas (Kern et al. 2023), and we expect high usage to occur on the range, we anticipate adverse reproductive effects to the species from large losses of insect pollinators across a large portion of the range to cause species-level reproductive 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 Kincaid's lupine.

References:

U.S. Fish and Wildlife Service. 2024. Letter of Concurrence for the APHIS Rangeland Grasshopper and Mormon cricket Suppression Program. Falls Church, Virginia. 26pp.

Kern, M., Kay, S., Christian, D., and Tandy, E. 2023. Methomyl Effects Assessment of the Kincaid's Lupine (*Lupinus sulphureus ssp. kincaidii*) for Risk Management of Methomyl Agricultural Uses. TKI-2023-EAM-044. 44 pp.

U.S. Fish and Wildlife Service. 2019. 5-Year Review Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*). Portland, Oregon. 29 pp.

U.S. Fish and Wildlife Service. 2010. Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington. Portland, Oregon. 255 pp.

Rationale for Species Conclusion: Avon Park harebells

Scientific Name:	Common Name:	Entity ID:
Crotalaria avonensis	Avon Park harebells	1235

Conclusion

Avon Park harebells is a narrow endemic found in and around the Lake Wales Ridge region of central and northern Florida. It is a long-lived, low-growing perennial herb with a long taproot. It occurs only on Archbold and Satellite white sand soils in scrubby flatwoods or rosemary scrub. Like other species in this ecosystem, Avon Park harebells relies on fire-dependent habitat. There are three extant populations: Avon Park Lakes, Florida Fish and Wildlife Conservation Commission's Carter Creek unit of the Lake Wales Ridge Wildlife Management Area (Lake Wales), and a reintroduced population in the Silver Lake Tract of Lake Wales. Avon Park Lakes has two sub-populations, one of which is protected by The Nature Conservancy (i.e., Saddle Blanket Scrub Preserve). The unprotected sub-population at Avon Park Lakes hosts the largest number of individuals (i.e., likely thousands). The Saddle Blanket sub-population had 531 individual plants in 2006, and the size of the Carter Creek population is unknown but likely in the thousands. The species has been successfully reintroduced at two conservation sites. The primary threat is habitat destruction and fragmentation from high rates of development. The limited geographic range of these species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of the Lake Wales Ridge species (USFWS 2019). In addition, rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lennartson 2002, Lienert 2004, Spira 2001, Setsuko et al. 2013). Pesticides were specifically mentioned as a threat to pollinators in the species' latest 5-Year Review (USFWS 2023).

Avon Park harebells relies on insects for pollination, and like all the species in this assessment group, they require pollen transfer between individual plants to reproduce successfully. Insect visitation rates are low, and less than 10% of flowers produce fruits. Seeds contribute to a persistent seed bank that lasts at least three years (USFWS 2019). The species exhibits low fecundity, recruitment, flowering rates, and seed production (USFWS 2023). The species likely uses both biotic and abiotic seed dispersal vectors.

Citrus is a registered use for carbaryl, and much of the range overlaps with or is adjacent to rangelands and citrus agricultural lands. Carbaryl use on rangelands is not expected within the range of the species based on data presented in the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024), so we expect most exposure to occur from agricultural uses for this species.

The overlap of carbaryl use sites with the species range is 25.6% and past usage data indicate that up to 12.1% of the species' range has been treated with carbaryl annually from agricultural

uses. We anticipate significant adverse effects to the species in the form of reduced reproductive success due to the reduction in pollinating insects that is likely to occur from carbaryl exposure. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators. A significant loss of pollinators within a large portion of its range is likely to exacerbate existing reproductive deficiencies due to habitat loss, low fruiting success, and low seed production. We anticipate adverse, species-level reproductive effects due to the carbaryl exposure and resultant pollinator loss that is expected to occur over the duration of the 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 Avon Park harebells.

References:

U.S. Fish and Wildlife Service. 2024. Letter of Concurrence for the APHIS Rangeland Grasshopper and Mormon cricket Suppression Program. Falls Church, Virginia. 26pp.

Kern, M., S. Kay, D. Christian, and E. Tandy. 2022. Carbaryl Effects Assessment of Wireweed (*Polygonella basiramia*) for Risk Management of Carbaryl Agricultural and Rangeland Uses. Tessenderlo Kerley, Inc. 2022-ENV-004. 38 pp.

