Integration and Synthesis Summary for Plants, CONUS

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 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, in order to reproduce successfully and maintain their populations over time. All species in these assessment groups are found inside the conterminous United States (CONUS).

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

Our assessment of vulnerability focuses on 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 B), 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

We anticipate plants and their pollinators will primarily be exposed to methomyl through direct contact, either as the result of exposure to pesticide applications on-field or through spray drift off-field. Methomyl 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 overlap data, past usage data, and any species-specific considerations such as life history information (e.g., habitat preferences, pollinator preferences) and existing protections or conservation actions. Species with greater than 10% overlap between their range and methomyl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with methomyl use sites, we considered past methomyl usage data within a species' range to determine how much of a species' range we expect to be treated with methomyl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the *Usage Analysis* section of this biological opinion. Species that data indicate will have a large portion of their range (>10%) treated with methomyl each year are assigned a high usage score. Species that will have a medium portion of their range (5-10%) treated with methomyl each year are assigned a medium usage score, and species that data indicate will have a low portion of their range (<5%) treated with methomyl each year are assigned a low usage score.

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

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to methomyl at levels estimated by EPA's environmental exposure modeling and is focused on determining the level of adverse effect expected to occur once exposure has taken place. Direct effects are based on the anticipated level of mortality and sublethal effects (e.g., reduced growth) likely to occur in exposed individuals. Indirect effects are based on the impact a listed species is likely to experience when the organisms they rely on, such as those that act as pollinators or seed dispersers, are exposed to methomyl 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 methomyl. In contrast, available toxicity data indicate that insects, including those that act as pollinators and seed dispersers for listed plants, are sensitive to methomyl 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 methomyl 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 methomyl exposure than insects. While methomyl exposure in birds and mammals can cause mortality under specific circumstances (e.g., by consuming exclusively contaminated food items on or adjacent to methomyl use sites) we do not expect methomyl 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

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

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the proposed registration of methomyl, and the cumulative effects, it is the Service's biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the plant species in this appendix .

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

Species with low concern of adverse effects

The species in **Table 1** are grouped together as they have low concern of adverse effects due to low exposure with low or medium vulnerability and variable toxicity. While we present some specific information about the species in **Table 1** below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Plant species in groups 5 and 9 (i.e., outcrossers with biotic pollination vectors) with low exposure informed by low total action area overlap

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total action area Overlap (%)	Determination
Acmispon dendroideus var. *traskiae (=Lotus d.* ssp. *traskiae)*	San Clemente Island lotus (=broom)	Medium	Low	High	0.1	No Jeopardy
Astragalus lentiginosus var. *coachellae*	Coachella Valley milk-vetch	Medium	Low	High	0.3	No Jeopardy
Chrysopsis floridana	Florida golden aster	Medium	Low	High	3.81	No Jeopardy
Cirsium wrightii	Wright's marsh thistle	Medium	Low	Medium	4.8	No Jeopardy
Conradina verticillata	Cumberland rosemary	Medium	Low	High	4.87	No Jeopardy
Deinandra (=Hemizonia) conjugens	Otay tarplant	Medium	Low	Medium	0	No Jeopardy
Dodecahema leptoceras	Slender-horned spineflower	Medium	Low	Medium	0.7	No Jeopardy
Eriastrum densifolium ssp. *sanctorum*	Santa Ana River woolly-star	Medium	Low	Medium	1	No Jeopardy
Eriogonum longifolium var. *gnaphalifolium*	Scrub buckwheat	Medium	Low	Medium	3.9	No Jeopardy
Eriophyllum latilobum	San Mateo woolly sunflower	Medium	Low	Medium	0.2	No Jeopardy
Galium buxifolium	Island bedstraw	Medium	Low	High	0	No Jeopardy

Scientific Name	**Common Name**	**Vulnerability Ranking**	**Exposure Ranking**	**Toxicity Ranking**	**Total action area Overlap (%)**	**Determination**
Helianthemum greenei	Island rush-rose	Medium	Low	High	0	No Jeopardy
Hesperolinon congestum	Marin dwarf-flax	Medium	Low	High	0.6	No Jeopardy
Hibiscus dasycalyx	Neches River rose-mallow	Medium	Low	High	2.06	No Jeopardy
Pediocactus despainii	San Rafael cactus	Medium	Low	High	2.46	No Jeopardy
Pediocactus winkleri	Winkler cactus	Medium	Low	High	0.49	No Jeopardy
Pentachaeta lyonii	Lyon's pentachaeta	Medium	Low	Medium	2.5	No Jeopardy
Physaria filiformis	Missouri bladderpod	Low	Low	High	4.3	No Jeopardy
Prunus geniculata	Scrub plum	Medium	Low	High	2.48	No Jeopardy
Sclerocactus brevihamatus ssp. *tobuschii*	Tobusch fishhook cactus	Low	Low	High	0.41	No Jeopardy
Sclerocactus mesae-verdae	Mesa Verde cactus	Medium	Low	High	4.12	No Jeopardy
Sclerocactus wrightiae	Wright fishhook cactus	Medium	Low	High	0.95	No Jeopardy
Townsendia aprica	Last Chance townsendia	Medium	Low	High	2.42	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 vulnerability of the species in Table 1 is low or medium. Our evaluation of the effects of the proposed action on these species indicates a low extent of exposure due to the low overlap of the action area within the range of these species. 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, many of the plants in Table 1 use abiotic vectors for seed dispersal and all plants in Table 1 can use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists) and are likely to recover more quickly from temporary losses of a small portion of the pollinator community.

While toxicity is high or medium for all species in Table 1, given that exposure is anticipated to be low (as demonstrated by the low percent overlap between the action area and species' ranges), the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is low. The total 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 methomyl usage. Thus, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to methomyl. Furthermore, because these species have low or medium vulnerabilities, they are more likely to be able to withstand additional stressors in their environment, including temporary declines in their pollinator and seed disperser populations in very small portions of their ranges from methomyl exposure.

As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from methomyl exposure, we do not expect that these adverse effects will cause species-level effects due to low expected exposure of pollinators and seed dispersers, the plant species' ability to withstand temporary declines in pollinator and seed dispersers in very small portions of their ranges, and reliance on a variety of pollinator species for successful reproduction. 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.

Species with low exposure (informed by low overlap with agriculture), high vulnerability, and medium or high toxicity

The species in Table 2, below are grouped together as they all have high vulnerability, medium or high toxicity, and low exposure informed by low overlap with agricultural sites where methomyl is registered for use. While we present some specific information about the species in Table 2 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 2. Plant species in groups 5 and 9 (i.e., outcrossers with biotic pollination vectors) with high vulnerability, medium or high toxicity, and low concern of adverse effects due to low exposure as informed by low overlap between the species' range and agricultural land uses where methomyl is registered for use.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total action area Overlap	Determination
Acanthomintha obovata ssp. *duttonii*	San Mateo thornmint	High	Low	High	1.1	No Jeopardy
Agalinis navasotensis	Navasota false foxglove	High	Low	High	0	No Jeopardy
Amsonia kearneyana	Kearney's blue-star	High	Low	Medium	0.14	No Jeopardy
Arctostaphylos confertiflora	Santa Rosa Island manzanita	High	Low	Medium	0.9	No Jeopardy
Arctostaphylos glandulosa ssp. *crassifolia*	Del Mar manzanita	High	Low	Medium	2.0	No Jeopardy
Arctostaphylos pallida	Pallid manzanita	High	Low	Medium	0.30	No Jeopardy
Argemone pleiacantha ssp. *pinnatisecta*	Sacramento prickly poppy	High	Low	Medium	0.4	No Jeopardy
Astragalus albens	Cushenbury milk-vetch	High	Low	High	0.1	No Jeopardy
Astragalus ampullarioides	Shivwits milk-vetch	High	Low	High	3.25	No Jeopardy
Astragalus holmgreniorum	Holmgren milk-vetch	High	Low	High	4.13	No Jeopardy
Astragalus humillimus	Mancos milk-vetch	High	Low	High	3.7	No Jeopardy

