Integration and Synthesis Summary for Plants, CONUS

Monocot and dicot flowering plants that can use self-fertilization and/or vegetative methods for reproduction

Assessment Groups 6 & 10

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will "likely be adversely affected" by the proposed action. Our jeopardy analysis of the proposed action's impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine 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 6 & 10) rely on biotic pollination vectors, are capable of self-fertilization and/or vegetative reproduction and can use these methods 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, 5-year species status reviews, species recovery plans, species status assessments, and other sources containing the best available scientific information for the species.

We scored each of the 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 are high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions (As usage is a subset of overlap, the overlap score will always be greater than the usage score.) In cases where overlap is high, but usage is low, we anticipate a moderate portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. 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 die 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 die. 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.

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

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

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 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 6&10, 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

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 either 1) low exposure and low toxicity with high vulnerability or 2) 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 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) with low to high vulnerability, low to 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 ilicifolia	San Diego thornmint	Medium	Low	High	0.5	No Jeopardy
Arabis macdonaldiana	McDonald's rock-cress	Medium	Low	High	0.63	No Jeopardy
Boltonia decurrens	Decurrent false aster	Medium	Low	Medium	0	No Jeopardy
Bonamia grandiflora	Florida bonamia	Medium	Low	High	4.24	No Jeopardy
Brodiaea filifolia	Thread-leaved brodiaea	Medium	Low	Medium	0.5	No Jeopardy
Brodiaea pallida	Chinese Camp brodiaea	Medium	Low	High	0	No Jeopardy
Chorizanthe robusta var. *robusta*	Robust spineflower	Medium	Low	Low	0	No Jeopardy
Cirsium vinaceum	Sacramento Mountains thistle	High	Low	Low	0.35	No Jeopardy
Clitoria fragrans	Pigeon wings	Medium	Low	High	1.77	No Jeopardy
Cordylanthus maritimus ssp. *maritimus*	Salt marsh bird's-beak	Medium	Low	Medium	4.3	No Jeopardy
Cycladenia humilis var. *jonesii*	Jones Cycladenia	Medium	Low	Low	0.64	No Jeopardy
Erigeron rhizomatus	Zuni fleabane	Low	Low	High	0.23	No Jeopardy

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Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Fremontodendron mexicanum	Mexican flannelbush	Medium	Low	High	0	No Jeopardy
Lilaeopsis schaffneriana var. *recurva*	Huachuca water-umbel	Medium	Low	Medium	1.92	No Jeopardy
Lilium occidentale	Western lily	High	Low	Low	0.67	No Jeopardy
Navarretia fossalis	Spreading navarretia	Low	Low	Medium	2.8	No Jeopardy
Nolina brittoniana	Britton's beargrass	High	Low	Low	3.14	No Jeopardy
Polygala lewtonii	Lewton's polygala	Medium	Low	High	4.47	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the vulnerability of the species in Table 1 is low or medium (some are high, discussed below). 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 low, medium, or high for the plant species in this group. Low or medium toxicity is due mainly to their reliance on taxa other than insects for pollination, or a combination of taxa, and their use of abiotic vectors for seed dispersal (wind and/or water). High toxicity for a species is due mainly to their reliance on only insects for pollination and seed dispersal and/or reliance on specialized (i.e., a few) pollinator species.

While toxicity is variable for 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, the species with low or medium vulnerabilities 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. The species with high vulnerabilities in Table 1 have both low exposure and toxicity. As such, even though these species may be less likely to be able to withstand additional stressors in their environment, their likelihood of adverse effects in the small portion of the range where exposure is expected is low. Therefore, we anticipate a minimal level of adverse reproductive effects for all species in this group.

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 taxa 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

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 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) 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
Astragalus brauntonii	Braunton's milk-vetch	High	Low	High	0.2	No Jeopardy
Astragalus tener var. *titi*	Coastal dunes milk-vetch	High	Low	High	0.8	No Jeopardy
Chionanthus pygmaeus	Pygmy fringe-tree	High	Low	High	3.0	No Jeopardy
Clarkia franciscana	Presidio clarkia	High	Low	High	0.3	No Jeopardy
Coryphantha scheeri var. robustispina	Pima pineapple cactus	High	Low	High	1.7	No Jeopardy
Dalea foliosa	Leafy prairie-clover	Medium	Low	High	3.9	No Jeopardy
Dicerandra christmanii	Garrett's mint	High	Low	High	3.8	No Jeopardy
Dudleya abramsii ssp. *parva*	Conejo dudleya	High	Low	High	2.9	No Jeopardy
Echinacea laevigata	Smooth coneflower	Medium	Low	High	2.33	No Jeopardy
Eriodictyon altissimum	Indian Knob mountain balm	High	Low	High	0.5	No Jeopardy
Eriogonum ovalifolium var. *williamsiae*	Steamboat buckwheat	High	Low	Medium	1.6	No Jeopardy

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Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap	Determination
Eriogonum kennedyi var. *austromontanum*	Southern mountain wild-buckwheat	High	Low	High	0.10	No Jeopardy
Geum radiatum	Spreading avens	High	Low	High	1.4	No Jeopardy
Leavenworthia texana	Texas golden Gladecress	High	Low	Medium	<0.1	No Jeopardy
Monardella viminea	Willowy monardella	High	Low	High	0.5	No Jeopardy
Packera franciscana	San Francisco Peaks ragwort	High	Low	High	0.2	No Jeopardy
Penstemon debilis	Parachute beardtongue	High	Low	Medium	3.6	No Jeopardy
Penstemon penlandii	Penland beardtongue	High	Low	High	4.1	No Jeopardy
Pilosocereus robinii	Key tree cactus	High	Low	High	0.2	No Jeopardy
Pogogyne nudiuscula	Otay mesa-mint	High	Low	High	0.6	No Jeopardy
Primula maguirei	Maguire primrose	High	Low	Medium	3.8	No Jeopardy
Spiranthes delitescens	Canelo Hills ladies'-tresses	High	Low	Medium	0.7	No Jeopardy
Stephanomeria malheurensis	Malheur wire-lettuce	High	Low	High	1.0	No Jeopardy
Trifolium amoenum	Showy Indian clover	High	Low	High	1.3	No Jeopardy
Thysanocarpus conchuliferus	Santa Cruz Island fringepod	High	Low	High	0.7	No Jeopardy
Yermo xanthocephalus	Desert yellowhead	High	Low	Medium	0.3	No Jeopardy
Ziziphus celata	Florida ziziphus	High	Low	High	2.3	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the vulnerability 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Toxicity is expected to be medium or high for the plant species in this group, mainly due to their reliance on insect pollinators for successful reproduction. However, all plants in this appendix can rely, at least in part, on either self-fertilization, and/or vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to methomyl. In addition, 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). 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 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, partial ability to reproduce successfully without using pollinators, 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