Kern, M., S. Kay, D. Christian, and E. Tandy. 2024. Methomyl Effects Assessment of the Avon Park Harebells (*Crotalaria avonensis*) for Risk Management of Methomyl Agricultural Uses. Tessenderlo Kerley, Inc. TKI-2024-EAM-062. 45 pp.

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology 83(11): 3060-3072.

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented Magnolia stellate populations. BMC Ecology 13:10.

Spira, T. P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal 21(1): 78-88.

U.S. Fish and Wildlife Service. 2023. Avon Park Harebells Crotalaria avonensis) 5-Year Status Review: Summary and Evaluation. Gainesville, Florida. 11 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for *Conradina brevifolia* (short-leaved rosemary), Crotalaria avonensis (Avon Park harebells), *Dicerandra christmanii* (Garrett's mint),

Dicerandra frutescens (scrub mint), *Eryngium cuneifolium* (snakeroot), *Hypericum cumulicola* (Highlands scrub hypericum*), Liatris ohlingerae* (scrub blazing star), *Polygala lewtonii* (Lewton's polygala), *Polygonella basiramia* (wireweed), *Polygonella myriophylla* (sandlace), *Warea carteri* (Carter's mustard), and *Ziziphus celata* (Florida ziziphus). Vero Beach, Florida. 23 pp.

Rationale for Species Conclusion: Fleshy-fruit gladecress

Scientific Name:	Common Name:	Entity ID:
Leavenworthia crassa	Fleshy-fruit gladecress	1710

Conclusion

The fleshy-fruit gladecress is an endangered winter annual in the mustard family (Brassicaceae) endemic to the cedar glade areas in north-central Alabama that have been significantly altered from their original condition. It is found in association with limestone outcroppings with exposed rock and shallow soil; it also occurs in disturbed areas like pastures, roadside rights of way, and cultivated or plowed fields. Fleshy-fruit gladecress grows best in full sun and does not compete well with plants that shade them. It germinates in the fall, overwinters as rosettes, and commences a month-long flowering period beginning in mid-March. There are eight populations in the Moulton and Tennessee Valleys of Alabama, all within a 13-mile radius. Occurrences declined by 60% between 1987-1997. Most populations are on private land, only one population is protected, and trend data is unavailable due to lack of monitoring. Remaining populations are isolated, and five populations occur on pasturelands, in planted fields surrounded by agriculture, or on powerline rights of way (USFWS 2020a, 2023). Threats to the species include habitat loss and fragmentation by development and agriculture, invasive species, herbicide use, plowing, natural forest succession, and potentially effects from climate change (USFWS 2020a).

During most years, the plants dry and drop seeds by the end of May. The fleshy-fruit gladecress uses two mating systems: self-compatibility and self-incompatibility. Self-compatible flowers are small and white, and they mature seeds earlier than self-incompatible plants. Self-incompatible flowers are large, either yellow or white, and require pollination by a variety of generalist bee species. Self-compatible populations tend to be larger than self-incompatible populations. Small populations might be more likely than large populations to shift to self-fertilization because of a lack of pollinators. The strongest selective force for the evolution of self-compatibility in *Leavenworthia* is the timing of emergence of native pollinators in relation to drying of the shallow-soil glade habitat in spring. Self-compatible plants can mature seeds earlier, when there are few insect visitors, than self-incompatible plants which cannot be pollinated until temperatures are favorable for insect flight (USFWS 2020b). Lower genetic diversity and some in-breeding have been identified in self-compatible populations, but we do not know if the species is experiencing in-breeding depression. Dispersal is primarily by water and wind. The species may be dispersed by agricultural machinery, cattle, mowing equipment, and vehicle traffic on disturbed sites may augment the species' limited natural dispersal capacity (USFWS 2020a).

The fleshy-fruit gladecress has a high percent overlap (34.8%) between the action area and its range, and past usage data indicate that up to 18.1% of the species' range has been treated with carbaryl annually from agricultural uses. The species can be found in disturbed areas such as rights of way and pastures, meaning there may be some additional exposure from carbaryl use on these areas (USFWS 2020a, 2023). However, available usage information indicates that carbaryl

is used infrequently in rights of way and use on rangelands is not expected within the range of the species based on data presented in the USDA APHIS grasshopper and Mormon cricket program (USFWS 2024). As such, we expect most exposure to occur from agricultural uses for this species. We expect a high level of exposure and mortality of the species' pollinators within the range and resultant adverse reproductive effects to the species. Because the species appears to rely on insect pollination for larger self-incompatible communities and smaller self-compatible communities have lower genetic diversity, we expect the high level of adverse reproductive effects from pollinator loss to result in species-level reproductive 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 fleshy-fruit gladecress.