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

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total action area Overlap	Determination
Astragalus lentiginosus var. piscinensis	Fish Slough milk-vetch	High	Low	High	1.2	No Jeopardy
Astragalus montii	Heliotrope milk-vetch	High	Low	High	1.80	No Jeopardy
Astragalus osterhoutii	Osterhout milkvetch	High	Low	High	1.7	No Jeopardy
Berberis nevinii	Nevin's barberry	High	Low	Medium	0.9	No Jeopardy
Calystegia stebbinsii	Stebbins' morning-glory	High	Low	High	0.5	No Jeopardy
Castilleja ornata	Swale paintbrush	High	Low	High	0	No Jeopardy
Chamaecrista lineata keyensis	Big Pine partridge pea	High	Low	High	0.2	No Jeopardy
Chamaesyce deltoidea serpyllum	Wedge spurge	High	Low	High	0.2	No Jeopardy
Chorizanthe pungens var. hartwegiana	Ben Lomond spineflower	High	Low	Medium	0.8	No Jeopardy
Cirsium fontinale var. *fontinale*	Fountain thistle	High	Low	High	1.1	No Jeopardy
Coryphantha minima	Nellie cory cactus	High	Low	High	0.00	No Jeopardy
Coryphantha ramillosa	Bunched cory cactus	High	Low	High	0.05	No Jeopardy
Coryphantha robbinsiorum	Cochise pincushion cactus	High	Low	High	0.92	No Jeopardy
Crotalaria avonensis	Avon Park harebells	High	Low	High	2.3	No Jeopardy
Cryptantha crassipes	Terlingua Creek cat's-eye	High	Low	High	0.03	No Jeopardy
Cucurbita okeechobeensis ssp. *okeechobeensis*	Okeechobee gourd	High	Low	High	0	No Jeopardy
Deeringothamnus pulchellus	Beautiful pawpaw	High	Low	Medium	1.67	No Jeopardy
Delphinium bakeri	Baker's larkspur	High	Low	Medium	3.3	No Jeopardy
Dudleya cymosa ssp. *marcescens*	Marcescent dudleya	High	Low	High	2.0	No Jeopardy

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

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total action area Overlap	Determination
Dudleya cymosa ssp. ovatifolia	Santa Monica Mountains dudleyea	High	Low	High	0.4	No Jeopardy
Dudleya verityi	Verity's dudleya	High	Low	High	2.00	No Jeopardy
Echinocactus horizonthalonius var. *nicholii*	Nichol's Turk's head cactus	High	Low	High	0.76	No Jeopardy
Echinocereus chisoensis var. chisoensis	Chisos Mountain hedgehog Cactus	High	Low	High	0.00	No Jeopardy
Echinocereus fendleri var. *kuenzleri*	Kuenzler hedgehog cactus	High	Low	High	2.34	No Jeopardy
Echinocereus viridiflorus var. *davisii*	Davis' green pitaya	High	Low	High	0.00	No Jeopardy
Echinomastus erectocentrus var. acunensis	Acuña Cactus	High	Low	High	0.2	No Jeopardy
Echinomastus mariposensis	Lloyd's Mariposa cactus	High	Low	High	0.07	No Jeopardy
Eriogonum codium	Umtanum Desert buckwheat	High	Low	High	1.5	No Jeopardy
Eryngium aristulatum var. *parishii*	San Diego button-celery	High	Low	Medium	0.3	No Jeopardy
Eryngium sparganophyllum	Arizona eryngo	High	Low	High	3.7	No Jeopardy
Erysimum teretifolium	Ben Lomond wallflower	High	Low	High	0.8	No Jeopardy
Fremontodendron californicum ssp. *decumbens*	Pine Hill flannelbush	High	Low	High	0.8	No Jeopardy
Gilia tenuiflora ssp. *hoffmannii*	Hoffmann's slender-flowered gilia	High	Low	Medium	0.7	No Jeopardy
Harrisia (=Cereus) aboriginum (=gracilis)	Aboriginal Prickly-apple	High	Low	High	1.8	No Jeopardy
Ipomopsis polyantha	Pagosa skyrocket	High	Low	Medium	3.6	No Jeopardy

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

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total action area Overlap	Determination
Ivesia webberi	Webber Ivesia	High	Low	Medium	1.5	No Jeopardy
Lasthenia burkei	Burke's goldfields	High	Low	High	1.6	No Jeopardy
Lasthenia conjugens	Contra Costa goldfields	High	Low	High	2.7	No Jeopardy
Layia carnosa	Beach layia	High	Low	Medium	3.9	No Jeopardy
Lepidium barnebyanum	Barneby ridge-cress	High	Low	High	1.59	No Jeopardy
Lessingia germanorum (=L.g. var. germanorum)	San Francisco lessingia	High	Low	High	1.0	No Jeopardy
Liatris ohlingerae	Scrub blazingstar	High	Low	Medium	2.20	No Jeopardy
Lithophragma maximum	San Clemente Island woodland-star	High	Low	High	0.3	No Jeopardy
Lupinus aridorum	Scrub lupine	High	Low	High	1.02	No Jeopardy
Malacothrix indecora	Santa Cruz Island malacothrix	High	Low	High	0.9	No Jeopardy
Pentachaeta bellidiflora	White-rayed pentachaeta	High	Low	High	1.7	No Jeopardy
Phacelia argillacea	Clay phacelia	High	Low	High	0.82	No Jeopardy
Phacelia formosula	North Park phacelia	High	Low	High	0.71	No Jeopardy
Phlox nivalis ssp. *texensis*	Texas trailing phlox	High	Low	Medium	0.30	No Jeopardy
Physaria obcordata	Dudley Bluffs twinpod	High	Low	High	3.35	No Jeopardy
Plagiobothrys hirtus	Rough popcornflower	High	Low	High	1.3	No Jeopardy
Polygonella basiramia	Wireweed	High	Low	Medium	2.79	No Jeopardy
Polygonella myriophylla	Sandlace	High	Low	Medium	1.85	No Jeopardy
Potentilla hickmanii	Hickman’s potentilla	High	Low	High	3.4	No Jeopardy
Purshia (=Cowania) subintegra	Arizona Cliff-rose	High	Low	Medium	0.92	No Jeopardy

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

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total action area Overlap	Determination
Schoenocrambe barnebyi	Barneby reed-mustard	High	Low	High	1.03	No Jeopardy
Sclerocactus wetlandicus	Uinta Basin hookless cactus	High	Low	High	4.4	No Jeopardy
Senecio layneae	Layne's butterweed	High	Low	High	0.2	No Jeopardy
Streptanthus albidus ssp. *albidus*	Metcalf Canyon jewelflower	High	Low	High	2.10	No Jeopardy
Streptanthis bracteatus	Bracted twistflower	High	Low	Medium	3.4	No Jeopardy
Trifolium trichocalyx	Monterey clover	High	Low	High	0.1	No Jeopardy
Trillium persistens	Persistent trillium	High	Low	High	3.10	No Jeopardy
Verbena californica	Red Hills vervain	High	Low	High	0.7	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 2 are high. Our evaluation of the effects of the proposed action on these species indicates a low extent of exposure due to the low overlap of the action area within the range of these species. 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, many 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 and seed dispersal (i.e., pollinator generalists) and are likely to recover more quickly from temporary losses of a small portion of their pollinating insect species. The few species that use a specialized pollinator, such as the Cochise pincushion cactus, Chisos Mountain hedgehog cactus, and Acuna cactus, all have overlaps of less than 1%. As such, even though they cannot rely on multiple pollinator species, the extent of methomyl exposure is so small, it is not likely to cause appreciable reductions in the pollinator communities of these species.

A few species, such as Baker’s larkspur and Kearney’s bluestar, use birds for pollination, thus decreasing the likelihood of adverse effects to their reproduction as birds are less sensitive to methomyl exposure as explained in the Effects of the Action section.

While all species listed in Table 2 have high vulnerability rankings and toxicity is high or medium, given that exposure is anticipated to be low (as demonstrated by the low percent overlap between the action area and species’ ranges), the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is low. Furthermore, the total 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 methomyl usage. Thus, while these species' vulnerability and toxicity rankings may be high, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to methomyl.