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 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) 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
Amphianthus pusillus	Little amphianthus	Medium	Low	Low	1.81	No Jeopardy
Astragalus applegatei	Applegate's milk-vetch	High	Low	High	0.9	No Jeopardy
Campanula robinsiae	Brooksville bellflower	High	Low	Low	2.32	No Jeopardy
Clematis socialis	Alabama leather flower	High	Low	High	3.1	No Jeopardy
Coryphantha sneedii var. *leei*	Lee pincushion cactus	High	Low	High	0.9	No Jeopardy
Coryphantha sneedii var. *sneedii*	Sneed pincushion cactus	High	Low	High	1.9	No Jeopardy
Eriogonum gypsophilum	Gypsum wild-buckwheat	High	Low	High	0.8	No Jeopardy
Eriogonum pelinophilum	Clay-Loving wild buckwheat	High	Low	Medium	4.3	No Jeopardy
Fritillaria gentneri	Gentner's Fritillary	High	Low	Medium	1.5	No Jeopardy
Helianthus schweinitzii	Schweinitz's sunflower	Medium	Low	High	4.36	No Jeopardy
Helonias bullata	Swamp pink	Medium	Low	Medium	3.6	No Jeopardy
Iris lacustris	Dwarf lake iris	Medium	Low	High	4	No Jeopardy

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Mimulus michiganensis	Michigan monkey-flower	High	Low	High	1.0	No Jeopardy
Pedicularis furbishiae	Furbish lousewort	High	Low	High	3.5	No Jeopardy
Pinguicula ionantha	Godfrey's butterwort	Low	Low	High	0.68	No Jeopardy
Pityopsis ruthii	Ruth's golden aster	High	Low	Low	0.21	No Jeopardy
Ptilimnium nodosum	Harperella	Medium	Low	Medium	3.15	No Jeopardy
Rhododendron chapmanii	Chapman rhododendron	High	Low	Medium	0.8	No Jeopardy
Ribes echinellum	Miccosukee gooseberry	High	Low	High	1.0	No Jeopardy
Sagittaria fasciculata	Bunched arrowhead	High	Low	Low	1	No Jeopardy
Sagittaria secundifolia	Kral's water-plantain	Medium	Low	Low	1.79	No Jeopardy
Sarracenia oreophila	Green pitcher-plant	Medium	Low	Medium	3.77	No Jeopardy
Sarracenia rubra ssp. *jonesii*	Mountain sweet pitcher-plant	High	Low	Medium	0.7	No Jeopardy
Silene polypetala	Fringed campion	Medium	Low	High	1	No Jeopardy
Spiraea virginiana	Virginia spiraea	Medium	Low	Medium	0.67	No Jeopardy
Spiranthes parksii	Navasota ladies'-tresses	High	Low	Medium	3.9	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 successful reproduction. However, all plants in this appendix can rely, at least in part, on either self-fertilization, and/or vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to methomyl. In addition, many of the plants in Table 3 use abiotic vectors for some or all seed dispersal and most plants in Table 3 can use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists). As such, they are likely to recover more quickly from temporary losses of a small portion of their pollinating insect species.

While 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, ability to reproduce successfully without using pollinators, ability to rely on a variety of pollinator species for 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Species with low exposure (informed by low past usage from the California Department of Pesticide Regulation, CalPUR), high vulnerability, and 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, 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 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) with high vulnerability, 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	Draft Determination
*Allium munz*ii	Munz's onion	High	Low	High	0	No Jeopardy
Clarkia imbricata	Vine Hill clarkia	High	Low	Low	0	No Jeopardy
Erysimum menziesii	Menzies' wallflower	High	Low	High	1.0	No Jeopardy
Lilium pardalinum ssp. *pitkinense*	Pitkin Marsh lily	High	Low	High	0	No Jeopardy
Limnanthes floccosa ssp. *californica*	Butte County meadowfoam	High	Low	Low	0.2	No Jeopardy
Rorippa gambellii	Gambel's watercress	High	Low	High	0.5	No Jeopardy
Streptanthus niger	Tiburon jewelflower	High	Low	High	0.0	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 high for the plant species in this group, mainly due to their reliance on insect pollinators for successful reproduction. However, the plants in this appendix can rely, at least in part, on vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to methomyl. In addition, the plants in Table 4 use abiotic vectors for some or all seed dispersal and 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 the species in Table 4 have high vulnerability and toxicity rankings, 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, ability to reproduce successfully without using pollinators, 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Species with medium exposure, medium vulnerability, and medium toxicity

The only species in Table 5 has a medium exposure ranking, while having low or medium vulnerability. However, since there is only one species in this group, we have provided an individual rationale below the table. 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 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) with medium exposure, low or medium vulnerability, and medium toxicity.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Rhus michauxii	Michaux's sumac	Medium	Medium	Medium	5	No Jeopardy

Rationale for Species Conclusion: Michaux's sumac

Scientific Name:	Common Name:	Entity ID:
Rhus michauxii	Michaux's sumac	992

Conclusion:

Michaux's sumac has a medium vulnerability ranking and a medium exposure ranking. Past usage indicates that up to 5% of the species' range has been treated with methomyl annually. Several populations and parts of populations (subpopulations) of *R. michauxii* have suffered from habitat modification and/or destruction. This species is threatened by fire suppression and the ecological succession (competition and/or shading by woody species) that occurs in areas that are not burned on a regular basis. Forest populations are threatened by timber operations. Logging activities can crush plants and/or compact the soil where they grow. Sites located within utility rights-of-way are threatened by herbicide use, mowing during critical growth periods, and ground disturbing activities. Habitat destruction, the result of development or land conversion, also threatens this species (Boyer 1996).