References:

U.S. Fish and Wildlife Service. 2024. Letter of Concurrence for the APHIS Rangeland Grasshopper and Mormon cricket Suppression Program. Falls Church, Virginia. 26pp.

U.S. Fish and Wildlife Service. 2023. Recovery Plan for Fleshy-fruit Gladecress (*Leavenworthia crassa*). Atlanta, Georgia. 8 pp.

U.S. Fish and Wildlife Service. 2020a. Fleshy-fruit Gladecress (*Leavenworthia crassa*) 5-Year Review: Summary and Evaluation. Daphne, Alabama. 21 pp.

U.S. Fish and Wildlife Service. 2020b. Species Status Assessment for the Fleshy-fruit Gladecress (*Leavenworthia crassa*). Version 1.0. Atlanta, Georgia. 77 pp.

Rationale for Species Conclusion: Short's bladderpod

Scientific Name:	Common Name:	Entity ID:
Physaria globosa	Short's bladderpod	1831

Conclusion

The Short's bladderpod is an endangered upright biennial or perennial found on steep, rocky, wooded slopes, and talus areas within forested areas of Indiana, Kentucky, and Tennessee. Short's bladderpod also occurs along tops, bases, and ledges of bluffs and infrequently on sites with little topographic relief. The species usually is found in these habitats on south- to west-facing slopes near rivers or streams. Most populations are closely associated with calcareous outcrops (USFWS 2020). It is believed to occur at 33 extant sites (11 in Kentucky, 21 in Tennessee, and 1 in Posey County, Indiana), most of which have fewer than 100 individuals. Five of these sites were surveyed between 2013-2019 and no individuals were found. Threats to the species include habitat loss (e.g., construction, transportation maintenance, utility rights of way), shading due to forest succession, encroachment by invasive species, natural landslides, effects of small populations, and effects of climate change (USFWS 2021).

Availability of mate-compatible genotypes and abundance of pollinators are critical factors for production of viable seed (USFWS 2020). The Short's bladderpod is likely self-incompatible (i.e., cannot self-pollinate) based on lack of seed production from plants in a greenhouse where pollinators were absent. Short's bladderpod flowers from March to June, mostly between April and May. The species is pollinated by flies (e.g., *Nemotelus bruesii*, *Toxomerus geminatus*) and bees, particularly ground-nesting bees (e.g., *Lasioglossum illinoense*, *L.versatum*, *Halictus ligatus*, *Augochlorella striata*); the two fly species were observed visiting the flowers more frequently than the bees. Fruit dehiscence (i.e., opening of fruit to release seeds) occurs when plants begin to senesce in late June to early July. Open habitats in otherwise forested landscapes support greater numbers of bees and flies, and therefore more Short's bladderpods (USFWS 2021). Seed dispersal is believed to be through wind, water, gravity, and potentially ungulates (USFWS 2020).

Short's bladderpod has a high percent overlap (15.8%) between carbaryl agricultural use sites and its range, and past usage data indicate that up to 14% of the species' range has been treated with carbaryl annually from agricultural uses. The species can be found along roadsides and rights of way and in managed forests, meaning there may be additional exposure from carbaryl use on non-agricultural lands (USFWS 2021). However, available usage information indicates that carbaryl is used infrequently in the U.S. Forest Service region where the Short's bladderpod occurs, and in rights of way in general. Therefore, usage in managed forests or rights of way within the range of the species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in managed forests or rights of way within the species' ranges, we expect no more than minimal loss of the pollinator community and resultant low levels of reproductive effects to the Short's bladderpod. As such, we expect most exposure to occur from agricultural uses for this species. Though we do not expect agricultural uses of carbaryl to occur

where Short's bladderpod is primarily found (i.e., forested areas and on or near calcareous outcrops of ledges and bluffs), pollinators likely travel through carbaryl use sites near these forests and outcrops within the species' range. As such, we expect a high level of exposure and mortality of the species' pollinators within the range resulting in a high level of reproductive effects to the species from this loss of pollination. We anticipate species-level adverse effects to the species reproduction from this pollinator loss due to its large magnitude. 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 Short's bladderpod.