As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from methomyl exposure, we do not expect that these adverse effects will cause species-level effects due to low expected exposure to methomyl, 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.

Species with low exposure (confirmed by low past usage from USDA Census of Agriculture), high vulnerability, and medium or high toxicity

The species in Table 3 are grouped together as they all have low exposure (% range treated) confirmed by low levels of past insecticide usage within their ranges, as informed by the USDA's Census of Agriculture (CoA) data. While we present some specific information about the species in Table 3 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Plant species in groups 5 and 9 (i.e., outcrossers with biotic pollination vectors) with high vulnerability, medium or high toxicity, and low concern of adverse effects due to low exposure confirmed by low past methomyl usage according to the U.S. Department of Agriculture's Census of Agriculture data.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Agalinis acuta	Sandplain gerardia	Low	Low	High	0.9	No Jeopardy
Amorpha crenulata	Crenulate lead-plant	High	Low	High	2.9	No Jeopardy
Arabis georgiana	Georgia rockcress	High	Low	High	4.2	No Jeopardy
Arabis serotina	Shale barren rock cress	Medium	Low	High	0.75	No Jeopardy
Argythamnia blodgettii	Blodgett's silverbush	High	Low	High	2.9	No Jeopardy
Astragalus bibullatus	Guthrie's (=Pyne's) ground-plum	High	Low	High	1.8	No Jeopardy
Astragalus robbinsii var. *jesupi*	Jesup's milk-vetch	High	Low	High	0.2	No Jeopardy
Baptisia arachnifera	Hairy rattleweed	Medium	Low	Medium	0.53	No Jeopardy
Brickellia mosieri	Florida brickell-bush	High	Low	High	2.9	No Jeopardy
Callirhoe scabriuscula	Texas poppy-mallow	High	Low	High	3.6	No Jeopardy
Chamaesyce deltoidea pinetorum	Pineland sandmat	High	Low	High	2.9	No Jeopardy
Chromolaena frustrata	Cape Sable Thoroughwort	High	Low	Medium	1.5	No Jeopardy

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

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Conradina etonia	Etonia rosemary	Medium	Low	High	1.49	No Jeopardy
Conradina glabra	Apalachicola rosemary	High	Low	Medium	0.9	No Jeopardy
Dicerandra cornutissima	Longspurred mint	High	Low	High	3.5	No Jeopardy
Galactia smallii	Small's milkpea	High	Low	High	2.9	No Jeopardy
Hackelia venusta	Showy stickseed	High	Low	High	2.5	No Jeopardy
Helenium virginicum	Virginia sneezeweed	Medium	Low	High	1.65	No Jeopardy
Lesquerella congesta	Dudley Bluffs bladderpod	High	Low	High	3.8	No Jeopardy
Linum carteri carteri	Carter's small-flowered flax	High	Low	Medium	2.9	No Jeopardy
Marshallia mohrii	Mohr's Barbara button	Medium	Low	Medium	2.63	No Jeopardy
Mirabilis macfarlanei	MacFarlane's four-o'clock	High	Low	Medium	0.9	No Jeopardy
Oxytropis campestris var. *chartacea*	Fassett's locoweed	Medium	Low	High	3.9	No Jeopardy
Phacelia submutica	DeBeque phacelia	Medium	Low	High	1.71	No Jeopardy
Sarracenia rubra ssp. *alabamensis*	Alabama canebrake pitcher-plant	High	Low	Medium	2.5	No Jeopardy
Sclerocactus glaucus	Colorado hookless cactus	Low	Low	Medium	3.5	No Jeopardy
Sclerocactus brevispinus	Pariette cactus	High	Low	High	3.6	No Jeopardy
Sidalcea oregana var. *calva*	Wenatchee Mountains checkermallow	High	Low	High	2.1	No Jeopardy
Solidago houghtonii	Houghton's goldenrod	Low	Low	Medium	3.08	No Jeopardy
Spiranthes diluvialis	Ute ladies'-tresses	Medium	Low	Medium	2.04	No Jeopardy

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Thymophylla tephroleuca	Ashy dogweed	High	Low	High	1.0	No Jeopardy
Xyris tennesseensis	Tennessee yellow-eyed grass	High	Low	Medium	2.6	No Jeopardy

All the species listed in Table 3 have high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capability of individuals from methomyl 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, many of the plants in Table 3 use abiotic vectors for some or all seed dispersal and all 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 all species listed in Table 3 have high vulnerability rankings and toxicity is high or medium, we anticipate only a small number of individuals are likely to be exposed to methomyl given the low insecticide usage in the past across their ranges. Low CoA usage indicates that very little insecticide usage (of any type) occurred in the past in the counties where these species' ranges occur. Given that this reporting broadly includes all insecticide usage, we consider CoA data to be conservative estimates of methomyl usage that indicate very little of the species' ranges are likely to be treated. Thus, while these species' vulnerability and toxicity rankings may be high, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to methomyl.

As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from methomyl exposure, we do not expect that these adverse effects will cause 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.

Species with low exposure (informed by low past usage from the California Department of Pesticide Regulation, CalPUR), high vulnerability, and medium or high toxicity

The species in Table 4 are grouped together because they all occur completely within California and they all have low exposure rankings determined by low levels of past usage within their ranges (% range treated), as informed by the California Department of Pesticide Regulation. While we present some specific information about the species in Table 4 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 4. Plant species in groups 5 and 9 (i.e., outcrossers with biotic pollination vectors) with high vulnerability, medium or high toxicity, and low exposure (confirmed by low past usage from California Department of Pesticide Regulation (CalPUR) data).

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Amsinckia grandiflora	Large-flowered fiddleneck	High	Low	High	0.22	No Jeopardy
Arctostaphylos morroensis	Morro manzanita	High	Low	Medium	0.2	No Jeopardy
Arctostaphylos myrtifolia	Ione manzanita	High	Low	Medium	0.0	No Jeopardy
Astragalus magdalenae var. peirsonii	Peirson's milk-vetch	High	Low	High	0.0	No Jeopardy
Blennosperma bakeri	Sonoma sunshine	High	Low	High	0.0	No Jeopardy
Calochortus tiburonensis	Tiburon mariposa lily	High	Low	High	0.0	No Jeopardy
Castilleja affinis ssp. *neglecta*	Tiburon paintbrush	High	Low	Medium	0.1	No Jeopardy
Cordylanthus mollis ssp. *mollis*	Soft bird's-beak	High	Low	Medium	0.0	No Jeopardy
Cordylanthus palmatus	Palmate-bracted bird's beak	High	Low	Medium	1.4	No Jeopardy
Cordylanthus tenuis ssp. *capillaris*	Pennell's bird's-beak	High	Low	Medium	0.0	No Jeopardy
Deinandra increscens ssp. *villosa*	Gaviota Tarplant	High	Low	Medium	0.2	No Jeopardy

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

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Eremalche kernensis	Kern mallow	High	Low	High	1.4	No Jeopardy
Erysimum capitatum var. *angustatum*	Contra Costa wallflower	High	Low	High	4.5	No Jeopardy
Holocarpha macradenia	Santa Cruz tarplant	High	Low	Medium	1.8	No Jeopardy
Limnanthes vinculans	Sebastopol meadowfoam	High	Low	Medium	0.0	No Jeopardy
Lupinus constancei	Lassic's lupine	High	Low	High	0.4	No Jeopardy
Lupinus nipomensis	Nipomo Mesa lupine	High	Low	High	2.9	No Jeopardy
Pseudobahia bahiifolia	Hartweg's golden sunburst	High	Low	Medium	0.0	No Jeopardy
Oenothera deltoides ssp. *howellii*	Antioch Dunes evening-primrose	High	Low	High	4.5	No Jeopardy
Opuntia treleasei	Bakersfield cactus	High	Low	High	1.2	No Jeopardy
Mimulus fremontii var. *vandenbergensis*	Vandenberg monkeyflower	High	Low	High	0.8	No Jeopardy
Phlox hirsuta	Yreka phlox	High	Low	Medium	0.0	No Jeopardy
Pseudobahia peirsonii	San Joaquin adobe sunburst	Medium	Low	High	0.4	No Jeopardy

The species listed in Table 4 have high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capability of individuals from methomyl 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, many of the plants in Table 4 use abiotic vectors for some or all seed dispersal and most plants in Table 4 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 their pollinating insect species.