When the recovery plan was completed in 1993, *R. michauxii* was believed extant at 21 sites in North Carolina and Georgia. No populations were known from Virginia at that time. *R. michauxii* was believed to be extirpated at 20 sites in the coastal plain and piedmont of North Carolina, South Carolina, Georgia, and Florida. Since listing, additional occurrences have been found in Georgia, North Carolina and Virginia. As of 2014, there are 43 parent populations rangewide. Many of the North Carolina populations occur on Fort Bragg Army Base and Camp Mackall (Sandhills Game Land) and receive protection and appropriate management, especially through the use of prescribed fire to reduce shade and competition. At least 29 extant populations in North Carolina are partially or fully on protected/conservation lands. In Virginia, five populations occur on protected lands at Fort Pickett National Guard Training Center and on private conservation lands. Two Georgia populations are in conservation management at the Broad River Wildlife Management Area and the Covington Water Tower Preserve (Mincy Moffitt, GNHP, pers. comm.). In addition, there are two "safeguarding sites" for *R. michauxii* in Georgia at Panola Mountain State Park and Chattahoochee Nature Center.

While the Michaux's sumac has a high exposure ranking with 33.6% overlap between the action area and the species' range, past usage data indicate that only up to 5% of the species' range has been treated with methomyl annually. As overlap is high and usage is low, we arrive at an expectation that exposure will be moderate for the pollinators of this species as described in the Effects of the Action section, above.

Because of its federal endangered status, *R. michauxii* is protected on federal lands such as Department of Defense property at Fort Bragg and Camp Mackall in North Carolina and Fort Pickett in Virginia. A total of 22 self-sustaining populations occur on lands that receive some level of protection and conservation management. Given the species distribution across multiple states, the unlikelihood of those populations being exposed to methomyl on federal lands where more than half of the extant populations exist, and despite a moderate exposure level for pollinators, we do not expect that adverse effects from methomyl use will 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 Michaux's sumac. **References:**

U.S. Fish and Wildlife Service. 2022. Michaux's sumac (*Rhus michauxii*) 5-Year Review: Summary and Evaluation. Raleigh, North Carolina. 45 pp.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Species with Individual Integration and Synthesis summaries

For the following species, 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 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 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) 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
Polygala smallii	Tiny polygala	No Jeopardy
Hoffmannseggia tenella	Slender rush-pea	No Jeopardy
Spigelia gentianoides	Gentian pinkroot	No Jeopardy
Arenaria paludicola	Marsh sandwort	No Jeopardy
Eryngium cuneifolium	Snakeroot	No Jeopardy
Erythronium propullans	Minnesota dwarf trout lily	No Jeopardy
Gilia tenuiflora ssp. *arenaria*	Monterey gilia	No Jeopardy
Lespedeza leptostachya	Prairie bush-clover	No Jeopardy
Manihot walkerae	Walker's manioc	No Jeopardy
Oxypolis canbyi	Canby's dropwort	No Jeopardy
Schwalbea americana	American chaffseed	No Jeopardy
Harperocallis flava	Harper's beauty	No Jeopardy
Warea carteri	Carter's mustard	No Jeopardy
Trillium reliquum	Relict trillium	No Jeopardy
Rhodiola integrifolia ssp. *leedyi*	Leedy's roseroot	No Jeopardy
Piperia yadonii	Yadon's piperia	No Jeopardy
Lindera melissifolia	Pondberry	No Jeopardy

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Rationale for Species Conclusion: Tiny polygala

Scientific Name:	Common Name:	Entity ID:
Polygala smallii	Tiny polygala	989

Conclusion:

Tiny polygala is an endangered milkwort found in critically imperiled pine rockland habitats in Florida. It occurs as six populations on ten pine rockland and scrub sites in Miami-Dade, Palm Beach, Martin, and St. Lucie Counties. The statuses of five sites are unknown and seven populations have been extirpated. The range-wide estimate includes 690 individuals, with most in one population in Miami-Dade County. Most population statuses are unknown or decreasing, with only one believed to be increasing (6 individuals in 2020). Between the 2007 and 2021 reviews, the abundance at one site (U.S. Coast Guard's Richmond Pinelands Complex) decreased from about 10,000 to 200 individuals, likely due to a lack of fire and increases of invasive plants. Most populations occur on publicly owned lands and are managed for conservation or protected from development (USFWS 2021), and one population is partially on private lands that are under a Habitat Conservation Plan (Coral Reef Commons) that includes protections for tiny polygala (USFWS 2017). Extant populations are fragmented and seed dispersal among them is unlikely. The species is threatened by habitat degradation, fire suppression, invasive plant species, hurricanes and other catastrophic events, and effects of small populations (USFWS 2021, 2010).

After 2.5 years of monitoring, pollination of tiny polygala was not observed. The species is believed to be self-pollinating because it has small tufts of hairs on the sterile apical lobe of the stigma, which catch pollen when the anthers dehisce (i.e., split open). As the flower develops, these hairs may touch the receptive lobes of the stigma and transfer pollen. Tiny polygala seeds have paired, fleshy outgrowths that are typical of ant dispersal, and ants have been observed carrying tiny polygala seeds to their nests. Tiny polygala seeds are also able to float in water for extended periods of time (over three weeks), suggesting water may be the primary dispersal method (USFWS 1999).

We determined that the tiny polygala has a high exposure ranking as there is 28.11% overlap between the action area and the species' range, and past usage data indicate that up to 10% of the species' range has been treated with methomyl annually. However, while mortality is expected for insects exposed to methomyl, the tiny polygala is believed to primarily self-pollinate; pollinators were not observed visiting plants and the plants are able to transfer pollen from dehisced anthers to the stigma when flowers develop. We do not expect insect pollinators are involved in tiny polygala reproduction. Though ants have been observed dispersing seeds, water is believed to be the primary dispersal method for tiny polygala seeds. In addition, all populations are protected from development and are, at least partially, managed for conservation of tiny polygala. We do not expect a loss of insects will lead to significant adverse effects to the reproductive capacity of this species. We do not anticipate that adverse effects to pollinators will cause species-level effects to the tiny polygala over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 tiny polygala.

References:

U.S. Fish and Wildlife Service. 2021. Tiny Polygala (*Polygala smallii*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 16 pp.

U.S. Fish and Wildlife Service. 2017. Biological Opinion and Conference Opinion for the Coral Reef Commons Project Incidental Take Permit TE15009C-0. Service Log #04EF1000-2017-F-0699. Jacksonville, Florida. 200 pp.

U.S. Fish and Wildlife Service. 2010. Tiny Polygala (*Polygala smallii*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 18 pp.