References:

U.S. Fish and Wildlife Service. 2021. Short's Bladderpod (*Physaria globosa*) 5-Year Review: Summary and Evaluation. Cookeville, Tennessee. 29 pp.

U.S. Fish and Wildlife Service. 2020. Species Status Assessment Report, Short's Bladderpod (*Physaria globosa*). Version 1.1 Atlanta, Georgia. 54 pp.

Rationale for Species Conclusion: Whorled sunflower

Scientific Name:	Common Name:	Entity ID:
Helianthus verticillatus	Whorled sunflower	1881

Conclusion

The whorled sunflower is an endangered, self-incompatible, clonal perennial found in Alabama, Georgia, Tennessee, and Mississippi. It occurs in the Loess Plains in Mississippi, Northern Hilly Gulf Coastal Plains in Tennessee, and Southern Shale Valleys in Alabama and Georgia in an area that is about 250 miles east to west and 100 miles north to south. Populations are generally isolated and separated from one another by 20+ miles. Their habitats usually have moist, well-drained, acidic soils with low fertility and little to no overstory canopy. They occur in prairies, woodlands, roadsides, railroad tracks, and agricultural fields. There are five natural populations, each consisting of multiple subpopulations. One subpopulation in Alabama has decreased since 2010 from ~100-200 genetically distinct individuals to potentially as few as three in 2018. The other subpopulation in Alabama decreased from 175-200 stems in 2008 to 42 stems in 2011. There are believed to be fewer than 100 individuals in Alabama as of 2020. The Georgia population is considered four subpopulations, abundance, and trends of which are unknown. Prescribed fires have resulted in vigorous growth of the species, and most of the population is protected by a conservation easement held by The Nature Conservancy (i.e., Coosa Valley Prairie). There is one known population in Mississippi, and it is the smallest one with only three to four stem clusters. In Tennessee, there are two extant natural populations: Madison County with 155 stems in 20 clusters as of 2015 and McNairy County with 70 stems counted in 2019. The McNairy population grows along creek banks and unplowed edges of cultivated crop fields, extended into a railroad right of way. The whorled sunflower is threatened by habitat loss and degradation from development, agriculture, vegetation management (e.g., right of way maintenance, indiscriminate herbicide application), invasive species, succession, and effects of climate change (USFWS 2020, 2023).

Whorled sunflowers propagate clonally through rhizomes and sexual reproduction. Therefore, they occur in a clumped distribution. They flower from August to October. Presumed pollinators of whorled sunflowers include two-spotted long-horned bees (*Mellisodes bimaculatus*) and honeybees (*Apis mellifera*) that are both believed to have short flight distances, so travel between populations is unlikely. The species is not adapted for wind pollination and likely requires insect pollination. Lower germination rates were observed in seeds produced from a smaller population than those observed from a larger population, suggesting that population size may influence population fitness (USFWS 2020). Seed dispersal mechanisms are undocumented but may be through water, birds, and small mammals.

The whorled sunflower has a high percent overlap (24.1%) between the action area and its range and past usage data indicate that up to 22.5% of the species' range has been treated with carbaryl annually from agricultural uses. The species can be found along roadsides and railroad tracks (right of ways) and in managed forests, meaning there may be some additional exposure from

carbaryl use in these areas (USFWS 2023). However, available usage information indicates that carbaryl is used infrequently in the U.S. Forest Service region where the whorled sunflower occurs, and in rights of way in general. Therefore, usage in managed forests or rights of way within the range of the species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in managed forests or rights of way within the species' ranges, we expect no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the whorled sunflower from non-agricultural exposures to carbaryl. As such, we expect most exposure to occur from agricultural uses for this species.

We determined the species has medium toxicity because it uses insect species for pollination (i.e., long-horned bees) that would be killed by carbaryl exposure, but it can also reproduce clonally. We do not believe whorled sunflowers rely on insects for seed dispersal. Because the species is self-incompatible, it relies on only a few insect pollinator species, the species is known to occur on or near agricultural fields, and we expect high carbaryl usage to occur on the range, we anticipate adverse reproductive effects to the species from large losses of insect pollinators to cause species-level reproductive 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 whorled sunflower.

References:

U.S. Fish and Wildlife Service. 2023. Species Status Assessment for Whorled Sunflower (*Helianthus verticillatus*). Version 1.0. Atlanta, Georgia. 46 pp.