While all species listed in Table 4 have high vulnerability rankings and toxicity is high or medium, we anticipate only a small number of individuals are likely to be exposed to methomyl given the low methomyl usage in the past across their ranges. Mandatory pesticide usage reporting data collected by the state of California indicates very little methomyl has been used in the agricultural sections where these species' ranges occur. Given that reporting of pesticide usage in agricultural areas is mandated by the state of California and that data are available with relatively high spatial resolution, we have high confidence that these species will experience, at most, low exposure to methomyl as a result of the proposed action. Thus, while these species' vulnerability and toxicity rankings may be high, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to methomyl.

As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from methomyl exposure, we do not expect that these adverse effects will cause 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 4.

Species with medium exposure, low or medium vulnerability, and medium toxicity

We group species together that have a medium exposure ranking and low vulnerability. Because Price's potato-bean is the only species in this group, an individual rationale is provided below. While we present some specific information about the species in Table 5 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 5. Plant species in groups 5 and 9 (i.e., outcrossers with biotic pollination vectors) with medium exposure, low or medium vulnerability, and medium toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Determination
Apios priceana	Price's potato-bean	Low	Medium	Medium	No Jeopardy

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 4 states. The species continues to have a limited distribution with isolated populations. Threats to the species—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 are necessarily subject to all the above threats, insect herbivory and competition via invasive species continue to be ubiquitous, adverse influences. Furthermore, emerging threats—from feral hogs and herbicide overspray—have been observed near or directly impacting a number of populations.

A recent study found multiple bee species (such as bumblebees 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 in order to reproduce successfully, and therefore relies on healthy pollinator communities within its range. Considering reports of widespread declines in North American bumblebee populations, reliance of Price's potato-bean upon a suite of pollinating bees might buffer potential impacts of individual bumblebee 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 (22%) between the action area but past usage data indicate that only up to 2.3% of the species' range has been treated with methomyl annually. While there is a low level of usage expected, given the uncertainties associated with this usage data and the high percent overlap, we determined the species has a medium exposure ranking. Price's potato-bean has a medium toxicity ranking 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.).

We anticipate minimal 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 methomyl exposure. However, we do not anticipate these adverse effects will cause species-level effects due to the minimal exposure, the species' ability to rely on a variety of pollinator species, and lack of adverse effects to 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 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 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.

Species with Individual Integration and Synthesis summaries

For the species in Table 6, our preliminary vulnerability, exposure, and toxicity rankings indicated 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 below. 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 6. Plant species in groups 5 and 9 (i.e., outcrossers with biotic pollination vectors) with moderate to high adverse effects anticipated from the proposed action. We addressed each species in individual Integration and Synthesis summaries.

Scientific Name	Common Name	Determination
Astrophytum asterias	Star cactus	No Jeopardy
Silene spaldingii	Spalding's catchfly	No Jeopardy
Asimina tetramera	Four-petal pawpaw	No Jeopardy
Cereus eriophorus var. *fragrans*	Fragrant prickly-apple	No Jeopardy
Dicerandra immaculata	Lakela's mint	No Jeopardy
Echinocereus reichenbachii var. *albertii*	Black lace cactus	No Jeopardy
Macbridea alba	White birds-in-a-nest	No Jeopardy
Solidago shortii	Short's goldenrod	No Jeopardy
Abronia macrocarpa	Large-fruited sand-verbena	No Jeopardy
Cirsium pitcheri	Pitcher's thistle	No Jeopardy
Platanthera leucophaea	Eastern prairie fringed orchid	No Jeopardy
Warea amplexifolia	Wide-leaf warea	No Jeopardy
Hymenoxys herbacea	Lakeside daisy	No Jeopardy
Ayenia limitaris	Texas ayenia	No Jeopardy
Platanthera praeclara	Western prairie fringed orchid	No Jeopardy
Lupinus sulphureus ssp. *kincaidii*	Kincaid's lupine	No Jeopardy
Leavenworthia crassa	Fleshy-fruit gladecress	No Jeopardy
Physaria globosa	Short's bladderpod	No Jeopardy
Helianthus verticillatus	Whorled sunflower	No Jeopardy
Lepidium papilliferum	Slickspot peppergrass	No Jeopardy
Lysimachia asperulaefolia	Rough-leaved loosestrife	No Jeopardy
Dalea carthagenensis floridana	Florida prairie-clover	No Jeopardy
Aeschynomene virginica	Sensitive joint-vetch	No Jeopardy
Physaria douglasii ssp. *tuplashensis*	White Bluffs bladderpod	No Jeopardy
Asclepias prostrata	Prostrate milkweed	No Jeopardy

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

Scientific Name	Common Name	Determination
Scutellaria ocmulgee	Ocmulgee skullcap	No Jeopardy
Phacelia argentea	Sand dune phacelia	No 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 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 there is overlap of agricultural use sites with the range of this species, 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).

While the star cactus depends on a few specific pollinator species 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 effects to its insect or avian seed dispersers to cause appreciable adverse effects to the reproductive capacity of this species.

While we anticipate minimal adverse effects from small losses of insect pollinators, including the cactus-specialist bees this species relies upon, we do not anticipate these adverse effects will cause species-level effects due to the lack of 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 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 star cactus.

References:

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

Preliminary 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 a hard time traversing 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, among others. (USFWS 2020).

Apios priceana flowers from mid-July through mid-August and produces fruit from August through September. Flowers are pollinated by bumblebees and honeybees 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 bumblebee) 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 spray drift areas of several methomyl use sites, primarily wheat (32% of the range) and vegetables and ground fruit (9% of the range) (Kern et al. 2023). Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of this species.

Pre-existing limitations on the species' reproductive capacity is likely to be exacerbated by loss of insect pollinators from exposure to methomyl. As this species only relies on a relatively narrow spectrum of pollinator species (*Bombus fervidus* and potentially two other *Bombus* spp.), a moderate decline in the populations of these species is likely to have a disproportionately large effect on the reproductive capacity of the Spalding's catchfly because it cannot use other members of the local pollinator community for pollination and therefore successful reproduction. Given the high exposure ranking and medium toxicity ranking for this species, we anticipate moderate adverse effects to this species due to the reduction in pollinating insects that would result in reduced reproductive success.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the Spalding's catchfly to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Spalding's catchfly.

References:

Kern, M., Kay, S., Christian, D., and Tandy, E. 2023. Methomyl Effects Assessment of the Spalding's Catchfly (*Silene spaldingi*) for Risk Management of Methomyl Agricultural Uses. TKI-2023-EAM-026. 34 pp.

U.S. Fish and Wildlife Service. 2020. 5-Year Review Spaldings catchfly (*Silene spaldingii*). Boise, Idaho. 48 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 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 traversing 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, 44.7%, between the action area and range, and past usage data indicate that up to 10.2% of the species' range has been treated with methomyl annually), 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 methomyl exposure to the beetles this species relies on for 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.

This plant relies on birds and mammals for seed dispersal. As explained in the Effects of the Action section, it is not likely that methomyl 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 species-level effects due to the lack of 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 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 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, Florida. 34 pp.

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

Rationale for Species Conclusion: Fragrant prickly-apple

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

Preliminary Conclusion:

The fragrant prickly-apple is a cactus endemic to the Atlantic Coastal Ridge of Florida in an area approximately 10 miles long and half a mile wide. 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 methomyl. As this species only relies on a relatively narrow spectrum of pollinator species (sphynx moths and possibly beetles), a moderate decline in the populations of the species 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. Given the medium exposure ranking (16% overlap of methomyl use sites with the range and up to 2.6% of the range treated annually in the past; exposure to pollinators on agricultural crops is expected to be minimal as there is very low on-field overlap (0.1%) with methomyl registered crops and this minimal overlap is with crops that are not pollinator attractive) and high toxicity ranking for this species, we anticipate moderate adverse effects to this species due to the reduction in pollinating insects that would result in reduced reproductive success.