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

Rationale for Species Conclusion: Slender rush-pea

Scientific Name:	Common Name:	Entity ID:
Hoffmannseggia tenella	Slender rush-pea	739

Conclusion:

Slender rush-pea is a narrow endemic known from two counties in Texas where it remains on rare patches of undisturbed prairie habitat. It has a high vulnerability based on its endangered status and limited distribution. Row-crop agriculture is prominent within its range and is the main cause of the loss of native short-grass prairie this species relies upon. There are eleven known populations, seven of which are on private land with no protections. The populations on private lands are highly threatened by habitat loss and fragmentation from agricultural and residential development, invasive pasture grasses, and localized disturbances such as mowing and road construction (USFWS 2008, 2018, 2022). The 2018 Recovery Plan states effective pollinators of the slender rush-pea have not been observed in the field or in a greenhouse setting. The rush-pea is thought to rely completely on self-pollination as the rate of fruit set is high despite the lack of observed floral visitors, and bagged flowers (bags are placed over flowers to isolate them from pollinators) still produced fruit and viable seed (USFWS 2018). Insect pollinators are expected to die within the action area, which overlaps most of the species' range (98% overlap); however, the species primarily relies on self-pollination for reproduction, and thus a loss of pollinating insects in its range is not anticipated to lead to significant adverse effects to the reproductive capacity of this species.

The slender rush-pea, like most legumes, likely relies on forcible or gradual dehiscence (ejection of the seeds from seed pods) for seed dispersal. As such, we do not anticipate adverse reproductive effects to the slender rush-pea from loss of seed dispersers due to methomyl exposure.

This species is a narrow endemic, primarily threatened by loss and modification of preferred prairie habitat and invasive non-native grasses. We anticipate methomyl usage in up to 6.4% of the species range, especially in unprotected areas. However, the slender rush-pea is able to reproduce successfully by self-pollination and therefore is not reliant on the presence of a large number of pollinators within its range in order to reproduce. As a result, we do not expect species-level effects from methomyl due to the slender rush-pea's ability to rely on self-pollination and abiotic seed dispersal for 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 slender rush-pea.

References:

U.S. Fish and Wildlife Service. 2008. Slender rush-pea (*Hoffmannseggia tenella*) 5-Year Review: Summary and Evaluation. Corpus Christi, Texas. 25 pg.

U.S. Fish and Wildlife Service. 2018. Texas Coastal Bend Shortgrass Prairie Multi-Species Recovery Plan: Including Slender Rush-Pea (*Hoffmannseggia tenella*) and South Texas Ambrosia (*Ambrosia cheiranthifolia*). Albuquerque, New Mexico. 130 pages.

U.S. Fish and Wildlife Service. 2022. Slender rush-pea (*Hoffmannseggia tenella*) 5- Year Review: Summary and Evaluation. Corpus Christi, Texas. 7 pg.

Rationale for Species Conclusion: Gentian pinkroot

Scientific Name:	Common Name:	Entity ID:
Spigelia gentianoides	Gentian pinkroot	836

Conclusion:

Gentian pinkroot is a perennial herb that can grow in small clumps or as solitary individuals. It occurs in predominately well-drained upland pinelands where it is a component of fire-maintained longleaf pine-wiregrass ecosystems. As of 2023, it is restricted to seven extant locations (two additional locations have been extirpated) within three counties west of the

Apalachicola River: Calhoun, Jackson, and Washington counties in Florida and Geneva County, Alabama. Another population of *Spigelia* in Alabama is now considered a separate species (*S. alabamensis*). As of 2018, these sites supported about 3,900 plants (3-2,000 individuals each) and some populations appear to be increasing and others appear to be decreasing. Populations are located on both public and private lands; several populations are on land managed and protected by The Nature Conservancy. Gentian pinkroot is threatened by land conversion, fire suppression, urban development, catastrophic events like hurricanes, and invasive plants (USFWS 2023).

While gentian pinkroot may reproduce using pollinators (xenogamy, or outcrossing) it is capable of reproducing in the absence of pollinators through autogamy (self-fertilization). Pollinator visitors (*Megachile campanulae* and *Bombus* spp.) were scarce, and several studies suggest that Gentian pinkroot is primarily selfing (USFWS 2023, Shotts 2021). Flowers are cleistogamous (i.e., they do not open) and still result in fruit and seed production, further supporting that Gentian pinkroot does not rely on pollinators for reproduction. Seeds are dispersed through dehiscence, or forceful expulsion from the seed capsule (Shotts 2021).

The Gentian pinkroot primarily uses self-pollination and dehiscence for seed dispersal. Even though insect pollinators are expected to die within the range of this species (there is 44.6% overlap of methomyl use sites and the range and 9.3% of the range has been treated with methomyl in the past), we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that adverse effects to pollinators will not cause species-level effects to the Gentian pinkroot over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Gentian pinkroot.

References:

U.S. Fish and Wildlife Service. 2023. *Spigelia gentianoides* Gentian pinkroot 5-Year Review: Summary and Evaluation. Panama City, Florida. 13 pp.

Shotts, G. 2021. Floral Biology of Alabama's *Spigelia* species (Family Loganiaceae). Thesis, Auburn University. Auburn, Alabama. 45 pp.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Rationale for Species Conclusion: Marsh sandwort

Scientific Name:	Common Name:	Entity ID:
Arenaria paludicola	Marsh sandwort	881

Conclusion:

The marsh sandwort is an endangered plant found in southwestern San Luis Obispo County, California. It is a clonal, mat-forming perennial found in freshwater marshes and other wetlands. Marsh sandwort grows among other wetland species and is structurally supported by them, especially in perennially wet areas. The only extant population occurs on the northwestern shore of Oso Flaco Lake (Oceano Dunes State Vehicular Recreation Area). Since listing in 1993, the population in a marshy area along Black Lake Canyon has been extirpated. The species historically occurred in Washington and Mexico also but has been extirpated. Marsh sandwort were successfully outplanted in 2003 in a marsh at the Morro Coast Audubon Society Sweet Springs Nature Preserve in San Luis Obispo County and in 2011 in two locations at Golden Gate National Recreation Area. All four populations occur on protected lands. Threats to the species include alteration of hydrology, competition with encroaching species (e.g., eucalyptus, willow, and bulrush), urban development, climate change, and effects of small populations (USFWS 2020).

Very little is known about this species' reproduction, including pollination, germination, or dispersal. We believe marsh sandwort is pollinated by insects, but no pollinators were observed during surveys in 1993 and 1994. The species has also been grown successfully from cuttings. There was a viable seed bank at Black Lake Canyon and seed dispersal is unknown for the species (USFWS 1998).