U.S. Fish and Wildlife Service. 2020. Whorled Sunflower (*Helianthus verticillatus*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi. 32 pp.

Rationale for Species Conclusion: Slickspot peppergrass

Scientific Name:	Common Name:	Entity ID:
Lepidium papilliferum	Slickspot peppergrass	2810

Conclusion

Slickspot peppergrass is a threatened annual or biennial mustard species found in Great Basin sagebrush steppe habitats of Ada, Canyon, Gem Elmore, Payette, and Owyhee counties of southwestern Idaho. It is found in the Snake River Plain and its adjacent foothills, an area encompassing approximately 2,250 square miles, and on the Owyhee Plateau, an area encompassing approximately 132 square miles. The slickspot peppergrass is found primarily in soil inclusions known as slick spots scattered within sagebrush steppe ecosystems of southwest Idaho. Of the 115 element occurrences, the vast majority occur on protected public lands: 87% on federal lands and 9% on state lands (USFWS 2020). Primary threats to the remaining 4% of occurrences on private lands include increasing frequency of wildfires, predation by Owyhee harvester ants, invasive plant species, habitat destruction due to development, and further fragmentation (USFWS 2020, 2021, 2023).

Slickspot peppergrass seeds are believed to be dispersed primarily through gravity and wind. The seed bank often constitutes most of the population, which buffers the species from unfavorable temperature and precipitation conditions that result in little to no reproduction some years. Slickspot peppergrass uses insects as pollinators, specifically bees, wasps, beetles, flies, moths, and butterflies. It relies on pollen transfer between individual plants for successful reproduction and has low seed set in the absence of insect pollination (USFWS 2023). In addition, the species has limited genetic diversity due to small, fragmented populations across the landscape and limited capacity for dispersal due to its dependence on gravity and wind for seed dispersal (USFWS 2020). Given the peppergrass' low genetic diversity, it is crucial for this species to maintain robust pollinator communities that transfer genetic material in the form of pollen between individuals and populations (USFWS 2020).

The slickspot peppergrass has a high percent overlap (66.2%) between carbaryl agricultural use areas and its range, and past usage data indicate that up to 22.1% of the species' range has been treated with carbaryl annually from agricultural uses. The species can be found in rights of way and on rangelands, meaning there may be additional exposure from carbaryl use in these areas (USFWS 2020). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. If small amounts of carbaryl usage did occur in rights of way within the species' ranges, we expect no more than minimal loss of the pollinator community and resultant low levels of reproductive effects to the slickspot peppergrass. In addition, under the USDA APHIS grasshopper and Mormon cricket suppression program (USFWS 2024), there is a 1-mile aerial and ground buffer requirement from the species range or habitat for carbaryl use on rangelands from April to May that should ensure carbaryl exposure to pollinators from rangeland use is minimal. As such, we expect most exposure to occur from

agricultural uses for this species and that exposure and resultant pollinator mortality from agricultural uses will be high given the high overlap and usage.

We determined the species has a medium toxicity ranking because it uses insect species for pollination that would be killed by carbaryl exposure. We do not believe slickspot peppergrass relies on insects for seed dispersal. Because the species relies on pollinators, is limited geographically by habitat requirements and restricted dispersal, is known to occur near agricultural fields, and we expect high carbaryl usage to occur within the range, we anticipate significant adverse reproductive effects to the species from large losses of insect pollinators to cause species-level reproductive 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 slickspot peppergrass.

References:

U.S. Fish and Wildlife Service. 2024. Letter of Concurrence for the APHIS Rangeland Grasshopper and Mormon cricket Suppression Program. Falls Church, Virginia. 26pp.

U.S. Fish and Wildlife Service. 2023. Draft Recovery Plan for Slickspot Peppergrass (*Lepidium papilliferum*). Portland, Oregon. 33 pp.

U.S. Fish and Wildlife Service. 2021. Slickspot Peppergrass (*Lepidium papilliferum*) 5-Year Review: Summary and Evaluation. Boise, Idaho. 26 pp.

U.S. Fish and Wildlife Service. 2020. Species Status Assessment of *Lepidium papilliferum* (Slickspot Peppergrass). Version 1.0. Boise, Idaho. 212 pp.