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 methomyl exposure from the proposed action would appreciably diminish the availability of bird, mammal, or reptile seed dispersers.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the fragrant prickly-apple to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the fragrant prickly-apple.

References:

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.

Rationale for Species Conclusion: Lakela's mint

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

Preliminary 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 bumblebees and non-native honeybees. Like all the species in this assessment group, they require pollen transfer between individual plants in order 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 bumblebees produce more viable seed than those pollinated by non-native honeybees. Plants pollinated by honeybees 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 bumblebee 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 (Lienert 2004; Spira 2001; Lennartson 2002, 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 is likely via gravity. As such, adverse effects to reproduction from loss of seed dispersers are not anticipated (USFWS 1999).

The Lakela's mint has a large percent overlap (25%) between the action area and its range, and past usage data indicate that up to 5% of the species' range has been treated with methomyl annually. Exposure to pollinators on agricultural crops is expected to be minimal as the vast majority of on-field overlap occurs with methomyl registered crops that are not pollinator attractive (all but 0.42% of the 6.3% on field overlap). While there is a low to moderate level of usage expected, given the uncertainties associated with this usage data and the high percent overlap, we determined the species has a medium exposure ranking. As a result, we anticipate a moderate reduction in the community of pollinating insects of this species. 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 methomyl.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the Lakela's mint to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of Lakela's mint.

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

U.S. Fish and Wildlife Service. 2019. Recovery Plan Amendment for Lakela's mint (*Dicerandra immaculata*). Vero Beach, Florida. 7 pp.

U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Atlanta, Georgia. 2172 pp.

Rationale for Species Conclusion: Black lace cactus

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

Preliminary 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 bumblebees, 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 Five 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 (25.4%) between spray drift areas of certain methomyl use sites and its range, and past usage data indicate that up to 2.7% of the species' range has been treated with methomyl annually. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of this species. While there is a low level of usage expected, given the uncertainties associated with this usage data and the high percent overlap, we determined the species has a medium exposure ranking. The black lace cactus has a high toxicity ranking because it uses primarily biotic vectors for its seed dispersal and relies on insects for pollination (such as bees, beetles, wasps, and ants). We anticipate moderate 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 moderate loss of insects within 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 moderate loss of reproductive success from pollinator mortality due to methomyl.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the black lace cactus to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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: White birds-in-a-nest

Scientific Name:	Common Name:	Entity ID:
Macbridea alba	White birds-in-a-nest	761

Conclusion:

The white birds-in-a-nest is threatened and endemic to Liberty, Bay, Gulf, and Franklin counties in the Florida panhandle. It is found in Gulf coastal lowlands near the mouth of the Apalachicola River, which provides grassy habitat on poorly drained, infertile soils that the species needs. As of 2008, there were an estimated 10,000 plant stems across the species' range in multiple populations, the highest density of which was found in Apalachicola National Forest. Eleven locations in Franklin County and 15 locations in Apalachicola are protected. In Apalachicola, occupied locations are also managed with prescribed fire. Populations occur on private lands and transportation rights-of-way, and they cannot reestablish after extirpation because they only survive dormancy for six months to a year. Several locations did not have plants during recent surveys or have been extirpated due to habitat loss and modification. Threats to the species include development, cattle grazing, effects of fire suppression like shrub encroachment, timbering, damage from *Endothenia hebesana* (moths), sea level rise, and catastrophic events. Herbicide use was formerly acknowledged as a threat, but we no longer view herbicides as a threat to white birds-in-a-nest because common practices for rights-of-way focus on mowing (USFWS 2020). We consider the white birds-in-a-nest to have low vulnerability, due to the relatively large number of individuals, threatened status, and 26 locations under protection.

The white birds-in-a-nest is hermaphroditic and capable of sexual and vegetative (i.e., rhizomal) reproduction. However, self-seeded individuals exhibit inbreeding depression. The species is believed to be pollinated exclusively by bumblebees because they were the only visitor large enough to contact the reproductive structures of the flowers. Seed dispersers are unknown and pollinator loss was not mentioned as a threat (USFWS 2020).

While the white birds-in-a-nest has a high toxicity ranking because it relies on a narrow range of insect species for pollination (i.e., bumblebees), we determined the species has a low exposure ranking due to the following factors and characteristics. First, the white birds-in-a-nest has a moderate percent overlap (5.86%) between the action area and its range, and past usage data indicate that only up to 1.3% of the species' range has been treated with methomyl. In addition, the species' habitat is considered infertile and poorly drained, making agricultural uses unlikely. Finally, the species exists in 26 locations where protections are in place and agricultural use of methomyl is also unlikely.

While we anticipate adverse reproductive effects from losses of insect pollinators in a small portion of the species' range, we do not anticipate these adverse effects will cause species-level effects due to the factors and characteristics described above. 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 white birds-in-a-nest.

References:

U.S. Fish and Wildlife Service. 2020. *Macbridea alba* (White birds-in-a-nest) 5-Year Review: Summary and Evaluation. Panama City, Florida. 23 pp.

Rationale for Species Conclusion: Short's goldenrod

Scientific Name:	Common Name:	Entity ID:
Solidago shortii	Short's goldenrod	835

Conclusion:

Short's goldenrod is a rare, perennial plant that grows in shallow, clay soils and produces bright yellow flowers from mid-August to October. The species occupies a very restricted range in dry, upland, mostly open habitats of a few counties in Kentucky, and the dry limestone ledges along the Blue River in Indiana. Historically, the species was associated with bison trails, and continues to occupy habitats along remnant bison traces. The number of occurrences has fluctuated over the last few decades due to extirpations and discovery of new occurrences, but currently stands at 20 extant occurrences, eight of which occur on protected lands. The primary threat to the species continues to be encroachment from invasive plants (USFWS 2023).

While specific pollinators have not been documented, a variety of species of native sweat bees and blister beetles have been observed on Short's goldenrod flowers, indicating the species is likely to use a variety of insect species for pollination, thus it can rely on other members of the local pollinator community for pollination if there is a temporary decline in the number of pollinators due to methomyl use. Seed dispersal occurs by wind, and as such, we do not anticipate loss of seed dispersal capacity of this species from methomyl exposure. The species demonstrates a high percentage of seeds viable for germination, suggesting there is not a pre-existing decline in the reproductive capacity of this species due to loss of pollination (USFWS 2023).

The Short's goldenrod has a large percent overlap (27.2%) between the action area and its range, and past usage data indicate that up to 5.8% of the species' range has been treated with methomyl annually. 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 a high exposure ranking, thus we anticipate a large loss of the pollinator community within the range of the species.

Though we anticipate a temporary loss of pollinators within the range, we anticipate low adverse reproductive effects to the species as it produces a high number of viable seeds, can depend on a variety of insect species for pollination, uses wind for seed dispersal, and more than a third of its occurrences are on protected lands where methomyl use is unlikely. As such, we do not anticipate species-level reproductive effects to the species from loss of insect pollinators due to methomyl exposure. 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 Short's goldenrod.

References:

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

Rationale for Species Conclusion: Large-fruited sand-verbena

Scientific Name:	Common Name:	Entity ID:
Abronia macrocarpa	Large-fruited sand-verbena	872

Conclusion:

Large-fruited sand verbena is an herbaceous perennial in the Four o'clock family endemic to three counties in East-central Texas (Freestone, Leon, and Robertson). Nine documented wild populations remain extant, with plant abundance ranging from an estimated 61 to 30,000 individuals across the range. As of 2022, two reintroduced populations were surveyed and confirmed to be persistent populations. While seven other reintroduced populations have been created it is not clear if they currently persist. The last survey of reintroduced populations shows they range in plant abundance from two to 90 individuals. Propagation and reintroduction efforts continue (USFWS 2022).

Primary threats (or stressors) to the large-fruited sand verbena include destruction and modification of habitat including clearing of vegetation for oil and gas pipeline projects and residential development within habitat; conversion of native grassland to improved pastures of introduced grasses; conversion of open grassland to woodland or food plots; and over-stocking of grazing animals. Additionally, other incompatible land use practices (based on the species biology) include herbicide application from October to April; and broad-scale insecticide use (which could kill pollinators). Currently, no populations are under any binding conservation agreement for legal protection and the species still faces moderate threats (USFWS 2022).