Like other species in this appendix, the marsh sandwort uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. We expect that insect pollinators are involved in marsh sandwort reproduction, but the species successfully reproduces vegetatively also. Insect pollinators are expected to die from methomyl exposure within the 13.6% of the range that overlaps with the action area. However, past methomyl usage in the range was lower (7.7% annually) and all remaining populations occur on protected lands where we expect methomyl use to be minimal. We therefore anticipate that exposure to methomyl across the species range will be low, and do not expect a small loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that low adverse effects to pollinators will not cause species-level effects to the marsh sandwort over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 marsh sandwort.

References:

U.S. Fish and Wildlife Service. 2020. Marsh sandwort (*Arenaria paludicola*) 5-Year Review: Summary and Evaluation. Ventura, California. 13 pg.

U.S. Fish and Wildlife Service. 1998. Recovery Plan for Marsh Sandwort (*Arenaria paludicola*) and Gambel's Watercress (*Rorippa gambelii*). Ventura, California. 63 pg.

Rationale for Species Conclusion: Snakeroot

Scientific Name:	Common Name:	Entity ID:
Eryngium cuneifolium	Snakeroot	932

Conclusion:

Snakeroot is an endangered short-lived, perennial herb with a very long taproot and flowering stems. The species is restricted to open areas of well-drained white sand in Florida rosemary scrub that is very xeric with persistent gaps and longer fire-return intervals than other types of scrub (USFWS 2010). They are found in southern Highlands County, Florida near Lake Placid, only on the southern Lake Wales Ridge. As of 2021, there were 13 species occurrences in Highlands County. Snakeroot population sizes vary widely (10-10,000 individuals) with time since last fire occurrence and most species occurrences do not have population estimates. Ten known occurrences are on protected lands, including conservation easements, Lake Wales Ridge Wildlife and Environmental Area, Archbold Biological Station, and a State park. The remaining three populations were last observed in the 1980s and are highly threatened by ongoing development pressures and destruction and further fragmentation of the snakeroot's preferred open scrub habitat. Additional threats include fire suppression and other sources of habitat loss (USFWS 2021).

Snakeroot persists in the seed bank and seedling recruitment is important due to the species' habitat being frequently affected by fire. A diverse array of insects visits snakeroot flowers, though only bees and syrphid flies have been observed to collect pollen. Snakeroot appears to be able to produce similar numbers of seeds whether it is cross-pollinated or self-pollinated, thus reducing its dependence on pollinating species for successful reproduction. Snakeroot relies on gravity for seed dispersal (USFWS 2010). As such, we do not anticipate adverse effects to the reproduction of this species due to loss of seed dispersers from methomyl exposure.

Like other species in this appendix, the snakeroot uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. There is 4.7% overlap between the action area and the species' range, and past usage data indicate that only up to 0.5% of the species' range has been treated with methomyl annually. While mortality is expected for insects exposed to methomyl, the snakeroot successfully reproduces using self-pollination, suggesting that its reliance on insect pollinators is low. As such, we do not expect a loss of pollinating insects in a small portion of the range will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that low adverse effects to pollinators will not cause species-level effects to the snakeroot over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 snakeroot.

References:

U.S. Fish and Wildlife Service. 2021. Snakeroot (*Eryngium cuneifolium*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 16 pp.

U.S. Fish and Wildlife Service. 2010. Snakeroot (*Eryngium cuneifolium*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 24 pp.

Rationale for Species Conclusion: Minnesota dwarf trout lily

Scientific Name:	Common Name:	Entity ID:
Erythronium propullans	Minnesota dwarf trout lily	935

Conclusion:

Minnesota dwarf trout lily is an endangered forest wildflower found in Rice and Goodhue Counties, Minnesota. They are restricted to portions of the Straight River, Cannon River, Little Cannon River, Zumbro River, and Prairie Creek watersheds in maple-basswood forests on slopes and ravines or floodplain forests. The underlying bedrock layer is Decorah shale. As of 2021, there were 36 recognized species occurrences, some of which are considered functionally connected populations. Populations range from 1 to >100 colonies, with an average of around 30 colonies per population, and number of plants visible in colonies highly varies between years. They occur on <600 acres, an estimated 71% of which are preserved in state or county parks or by The Nature Conservancy (Grace Nature Preserve, Nerstrand-Big Woods State Park, River Bend Nature Center, The Nature Conservancy's Trout Lily Preserve, and Clinton Falls Dwarf Trout Lily Scientific and Natural Area). The other population occurs on private lands. Recent surveys efforts suggest that managed populations are declining (USFWS 2021). Threats to the species include climate change and associated large-scale precipitation events, residential development, effects of deer and exotic earthworm herbivory, and vegetation management (USFWS 2021, 2011).

Minnesota dwarf trout lilies flower from late April to mid-May. The species predominantly reproduces through vegetative means and rarely produces seeds. Vegetative production of a new individual is accomplished by the formation of a second bulb at the tip of a runner that arises from the underground stem of flowering plants. When flowers are available for pollination, they are principally visited by a small bee (*Andrena carlini*), a bee that prefers flowers of white trout lily (*E. albidum*) to those of Minnesota dwarf trout lily. Other bees and beetles infrequently visit Minnesota dwarf trout lily flowers. However, studies have shown that Minnesota dwarf trout lily pollen sterility is high, and the species only produces fertile seeds when pollinated by *E. albidum*. We believe the species' primary reproductive strategy is vegetative (USFWS 1987). The role of pollination and the overall viability and contribution to successful reproduction of any produced seed set is unknown. Some known dwarf trout lily colonies are almost exclusively dominated by large beds of sterile leaves (USFWS 2011).

We believe the Minnesota dwarf trout lily primarily uses vegetative reproduction, and most (71%) of the known individuals are on protected lands. Even though overlap of the range with the action area and the percent of the range treated with methomyl are high at 57.7% and 18.8%, respectively, and insect pollinators are expected to die in a large portion of the range of this species, we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species because its primary reproductive strategy is vegetative and does not require insect pollinators. We anticipate that low adverse effects to pollinators will not cause species-level effects to the Minnesota dwarf trout lily over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Minnesota dwarf trout lily.

References:

U.S. Fish and Wildlife Service. 2021. Minnesota Dwarf Trout Lily (*Erythronium propullans*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 19 pp.