Rationale for Species Conclusion: Florida prairie-clover

Scientific Name:	Common Name:	Entity ID:
Dalea carthagenensis floridana	Florida prairie-clover	5273

Conclusion

The Florida prairie-clover is an endangered shrub that grows in pine rockland, rockland hammock, marl prairie, and coastal berm habitats in open, well-lit areas maintained by disturbance. It may also occur along roadsides within these habitats. Many of their habitats depend on fire to prevent hardwood encroachment. As of 2023, there were an estimated 980 individuals across 13 known extant occurrences, predominantly found in Miami-Dade County, and 87% of which occur on public lands. A few historical populations are extirpated; one in Everglades National Park was believed to be extirpated and was rediscovered in 2018. Abundances for the Everglades National Park, R. Hardy Matheson Preserve, Crandon Park, Strawberry Fields Hammock, and the Florida Department of Health populations have increased since 2017. Abundance at Big Cypress National Park appears to be in decline (40 individuals in 2018, 253 in 2014) and abundance at Deering Estate has fluctuated (50 individuals in 2003, 500 in 2008, and 300 in 2019). The Florida prairie-clover is threatened by habitat loss and fragmentation (e.g., land use changes, invasive species, succession), effects of climate change, and effects of small populations (USFWS 2023).

Florida prairie-clovers are believed to be pollinated by insects. They can produce over 500 seeds and provide a significant seed bank, therefore pollination services are assumed to be adequate. Their seeds fall to the ground and can be dispersed short distances by wind (USFWS 2023).

The Florida prairie-clover has a high percent overlap (18.01%) between carbaryl agricultural use sites and the species' range, and past usage data indicate that up to 9.04% of the species' range has been treated with carbaryl annually from agricultural uses. The species can be found along roadsides, meaning there may be exposure to carbaryl use on right of ways (USFWS 2023). Less than 500 pounds of carbaryl is applied annual to roadways nationally, thus, we expect use on right of ways within the species range is likely to be minimal, and most exposure is expected to occur from agricultural uses for this species. However, the species occurs primarily (approximately 87%) on protected lands (i.e., Big Cypress National Park, Everglades National Park, R. Hardy Matheson Preserve) where carbaryl application is unlikely, and on areas that are not in proximity to agriculture (i.e., Deering Estate, Crandon Park, Florida Department of Health and Rehabilitation Services, and the Florida Power and Light near Deering Estate) (Kern et al. 2024). Florida prairie-clover relies on abiotic means for seed dispersal, thus we do not anticipate adverse effects to the species' seed dispersal capacity due to carbaryl exposure. As such, we anticipate that exposure of the pollinator community for this species to carbaryl will be low.

Therefore, we expect minimal adverse reproductive effects to the species from minimal losses of insect pollinators. We do not expect these adverse effects to cause species-level reproductive 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 Florida prairie-clover.

References:

Kern, M., S. Kay, D. Christian, and E. Tandy. 2024. Methomyl Effects Assessment of the Florida Prairie-Clover (*Dalea carthagenensis floridana*) for Risk Management of Methomyl Agricultural Uses. TKI-2024-EAM-050. 34 pp.

U.S. Fish and Wildlife Service. 2023. Florida Prairie-clover (*Dalea carthagenensis* var. *floridana*) Status Review: Summary and Evaluation. Vero Beach, Florida. 12 pp.

Rationale for Species Conclusion: Prostrate milkweed

Scientific Name:	Common Name:	Entity ID:
Asclepias prostrata	Prostrate milkweed	3686

Conclusion:

Prostrate milkweed is an endangered, herbaceous perennial plant endemic to Starr and Zapata counties in Texas and isolated areas in northern Mexico. It requires open canopy with little to no herbaceous cover, so it often occurs in disturbed areas like along maintained roads. Prostrate milkweed occurs in a warm, semiarid climate in sparsely vegetated sites, including openings in shrub-invaded grasslands, open areas of Tamaulipan thornscrub, prairies/grasslands, and areas converted to pasture land on level or gently sloping sites on upland terraces and floodplains of the Rio Grande. Because it has a large taproot, it can survive underground in a dormant state for months or years through drought. Prostrate milkweed has never been abundant in surveys. One population has had more than 50 individuals since 1995 and most others have abundances fewer than 10. There are 24 populations between Texas and Mexico (16 of which are in Texas), and 19 populations are estimated to be in low condition. Threats to prostrate milkweed include conversion of native vegetation to non-native grasses, right of way maintenance (e.g., mowing, herbicide use), land conversion (e.g., road and other development), border security activities, and potentially effects of climate change.