Large-fruited sand-verbena flowers open in the late afternoon and stay open all night until 9:00 or 10:00 am the next morning. They produce a strong sweet aroma resembling honeysuckle that increases until early evening. Likely pollinators include a variety of species of nocturnal sphynx and Noctuid moths. In addition, some diurnal floral visitors such as bees, bumblebees, and butterflies may pollinate the species, though it is yet to be determined whether there is successful fruit and seed set after visits by these species. In addition, the species is documented to be self-incompatible, illustrating how important the presence of insect pollinators are to the successful reproduction of this species. Recent Service documents mention limited seed dispersal range but do not discuss seed dispersal vectors, thus, to be conservative, we assume insects play a role in seed dispersal (USFWS 2022).

The overlap of the action area and the species' range is 9.1%. However, past usage data indicate that only up to 0.7% of the species' range has been treated with methomyl annually. While there is a low level of usage expected, given the uncertainties associated with this usage data and the medium percent overlap, we determined the species has a medium exposure ranking, indicating we anticipate a loss of insect pollinators and seed dispersers in a moderate portion of the range. However, we anticipate low adverse reproductive effects to the species due to its reliance on a variety of pollinator species for successful reproduction. 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 large-fruited sand verbena.

References:

U.S. Fish and Wildlife Service. 2022. Large-fruited sand verbena (*Abronia macrocarpa*) 5-Year Review: Summary and Evaluation. Houston, Texas. 45 pp.

Rationale for Species Conclusion: Pitcher's thistle

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

Preliminary Conclusion:

This distinctive dune plant, often referred to as the 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 (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: 182 in Michigan, 24 in Indiana, 11 in Wisconsin, and 5 in Illinois. Over the last 10 years this species has remained stable in Michigan, stable to slightly increasing in Canada, declining >50% in Indiana, and stable to declining <25% in Wisconsin. The highest ranked occurrences are on large, intact, active dunes (USFWS 2023).

Pitcher's thistle relies on insects for pollination, and like all species in this appendix, they require pollen transfer between individual plants in order to reproduce successfully and therefore rely on healthy pollinator communities within their range. The pollinator type may also be critical to the success of a Pitcher's thistle population. One study found a total of 14 insect families were observed 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 as compared to other species (USFWS 2023).

Seed dispersal is accomplished mainly by wind. As such, adverse effects to reproduction from loss of seed dispersers are not anticipated (USFWS 2002).

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 methomyl exposure in a large portion of the range (the overlap of spray drift areas from methomyl use sites with the species range is 54.6% and past usage data indicate that up to 19.7% of the species' range has been treated with methomyl annually; exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species). The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction, particularly bees. A significant loss of pollinators within almost a quarter 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. For these reasons, we anticipate adverse, species-level effects in the form of high loss of reproductive success from pollinator mortality due to methomyl exposure.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the Pitcher's thistle to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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: Eastern prairie fringed orchid

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

Preliminary 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. The species range entirely overlaps with the action area and the past usage data indicate that up to 14.5% of the species' range has been treated with methomyl annually. Exposure to pollinators on agricultural crops is expected to be minimal as a significant amount of on-field overlap occurs with methomyl registered crops that are not pollinator attractive, particularly to the moth pollinators of this species. Given past usage data and the high percent overlap of methomyl use sites, we determined the species has a high exposure ranking. The eastern prairie fringed orchid has a high toxicity ranking 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 for reproduction. A loss of insects within its range is likely to exacerbate existing reproductive deficiencies of this species due to its highly fragmented and restricted range. For these reasons, we anticipate adverse, species-level effects in the form of loss of reproductive success from pollinator mortality due to methomyl exposure.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the eastern prairie fringed orchid to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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

Preliminary 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. It 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 exposure ranking for wide-leaf warea is low based upon the 4.8% total overlap (0.8% of which is on field overlap) of methomyl use sites and its range and past usage data indicate that up to 3.5% of the species' range has been treated with methomyl annually. On field exposure to pollinators is expected to be minimal as there is very low (0.8%) on-field overlap with methomyl registered crops with the range of the species and some of this overlap is from crops that are not pollinator attractive. The plant relies on wind for seed dispersal. However, the species relies on biotic pollinators, specifically insects, making it generally more susceptible to adverse effects resulting from loss of pollinators. Because of the species high vulnerability, limited distribution, documented declines, and reliance on pollinators for reproduction, reductions in pollinators could be detrimental to the species.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the wide-leaf warea to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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: Lakeside daisy

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

Preliminary 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 range-wide population 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 pollinated by bumblebees (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 a flower disk. 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 (USFWS 2021).

The lakeside daisy has a high percent overlap (62.0%) between the action area and its range and past usage data indicate that up to 10.1% of the species' range has been treated with methomyl annually. Exposure to pollinators on agricultural crops is expected to be minimal as the vast majority of on-field overlap occurs with methomyl registered crops that are not pollinator attractive. We determined the species has a high exposure ranking and a medium toxicity ranking because it relies on insect species for pollination (i.e., bumblebees, carpenter bees, halictid bees, and possibly others).

We do not anticipate agricultural land uses on the species' habitat (i.e., flat limestone or dolostone bedrock with thin to no soil), but exposure is high and pollinators that the species requires use nearby lands, including agricultural lands where methomyl may be used. Therefore, we anticipate adverse effects from insect pollinator loss, including the bumblebees this species relies upon.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the lakeside daisy to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the lakeside daisy.

References:

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

Preliminary Conclusion:

Texas ayenia is 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 and the species is not protected by the government of Mexico. It has a high vulnerability as we identified listing status, distribution, known pesticide threats, and known pollinator threats as areas of high concern for the species. The primary threat to its existence is loss of habitat due to agricultural and urban development, especially in the three unprotected populations on private lands. This species relies on unknown insects for pollination, and like all species in this assessment group, requires pollen transfer between individual plants in order to reproduce successfully and therefore relies on sufficient pollinator populations within its range. Insects are expected to experience significant mortality within the range of this species from exposure to methomyl from application on agricultural use sites and in areas subject to spray drift from these sites. We anticipate adverse effects to this species due to the reduction in pollinating insects that would result in reduced reproductive success. The 2016 recovery plan for this species identifies 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 the need to minimize impacts from pesticide drift and runoff to prevent significant decline in this species’ status in the future.

Specific biotic seed dispersal species are unknown, though it may use a combination of biotic (insects, birds, and/or mammals) and abiotic (water) vectors for dispersal. As explained in the Effects of the Action section above, it is not likely that methomyl exposure from the proposed action would appreciably diminish the availability of bird or mammal seed dispersers. However, insect seed dispersal species are expected to experience losses due to methomyl exposure. Given that this species can rely on a variety of seed dispersal vectors, we do not anticipate effects to its insect seed dispersers to cause appreciable adverse effects to the reproductive capacity of this species.

Overlap of spray drift areas from certain methomyl use sites and the species range is high at 73.55% and based on past usage data we expect up to 15.7% of the species’ range will be treated with methomyl annually, especially for those populations that remain unprotected. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species. This species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction, especially given its restricted range and anticipated threat to local pollinator populations from pesticide use. We anticipate adverse effects from loss of insect pollinators and resultant loss of reproductive success from exposure to methomyl. While there is uncertainty regarding the specific insect pollinators that are important to this species, the species' limited geographic distribution, the high overlap and usage related to agricultural use sites necessitates a conservative evaluation of the likelihood of effects from methomyl use. Thus, we anticipate that adverse effects from methomyl use will cause high levels of insect pollinator mortality across the range of the species.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the Texas ayenia to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Texas ayenia.

References:

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 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).

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 hawk-moth (*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).