U.S. Fish and Wildlife Service. 2011. Minnesota Dwarf Trout Lily (*Erythronium propullans*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 32 pp.

U.S. Fish and Wildlife Service. 1987. Minnesota Trout Lily (*Erythronium propullans* Gray) Recovery Plan. Twin Cities, Minnesota. 35 pp.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Rationale for Species Conclusion: Monterey gilia

Scientific Name:	Common Name:	Entity ID:
Gilia tenuiflora ssp. *arenaria*	Monterey gilia	940

Conclusion:

Monterey gilia is an endangered, narrow endemic species found in the coastal dunes and maritime chaparral of Monterey County and Santa Cruz County, California. It is found on substrates primarily composed of sand with some soil development and litter accumulation. The species is intolerant to competition, evidenced by its occurrence in areas with low vegetative cover. There are 11 species occurrences, ten of which are believed to be extant and one of which was not observed during the last survey (unknown year). Some occurrences are protected from development (State beaches, portions of former Fort Ord), but other areas of Fort Ord represent the largest development concern for the species. Threats to the species include habitat loss from residential and commercial development, competition with non-native plants, habitat conversion to shrub-dominated vegetation, and climate change (USFWS 2020).

Monterey gilia is thought to be primarily self-pollinating, based on its stamens not protruding from the flowers, no observations of pollinators, and very viable, abundant seed production. As a result, it is not likely Monterey gilia relies heavily on pollinating insects for successful reproduction. Monterey gilia disperses its seeds using the strong winds blowing across its dune habitat (USFWS 1998). As such, we do not anticipate adverse reproductive effects to this species from loss of seed dispersers due to methomyl exposure.

We believe the Monterey gilia primarily uses vegetative reproduction. Even though overlap of the range with the action area is high at 21.9% and the percent of the range treated with methomyl is moderate at 7.9%, and insect pollinators are expected to die within the range of this species, we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species because its primary reproductive strategy is through self-pollination, which does not require insect pollinators. As such, we anticipate that adverse effects to pollinators will not cause species-level effects to the Monterey gilia over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Monterey gilia.

References:

U.S. Fish and Wildlife Service. 2020. Monterey gilia (*Gilia tenuiflora* ssp. *arenaria*) 5-Year Review: Summary and Evaluation. Ventura, California. 15 pp.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

U.S. Fish and Wildlife Service. 1998. Seven Coastal Plants and the Myrtle's Silverspot Butterfly Recovery Plan. Portland, Oregon. 151 pp.

Rationale for Species Conclusion: Prairie bush-clover

Scientific Name:	Common Name:	Entity ID:
Lespedeza leptostachya	Prairie bush-clover	957

Conclusion:

The prairie bush-clover is a threatened member of the pea family (Fabaceae). It is a long-lived, dry-prairie plant that occurs in remnant prairies and on disturbed sites in Illinois, Iowa, Minnesota, and Wisconsin. Plants are usually found around the edges of slopes or within barely concave areas that are not subject to nutrient or herbicide input from drain-tile discharge (USFWS 2021b). As of 2021, there were 113 populations (an increase since listing in 1987, when there were 36 populations). This increase is due, in part, to increased survey effort. Across the four states, 12 populations are considered extirpated, 76 have poor to fair resiliency, 26 are in fair to poor condition, 28 are in good to excellent condition, and 54 (48%) are owned by a conservation organization (e.g., federal, state, or non-profit). Threats to the species include conversion of prairie habitat to cropland or development, spread of invasive plant species, vegetation encroachment, prolonged drought, hybridization with *Lespedeza capitata*, and herbicide use in nearby agricultural fields. In the 2021 status review, we recommended the species for delisting because of the high number of protected populations (>50) and increasing trends since listing (USFWS 2021a).

After 5+ years to reach maturity, prairie bush-clovers may flower annually, and individuals may persist for 30+ years. The species has a relatively short-lived seed bank, with most seeds germinating in their second year after physical scarification (USFWS 2021a, 2021b). Seeds are dispersed through gravity and potentially small mammals. A single plant can produce both open, potentially outcrossing flowers and closed, self-pollinating flowers. As such, they are capable of self-pollination and may rely on cross pollination via wind or pollinators. Pollinators for the species are unknown, but the following species have been documented on individual plants: hairstreak butterfly (*Satyrium* spp.), western honeybee (*Apis mellifera*), weevil species, goldenrod soldier beetle (*Chaliognathus pennsylvanicus*), skeletonizing leaf beetle (*Scelolyperus* spp.) or flea beetle (*Altica* spp.), halictid bee (Halictidae), snout moth (Pyralidae), Pennsylvania ambush bug (*Phymata pennsylvanica*), and common walking stick (*Diapheromera femorata*). Gene flow appears to be limited due to the dominance of self-pollinating flowers (USFWS 2021b).

Like other species in this appendix, the prairie bush-clover uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. The species primarily relies on self-pollination, which has caused the species to have low genetic diversity across its range. Even so, the species has recovered since listing and many of the populations (>50) are protected; many others (28) are in good to excellent condition. Even though overlap of the range with the action area is high at 49.1% and the percent of the range treated with methomyl is moderate at 8.7%, and insect pollinators are expected to die within the range of this species, we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species because its primary reproductive strategy is through self-pollination, which does not require insect pollinators . As such, we anticipate that adverse effects to pollinators will not cause species-level effects to the prairie bush-clover over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 prairie bush-clover.

References:

U.S. Fish and Wildlife Service. 2021a. Prairie Bush-Clover (*Lespedeza leptostachya*) 5-Year Review: Summary and Evaluation. Bloomington, Minnesota. 13 pp.

U.S. Fish and Wildlife Service. 2021b. Species Status Assessment Report for Prairie Bush-Clover (*Lespedeza leptostachya*). Version 1.0. Bloomington, Minnesota. 59pp. + appendices

Rationale for Species Conclusion: Walker’s manioc

Scientific Name:	Common Name:	Entity ID:
Manihot walkerae	Walker's manioc	763

Preliminary Conclusion:

Walker’s manioc is a narrow endemic found in native brush and grassland habitats on shallow calcareous soils over caliche in two counties in the Lower Rio Grande Valley of Texas. There are 11 potentially extant sites in Texas, 24 potentially extant sites in Mexico, and all 35 are believed to operate as a metapopulation. Many areas between surveyed sites have appropriate habitat but have not been surveyed. Each Texas site has between one to approximately 90 individuals and many occur on private lands. Three of the largest sites are on protected areas of Lower Rio Grande Valley National Wildlife Refuge and three private landowners in Mexico have active voluntary conservation agreements (USFWS 2019). While Walker’s manioc can self-fertilize and use tubers for vegetative reproduction, the species relies on insect pollinators to maintain genetic diversity through pollen transport between individual plants. However, the species does not appear to require a rare or specialized pollinator (USFWS 2009, 2019). Threats include destruction and fragmentation of habitat, non-native grasses, conversion to agriculture, pesticide runoff and drift, caliche surface mining, javelina and feral hog uprooting, and development (e.g., residential, urban, and energy). Walker's manioc reemerged following herbicide application that killed the above-ground portion of the plant (USFWS 2019).