Prostrate milkweed produce many seeds that are believed to be viable for 1-2 years. Seeds are dispersed by wind. Seedling emergence is dependent on rainfall and varies between years. Reproductive biology for prostrate milkweed is not completely understood, but many milkweeds are rhizomatous and form clones via ramets in adjoining areas. This characteristic has not been reported for prostrate milkweed. Most milkweed species are self-incompatible and require outcrossing. Prostrate milkweed plants reproduce sexually through seeds and have highly specialized pollen sacs and intricate flowers with male and female structures. The specialized pollen sacs need to be inserted into the stigma of another flower by an insect or other pollinator, and flowers are designed to attract pollinators. Because of the large pollinia structures, pollinators need to be large enough to be able to transport them. The unique, highly specialized floral structures of this milkweed species are likely most effectively pollinated by large bees and wasps, including tarantula hawk wasps (*Pepsis* and *Hemipepsis* spp.) (USFWS 2020). Declines in prostrate milkweed may be related to declines in pollinators.

This species has a large percent overlap (20.2%) between the action area and its range and past usage data indicate that up to 2.2% of the species' range has been treated with carbaryl annually, indicating moderate levels of potential exposure. Exposure to pollinators on agricultural crops is expected to be minimal as the much of the on-field overlap occurs with carbaryl registered crops that are not pollinator attractive and the very low levels of exposure to pollinators on-field are not anticipated to result in meaningful negative impacts to the pollinator community (Pers. Comm. Chris Best, Texas Service Botanist, November 12, 2024). The species is known to occur near agricultural lands, lands grazed by cattle, and disturbed areas like rights of way. Fourteen

populations occur, at least in part, in road or highway rights of way (USFWS 2020). Because of low past usage in rights of way across the country (i.e., less than 500 lbs of carbaryl used nationally each year), we expect minimal exposure to pollinators from rights of way uses for the prostrate milkweed. No reported carbaryl usage on rangelands has occurred in Texas, so we expect exposure from rangeland uses will also be very low.

We determined the species has a high toxicity ranking because it uses insects (i.e., bees and wasps) for pollination that would be killed by carbaryl exposure. Because the species relies on insect pollinators, is known to occur near agricultural fields, and we anticipate moderate carbaryl use to occur in the range, we expect adverse reproductive effects to the species from moderate losses of insect pollinators to cause species-level reproductive 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. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of prostrate milkweed in the wild.

References:

U.S. Fish and Wildlife Service. 2020. Species Status Assessment Report for Prostrate Milkweed (*Asclepias prostrata* W.H. Blackwell). Albuquerque, New Mexico. 77 pp.

Rationale for Species Conclusion: Ocmulgee skullcap

Scientific Name:	Common Name:	Entity ID:
Scutellaria ocmulgee	Ocmulgee skullcap	4284

Conclusion:

Ocmulgee skullcap is an endangered member of the mint family (Lamiaceae) restricted to calcium rich slopes along the Ocmulgee and Savannah River watersheds in Georgia and South Carolina. Populations are isolated and the forest structure is comprised of mixed-hardwood trees with partially open canopy to allow plants to reach maturity and produce viable seed. As of 2020, there are 19 extant populations: 13 in the Ocmulgee River and 6 in the Savannah River watershed. Populations are generally small, many with fewer than 20 individuals, and resilience of 16 out of 19 populations is low or very low. Historically, suitable habitat occupied by Ocmulgee skullcap has been lost or modified due to land conversion and development. Factors influencing Ocmulgee skullcap include white-tailed deer herbivory, habitat loss and fragmentation from urbanization and forest conversion, competition from non-native invasive species, and effects of climate change.

Ocmulgee skullcap begins flowering in late June, and seeds are released in the fall and usually overwinter from November through February. It may take two years for plants to become sexually mature and produce seeds. Seeds must be dislodged from the calyx of the parent plant through disturbance of the stem (e.g., wind, rain, animal activity, etc.). It reproduces sexually and is pollinated by bees, moths, butterflies, and sometimes flies and wasps. Over 35 pollinator species have been observed and bees are the most common. Ocmulgee skullcap populations may be experiencing reproductive concerns, with poor seed set noted. Low seed set may be a result of low pollinator visitation, which was observed for a similar congener *S. montana*. Small, isolated populations are less likely to be visited by pollinators due to the limited resources available to pollinators.