The western prairie fringed orchid has a high percent overlap (27.19%) between the action area and its range and past usage data indicate that up to 3.4% of the species' range has been treated with methomyl annually. However, this species is primarily found on protected land (82% of known individuals) and as such, we determined the species has a low exposure ranking. We determined the species has a medium toxicity ranking because it uses insect species for pollination (i.e., sphinx moths) that would be adversely affected by methomyl exposure, but its seed dispersal is through wind. We expect minimal adverse effects to the species from losses of insect pollinators due to low exposure of methomyl in its range. As such, we anticipate that adverse effects from insect pollinator loss, including the moths this species relies upon, will not cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the western prairie-fringed orchid.

References:

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

Preliminary 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 this time. Most of the species occurs on private lands. Primary threats to the species 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 this species 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 (42.0%) between the action area and its range, and past usage data indicate that up to 28% of the species' range has been treated with methomyl annually. Pollinators of Kincaid's lupine are likely to be attracted to certain blooming crops registered for methomyl use, and there is moderate overlap of the range with these on-field use sites (8.1%). We determined the species has a high toxicity ranking because it uses insect species for pollination (i.e., several species of bees) that would be adversely affected by methomyl exposure. We do not believe Kincaid's lupine relies on insects for seed dispersal. Because the species relies on insect pollinator species, agriculture occurs on or near suitable habitat areas (Kern et al. 2024), and we expect high usage to occur on the range, we anticipate adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for the Kincaid's lupine and its pollinators by >95% for terrestrial habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*
2. *Methomyl will not be applied from two hours after sunrise until two hours before sunset on mint and cucurbits. This measure will minimize on-field exposure to pollinators of the species during their most active foraging period. In addition, methomyl will not be applied within three days prior to bloom, during bloom, and until petal fall is complete on snap beans, peas, dry beans, chickpeas, fresh beans, and blueberries and all methomyl-registered crops in the 'other orchards' UDL in order to minimize exposure to pollinators attracted on field during bloom of these crops.*

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

After incorporating the specific conservation measures above, we expect exposure for the pollinators of Kincaid's lupine to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of Kincaid's lupine.

References:

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: 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; they also occur 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 and trend data is unavailable due to lack of monitoring. Five known populations occur on pasture lands, in planted fields surrounded by agriculture, or on power line rights-of-way. 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 their 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 generalist bees (a variety of 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 whether the species is experiencing in-breeding depression. Dispersal is 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 (28.71%) between the action area and its range but past usage data indicate that only up to 2.1% of the species' range has been treated with methomyl annually. As such, we expect a medium (or moderate) level of exposure to the species' pollinators and seed dispersers within the range. However, even though exposure may be moderate, we anticipate low adverse reproductive effects to the species from pollinator and seed disperser loss for the following reasons. First, the species can self-pollinate (self-compatible) and therefore is less dependent on insect pollinators for reproduction, and second, the species uses abiotic vectors for seed dispersal, so methomyl will not diminish the species' ability to disperse.

For the reasons listed above, we determined that adverse effects from the use of methomyl will not rise to the level of species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the fleshy-fruit gladecress.

References:

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 known from 33 extant sites, most of which have fewer than 100 individuals. Five 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 (USFW 2020). The Short's bladderpod is likely self-incompatible (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 (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 Short's bladderpods (USFWS 2021). Seed dispersal is believed to be completed through wind, water, gravity, and potentially ungulates (USFWS 2020).

Short's bladderpod has a high percent overlap (14.4%) between the action area and its range but past usage data indicate that only up to 1.7% of the species' range has been treated with methomyl annually. As such, we expect a medium (or moderate) level of exposure to the species' pollinators and seed dispersers within the range. However, even though exposure may be moderate, we anticipate low adverse reproductive effects to the species from pollinator and seed disperser loss for the following reasons. First, the species is found in forested areas and on or near calcareous outcrops of ledges and bluffs, where we do not expect agricultural uses of methomyl to occur, and second, the species likely uses abiotic vectors for seed dispersal, so methomyl will not diminish the species' ability to disperse.

For the reasons listed above, we determined that adverse effects from the use of methomyl will not rise to the level of species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the 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

Preliminary 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, and 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 3 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 at 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 (Coosa Valley Prairie). There is one known population in Mississippi, and it is the smallest one with only 3-4 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 along unplowed edges of cultivated crop fields and 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 (31.78%) between spray drift areas from methomyl use sites and its range and past usage data indicate that up to 2.1% of the species' range has been treated with methomyl annually. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species. We determined the species has a medium toxicity ranking because it uses insect species for pollination (i.e., long-horned bees) that would be adversely affected by methomyl exposure. 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 usage to occur on the range, we anticipate adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the whorled sunflower to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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 (67.64%) between the action area and its range and past usage data indicate that up to 23.3% of the species' range has been treated with methomyl annually. In addition, pollinators of slickspot peppergrass are likely to be attracted to certain blooming crops registered for methomyl use. These on-field use sites represent a portion of the total overlap with the action area, accounting for 8% of the species' range. We determined the species has a medium toxicity ranking because it uses insect species for pollination that would be adversely affected by methomyl 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 methomyl usage to occur within the range, we anticipate adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

1. *Methomyl must be applied using the following buffers: 320 feet for aerial applications, 105 feet for ground applications, and 160 feet for airblast applications. Based on AgDRIFT modeling, the buffers will reduce spray drift from entering habitat for the slickspot peppergrass and its pollinators by >95% for terrestrial habitat. These buffer distances may be reduced using other measures identified as equivalent mitigations (i.e., reducing spray drift by similar magnitude) as specified in EPA's Draft Insecticide Strategy and as described in Appendix A-1 of this Opinion.*
2. *Methomyl will not be applied from two hours after sunrise until two hours before sunset on mint. This measure will minimize on-field exposure to pollinators of the species during their most active foraging period. In addition, methomyl will not be applied within three days prior to bloom, during bloom, and until petal fall is complete on snap beans, peas, and dry beans and all methomyl-registered crops in the 'other orchards' UDL in order to minimize exposure to pollinators attracted on field during bloom of these crops.*

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the slickspot peppergrass to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the slickspot peppergrass.

References:

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: Rough-leaved loosestrife

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

Preliminary 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 since populations are highly fragmented, reducing the chances of cross pollination (outcrossing) by the few pollinators that are present. Low seed production within populations supports the conclusion that populations contain little to no genetic diversity. Since flowers are self- incompatible (cannot self-fertilize) and there appear to be few pollinators present, there is generally low seed production. 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 in order to reproduce successfully over time and therefore relies on healthy pollinator communities within its range, however, it can also reproduce using vegetative rhizomes. This species has a large percent overlap (31.5%) between spray drift areas from methomyl use sites and its range and past usage data indicate that up to 4.7% of the species' range has been treated with methomyl annually, indicating moderate levels of potential exposure. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species. The rough-leaved loosestrife has a high toxicity ranking 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 moderate loss of the pollinator community from methomyl exposure is likely to exacerbate the pre-existing deficit of pollinators, resulting in moderate decreases in pollination and reproductive capacity of 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 in the form of reduced reproductive success due to the reduction in pollinating insects that is likely to occur from methomyl exposure in a substantial portion of the range. We anticipate these adverse effects will cause species-level 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.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the rough-leaved loosestrife to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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: 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 are an estimated 980 individuals across 13 known extant occurrences, predominantly found in Miami-Dade County. 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 has increased since 2017. Abundance at Big Cypress National Park appear 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. Their seeds fall to the ground and can be dispersed short distances by wind.

The Florida prairie-clover has a high percent overlap (18.0%) between the action area and past usage data indicate that up to 6.9% of the species' range has been treated with methomyl annually. However, the species occurs primarily on protected lands (Big Cypress National Park, Everglades National Park, R. Hardy Matheson Preserve) and on areas that are unlikely to be near agriculture (Deering Estate, Crandon Park, Florida Department of Health and Rehabilitation Services, and the Florida Power and Light near Deering Estate) (Kern et al. 2024). As such, we anticipate that exposure to methomyl will be low. We determined the species has a medium toxicity ranking because it uses insect species for pollination that would be adversely affected by methomyl exposure. Florida prairie-clover relies on abiotic means for seed dispersal. Therefore, we expect minimal adverse effects to the species from losses of insect pollinators. We do not expect these adverse effects to cause species-level effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the 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: Sensitive joint-vetch

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

Preliminary 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 in a given year since 1991 have fluctuated between 1,580-24,073. Plants likely occur in fewer locations than in 1991, but population trends are unknown. Between 2007-2010, range-wide estimates were consistently between 5,800-7,600. 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).