Ants are described as a seed disperser of the species as they are attracted to the seed caruncle (a specialized appendage full of lipids, protein, starch, and vitamins) and disperse seeds by carrying them back to their nests. The species can also disperse seeds through explosive dehiscence (i.e., seeds forcefully ejected from their seed pod) (USFWS 2009). Ant seed dispersers will die from methomyl exposure, though effects to seed dispersal capability of the plants from loss of ant dispersal will be moderated by their ability to disperse via dehiscence. As such, we anticipate a moderate level of impact to the seed dispersal ability of the plant species.

Walker's manioc has a large percent overlap (67.5%) between the action area and its range, and the range has high levels of methomyl usage (14.1%) based on past usage data. 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 do not expect significant use of methomyl on protected sites, but that only constitutes about 1.6% of the species' range (Kern et al. 2023). Walker's manioc uses both abiotic and biotic vectors for seed dispersal and relies on insect pollinators to increase genetic diversity, even though it can reproduce asexually through underground tubers.

We anticipate significant adverse effects to the species due to the reduction in pollinating and seed dispersing insects across a large portion of the range that will result in reduced reproductive success. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators and seed dispersers for reproduction and maintenance of genetic diversity. A significant loss of pollinating and seed dispersing 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 significant loss of reproductive success due to methomyl exposure that we expect to occur over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

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 Walker's manioc 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.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

The PULA for the Walker's manoic 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 and seed dispersers of the Walker's manioc 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 Walker's manioc.

References:

Kern, M., Kay, S., Christian, D., and Tandy, E. 2023. Methomyl Effects Assessment of the Walker's Manioc (*Manihot walkerae*) for Risk Management of Methomyl Agricultural Uses. TKI-2023-EAM-030. 38 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan Amendments for Nine Southwest Species. Albuquerque, New Mexico. 14 pp.

U.S. Fish and Wildlife Service. 2009. Walker's Manioc (*Manihot walkerae*) 5-Year Review: Summary and Evaluation. Corpus Christi, Texas. 30 pp.

Rationale for Species Conclusion: Canby's dropwort

Scientific Name:	Common Name:	Entity ID:
Oxypolis canbyi	Canby's dropwort	976

Preliminary Conclusion:

Canby's dropwort is an endangered, rare, herbaceous plant. They are found in coastal plain habitats including pond cypress savannas, wet pineland savannas, wet meadows, Carolina bays, sloughs, and around edges of cypress-pine ponds. The largest and most vigorous populations are found in bays and ponds that are flooded during most of the year (USFWS 2010). Historically, Canby's dropwort occurred in Delaware, Maryland, North and South Carolina, and Georgia. Today, Canby's dropwort only occurs in three states: Maryland, South Carolina, and Georgia. Further, Canby's range within these states has been reduced greatly overtime with Canby's dropwort being extirpated from 11 counties since the time it was listed. As of 2022, there were 18 extant populations and one introduced population (i.e., Brubaker Farm in South Carolina). Eleven Canby’s dropwort populations are partially protected. Because many populations are owned by several landowners, protection and management of populations is difficult to achieve (USFWS 2022).

Threats include direct loss or alteration of its wetland habitat from ditching, draining, changes to hydrology, reducing surface water, changing soil moisture, lowering water table, changes to vegetative composition, fire suppression, shrub and woody encroachment, and effects of climate change (USFWS 2022).

Reproduction is primarily asexual through rooting at the nodes of the rhizomes. The flowers are bisexual and/or unisexual and appear from mid-August to early October. There may be some self-pollination, but the flowers are protandrous (anthers release their pollen before the stigma of the same flower is receptive, so an individual flower cannot pollinate itself), indicating some outcrossing does occur. Furthermore, Canby’s dropwort has high genetic diversity compared to other rare herbaceous species. As genetic diversity in a plant population often arises from successful outcrossing, this adds to evidence that the species relies on outcrossing to reproduce successfully over time (USFWS 2022). Pollinators for this species are unknown, but Canby’s dropwort is a favorite food plant for larval black swallowtail butterflies (*Papilio polyxenes asterius* Stoll) and adults may visit flowers and serve as pollinators. Their flowers appear from mid-August to early October (USFWS 1990). Seed germination takes a year or longer (USFWS 2022), and seeds are believed to be dispersed via wind. There may be other, unknown sources of seed dispersal (USFWS 1990).

Like other species in this appendix, Canby's dropwort uses two methods of reproduction: pollen transfer between individual plants (outcrossing) and vegetatively through rhizome spread. Canby’s dropwort primarily relies on vegetative reproduction, but their flower structure (protandrous) and genetic diversity indicate reliance on outcrossing by unknown insect pollinators. Due to high overlap between the species’ range and the action area (54.84%) and high past methomyl usage within the range (17.2% annually), insect pollinators are expected to experience significant mortality within the range of Canby’s dropwort. On field exposure to pollinators is expected to be minimal as there is very low on-field overlap with methomyl registered crops with the range of the species. We expect a loss of pollinating insects in a large portion of the range will lead to significant adverse effects to the reproductive capacity of this species and we anticipate that these effects to pollinators will cause species-level effects to the Canby’s dropwort over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

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 Canby's dropwort 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 Canby's dropwort 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 Canby's dropwort 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 Canby's dropwort.

References:

U.S. Fish and Wildlife Service. 2022. Canby's Dropwort (*Oxypolis canbyi*) 5-Year Review: Summary and Evaluation. Charleston, South Carolina. 13 pp.

U.S. Fish and Wildlife Service. 2010. Canby's Dropwort (*Oxypolis canbyi*) 5-Year Review: Summary and Evaluation. Charleston, South Carolina. 17 pp.