This species has a large percent overlap (25.5%) between spray drift areas from carbaryl use sites and its range and past usage data indicate that up to 9.2% of the species' range has been treated with carbaryl annually, indicating moderate to high levels of potential exposure and mortality of the pollinator community for this species. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with registered crops with the range of the species. It is known to occur in mixed hardwood forests near agricultural lands and forests managed for timber (USFWS 2020). There has been no carbaryl usage in managed forests in Georgia or South Carolina in the past, so we expect exposure of pollinators through forestry uses will be low.

We determined the species has a high toxicity ranking because it uses insects (i.e., bees, moths, butterflies, flies, and wasps) for pollination that would be killed by carbaryl exposure. Because the species relies on insect pollinators, is known to occur near agricultural fields, and we anticipate high carbaryl use to occur in the range, we expect adverse reproductive effects to the species from large losses of insect pollinators to cause species-level reproductive 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. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of Ocmulgee skillcap in the wild.

References:

U.S. Fish and Wildlife Service. 2020. Species Status Assessment Report for *Scutellaria ocmulgee* (Ocmulgee skullcap). Version 1.2. Atlanta, Georgia. 80 pp.

Rationale for Species Conclusion: Sand dune phacelia

Scientific Name:	Common Name:	Entity ID:
Phacelia argentea	Sand dune phacelia	7270

Conclusion:

Sand dune phacelia is in the forget-me-not family (Boraginaceae) and endemic to the southern Oregon and far northern California coasts. They require sand dune habitats with limited competition from invasive species, sunlight, water, and the presence of pollinating insects to complete its life cycle. Specifically, sand dune phacelia occurs on the open sand above the high tide line, further inland on semi-stabilized and open dunes, and on coastal bluffs. As of 2017, there are 26 populations with about 33,858 plants total. Individuals at two large sites, Bandon Preserve & Bandon Trails Golf Courses in Oregon, and the South Lake Tolowa Restoration site in California, comprise 89% of individuals. Conversely, nearly half of all populations across the range of the species (12 populations) consist of 25 or fewer individuals. Most populations are in low condition, and several have been extirpated. Threats to sand dune phacelia include actions that affect sediment delivery (e.g., damming rivers), competition with non-native invasive species, human activities (e.g., recreation, off-highway vehicles), and habitat loss and direct mortality from coastal development. Many remaining populations occur on public lands where protections are in place to limit direct mortality or habitat loss.

Reproduction is primarily by seeds and short rhizomes. Fruits are produced from June to August, with seeds dropping at maturity. The species appears to be largely incapable of self-pollination, relying on pollination by leafcutter bees (*Anthidium palliventre*), bumblebees (*Bombus* spp.), and honeybees (*Apis melifera*). Ants (*Formica* spp.) and beetles (unidentified species) may also pollinate sand dune phacelia.

The sand dune phacelia has a high percent overlap (17.3%) between spray drift areas from carbaryl use sites and its range and past usage data indicate up to 6.5% of the range has been treated with carbaryl annually, indicating moderate to high levels of potential exposure. While the species is not found on agricultural lands, they are found on nearby sand dunes, golf courses, county airports, road rights of way, and some lands grazed by livestock. No reported carbaryl usage on rangelands has occurred in Oregon or California, so we expect exposure from rangeland uses will also be very low. Because of low past usage in rights of way across the country (i.e., less than 500 lbs of carbaryl used nationally each year), we expect minimal exposure to pollinators from rights of way uses for the prostrate milkweed. Developed uses, including two populations that occur on golf courses where the species could be exposed to carbaryl.

We determined the species has a high toxicity ranking because it uses insects (i.e., leafcutter bees, bumblebees, and honeybees) for pollination that would be killed by carbaryl exposure. Sand dune phacelia relies on abiotic means for seed dispersal. Because the species relies on pollinators, occurs near agricultural fields and golf courses, and we anticipate high carbaryl use

to occur on the range, we expect adverse reproductive effects to the species from losses of insect pollinators to cause species-level reproductive 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. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of sand dune phacelia in the wild.

References:

U.S. Fish and Wildlife Service. 2021. Species Status Assessment Sand Dune Phacelia (*Phacelia argentea*). Portland, Oregon. 98 pp.