Sensitive joint-vetch in greenhouses self-pollinated at a rate of 13%, but outcrossing also occurred and morphological and biological features typical of asexual reproduction were not observed for this plant. Bumblebees 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 (22.6%) between the action area and its range and we do not have past usage data for the species. Exposure to pollinators on agricultural crops is expected to be minimal as there is very low (0.1%) on-field overlap with methomyl registered crops with the range of the species. We determined the species has a high toxicity ranking because it uses insects (i.e., bumblebees) for pollination that would be adversely affected by methomyl 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 methomyl use to occur on the range, we expect adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the sensitive joint-vetch to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not 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: White Bluffs bladderpod

Scientific Name:	Common Name:	Entity ID:
Physaria douglasii ssp. tuplashensis	White Bluffs bladderpod	4565

Conclusion:

White Bluffs bladderpod is a short-lived, herbaceous perennial that occurs intermittently in a narrow, linear strip associated with highly alkaline, cemented calcium carbonate soil on the White Bluffs along the Columbia River in the State of Washington. The subspecies' habitat is limited to dry, sparsely vegetated upper and top exposures of the White Bluffs. Most of its current range and most individuals occur within its designated critical habitat, located on the Hanford Reach National Monument. Its narrow substrate requirements, short lifespan, and highly variable survival rates render it vulnerable, whereas its deep taproot, fecundity (it produces abundant seed), potential to bloom twice in a year, and short generation time confer resiliency (USFWS 2022).

The Hanford Reach Monument is owned by the U.S. Department of Energy but managed by the Service's Central Washington National Wildlife Refuge Complex. The subspecies once existed south and east of the Monument on State and private lands, but the status of these occurrences is unknown. Critical habitat (823 hectares) was designated at the time of listing and includes the White Bluffs plus adjacent shrub-steppe habitat, which creates an effective boundary or buffer around populations of approximately 300-350 meters (USFWS 2022; Stacy James, pers. comm. Washington Service Field Office 2024). Population monitoring began in 1995 and has occurred nearly annually. The estimated number of flowering plants has fluctuated greatly, from 2,529 to 58,887, oscillating around a relatively stable mean of approximately 24,300 individuals. Annual fluctuations are believed to be tied to environmental conditions, particularly precipitation and temperature (USFWS 2022). In addition to wild individuals, successful outplanting has occurred on the Monument. In 2020 the outplanting area had 151 surviving plants. None of the plants outplanted from 2013-2015 were still alive, so remaining individuals represent recruitment or successful experimental seeding (USFWS 2020).

The primary threats to the subspecies are wildfire and fire suppression activities, slope failure/landslides, recreational activities and/or off-road vehicle use, competition and fuels load from non-native plants, small population size, limited geographic range, and climate change. In the final listing rule, the Service determined, based on the best available information, that the agricultural use of pesticides and herbicides on lands adjacent to the range of the White Bluffs bladderpod was not a threat (USFWS 2013).

White Bluffs bladderpod is insect-pollinated and likely requires outcrossing to ensure successful reproduction, as do many species in the *Physaria* genus. Specific pollinator species are not mentioned (USFWS 2022). Seed dispersal is most prevalent near the parent plant by unknown vectors, though longer dispersal by wind and gravity are possible (Montana Natural Heritage Program 2024).

This species has a large percent overlap (11.7%) between the action area and its range and past usage data indicate that up to 7.9% of the species' range has been treated with methomyl annually, indicating moderate to large levels of potential exposure. While there is moderate to high potential for exposure of pollinators to methomyl and their resultant mortality, we determined there will be low adverse reproductive effects to the species for several reasons. First, the species is known to produce abundant seed, indicating that pollinators are available in the range and there is no pre-existing deficit. Second, almost all individuals occur within designated critical habitat and within the Hanford Reach National Monument where exposure from agricultural uses of methomyl are not expected to occur. In addition, the final listing rule determined pesticide use on agricultural fields adjacent to the range of the species is not a threat to the species or its pollinators. Furthermore, when critical habitat was designated, a built-in 'buffer' was added to the designated area of 300-350m, so drift of methomyl from adjacent agricultural fields is unlikely. Lastly, seed dispersal is likely through abiotic means, thus we do not anticipate reductions in the dispersal capacity of the species from methomyl use.

In summary, while we anticipate moderate to high exposure of pollinators of the species within its range, we anticipate low adverse reproductive effects to the species and do not anticipate these adverse effects will cause species-level effects for the reasons described above. 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 White Bluffs bladderpod.

References:

Montana Natural Heritage Program. 2024. Divide Bladderpod — *Physaria klausii*. Montana Field Guide. Retrieved on May 31, 2024, from https://FieldGuide.mt.gov/speciesDetail.aspx?elcode=PDBRA1N1Z0

U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Threatened Status for *Eriogonum codium* (Umtanum Desert Buckwheat) and *Physaria douglasii* subsp. *tuplashensis* (White Bluffs bladderpod) and Designation of Critical Habitat. 78 FR 76995-77005.

U.S. Fish and Wildlife Service. 2020. White Bluffs bladderpod (*Physaria douglasii* ssp. *tuplashensis*) 5-Year Review: Summary and Evaluation. Spokane, Washington. 14 pp.

U.S. Fish and Wildlife Service. 2022. Recovery Plan for White Bluffs bladderpod (*Physaria douglasii* subsp. *Tuplashensis*). Portland, Oregon. 31 pp.

Rationale for Species Conclusion: Prostrate milkweed

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

Preliminary Conclusion:

Prostrate milkweed is an 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, 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 unknown, 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 milkweeds are most effectively pollinated by large bees and wasps. Declines in prostrate milkweed may be related to the decline in pollinators.

This species has a large percent overlap (44.3%) between the action area and its range and past usage data indicate that up to 1.4% of the species' range has been treated with methomyl annually, indicating moderate levels of potential exposure. Exposure to pollinators on agricultural crops is expected to be minimal as the vast majority of on-field overlap occurs with methomyl registered crops that are not pollinator attractive. It is known to occur on and near agricultural lands, lands grazed by cattle, and disturbed areas like rights of way. We determined the species has a high toxicity ranking because it uses insects (i.e., bees and wasps) for pollination that would be adversely affected by methomyl exposure. Because the species relies on insect pollinators, is known to occur on and near agricultural fields, and we anticipate high methomyl use to occur on the range, we expect adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the prostrate milkweed to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the prostrate milkweed.

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

Preliminary Conclusion:

Ocmulgee skullcap is in the mint family (Lamiaceae) and is 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 (60.6%) between spray drift areas from methomyl use sites and its range and past usage data indicate that up to 12.2% of the species' range has been treated with methomyl annually, indicating moderate to high levels of potential exposure. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl 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. 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 adversely affected by methomyl exposure. Because the species relies on insect pollinators, is known to occur near agricultural fields, and we anticipate high methomyl use to occur near the range, we expect adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the Ocmulgee skullcap to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the Ocmulgee skullcap.

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

Preliminary 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 (18.7%) between spray drift areas from methomyl use sites and its range and we do not have past usage data for the species. Exposure to pollinators on agricultural crops is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species. While the species is not found on agricultural lands, they are found on nearby sand dunes, golf courses, county airports, and some lands grazed by livestock. 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 adversely affected by methomyl exposure. Sand dune phacelia relies on abiotic means for seed dispersal. Because the species relies on pollinators, occurs near agricultural fields, and we anticipate high methomyl use to occur on the range, we expect adverse effects to the species from losses of insect pollinators to cause species-level effects.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

After incorporation of the specific conservation measures above, we expect exposure for the pollinators of the sand dune phacelia to be low. Upon review of the current status of the listed species, environmental baseline for the action area, effects of the proposed action, cumulative effects, and species-specific conservation measures, it is our biological opinion that the registration of methomyl, as proposed, is not likely to jeopardize the continued existence of the sand dune phacelia.

References:

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