U.S. Fish and Wildlife Service. 1990. Canby's Dropwort Recovery Plan. Atlanta, Georgia. 30 pp.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Rationale for Species Conclusion: American chaffseed

Scientific Name:	Common Name:	Entity ID:
Schwalbea americana	American chaffseed	996

Conclusion:

American chaffseed is an endangered, hemiparasite plant that photosynthesizes in addition to acquiring food from a host species through haustoria (i.e., modified roots that serve as a bridge between the vascular system of the host and that of the parasite). The species primarily occurs in transitional areas between uplands and freshwater wetlands with sandy, acidic, seasonally moist to dry soils. It is generally found on savannas and pinelands throughout the coastal plain. American chaffseed can form haustorial relationships (a parasitic relationship where a plant forms root-like structures to absorb nutrients or water from another organism) with a wide variety of species, but there was a consistent correlation with composites and grasses. Composites and grasses have high root densities near the soil surface, increasing the likelihood that American chaffseed seedlings can connect to them (USFWS 2008). Between 2008-2019, five new populations were identified. The species remains extirpated from Connecticut, Delaware, Kentucky, Maryland, Mississippi, New York, Tennessee, Texas, and Virginia. As of 2019, there were 43 extant populations across the species range in Massachusetts (1), New Jersey (2), North Carolina (6), South Carolina (18), Georgia (9), Alabama (2), Florida (3), and Louisiana (2). Overall, populations unmanaged with prescribed fire and/or on unprotected land generally decline and become extirpated overtime. Across the species' range, the most stable populations occur on well-managed (i.e., 1-2-year fire return interval), protected land. Forty-one of the 43 extant chaffseed populations occur on lands with long-term protection secured through management plans on federal and state property and through landowner agreements (e.g., Safe Harbor Agreements) and conservation easements on private lands (USFWS 2019). Threats to the species include loss and modification of habitat (e.g., development, fire suppression, incompatible agriculture and silviculture), deer and insect herbivory, effects of climate change, and effects of small population sizes (USFWS 2008, 2019).

American chaffseed plants flower from June to mid-July in the northern part of its range and from April to June in the southern part of its range. Their flowers are pollinated by bees, likely worker bumblebees *Bombus impatiens* and *B. pennsylvanicus*. After a pollinator-exclusion experiment, American chaffseed fruit production remained high, suggesting that pollination is not a requirement for fruit and viable seed (USFWS 1995). American chaffseed plants particularly rely on vegetative reproduction in the absence of fire. Flowering and subsequent viable seed production is strongly stimulated by above-ground stem removal and increased light availability following fire or a combination of mowing and raking to remove litter. American chaffseed plants are long-lived (10+ years), with peak flowering between 3-6 years (Service 2008, 2019). Seed dispersal is likely completed by wind due to their shape, but ultimate seed dispersal method is unconfirmed (USFWS 1995). Seeds in the seed bank are most viable the first year and remain viable for up to four years (USFWS 2008, 2019). The species has low genetic diversity across its range, suggesting that dispersal occurred after a past rangewide genetic bottleneck (USFWS 2008).

The American chaffseed uses several methods to reproduce pollen transfer between individual plants, self-fertilization, and vegetative propagation. Pollinators are not required for American chaffseed to fruit and produce viable seeds, and seeds are believed to be dispersed primarily via wind. In addition, most known populations are on protected lands (95%). Even though insect pollinators are expected to die within the range of this species as there is high overlap at 49% and past usage at 17.1%, we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. As such, we anticipate that adverse effects to pollinators will not cause species-level effects to the American chaffseed over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 American chaffseed.

References:

U.S. Fish and Wildlife Service. 2019. American chaffseed (*Schwalbea americana*) 5-Year Review: Summary and Evaluation. Charleston, South Carolina. 45 pp.

U.S. Fish and Wildlife Service. 2008. American chaffseed (*Schwalbea americana*) 5-Year Review: Summary and Evaluation. Pleasantville, New Jersey. 33 pp.

U.S. Fish and Wildlife Service. 1995. American chaffseed (*Schwalbea americana*) Recovery Plan. Hadley, Massachusetts. 57 pp.

Rationale for Species Conclusion: Harper’s beauty

Scientific Name:	Common Name:	Entity ID:
Harperocallis flava	Harper's beauty	723

Conclusion:

Harper’s beauty is an endangered grass-like perennial endemic to the Florida Panhandle. It occurs in Bay, Franklin, and Liberty Counties on gentle slopes, seepage savannas between pinelands, wet prairies, cypress swamps, and open roadside depressions. It is found in fire-prone habitats, typically wetlands but also occasionally uplands. As of 2022, there were 27 extant occurrences with most in Liberty County and two potentially extirpated occurrences. Twenty-six of these occurrences are in Apalachicola National Forest and one extends into Tate’s Hell State Forest. Therefore, all extant populations are on public land; the one potentially extirpated location in Bay County is on private land and is not protected. Harper's beauty is threatened by modification of its habitat (e.g., industrial forestry practices, land conversion to grazing lands, road widening, and new road construction), fire suppression, and soil and hydrological disturbances. Additional threats include limited range, effects of small populations, and effects of climate change (USFWS 2022).

Flowers occur from mid-April to May and seeds appear in July. Harper's beauty primarily reproduces through asexual rhizomes, but insects, particularly halictid bees, were infrequently observed visiting flowers and leaving with pollen (Pitts-Singer et al. 2002). In our 2016 5-Year Review, we stated that we believe that Harper's beauty does not rely on pollinators, but the pollen may serve as a food source for the bees (USFWS 2016). Moderate clonal reproduction occurs, but individuals are not genetically identical. Overall, genetic diversity is low, and we believe that the species relies on self-fertilization. They can form a short-term persistent seed bank (USFWS 2022), and seeds are believed to be dispersed by water and mowing equipment.

Harper's beauty may use pollination, but pollinators seen on the flowers and transporting pollen are believed to use the pollen as a food source and are not believed to be necessary for Harper's beauty reproduction. The species primarily reproduces using asexual, clonal reproduction and self-pollination. Seeds are believed to be dispersed via water and equipment. In addition, 26 of 27 extant populations are on protected lands (96%). Even though insect pollinators are expected to die within the range of this species (methomyl use sites overlap with 5.8% of the species' range and 1.3% of the range has been treated annually with methomyl in the past), we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that adverse effects to pollinators will not cause species-level effects to the Harper's beauty over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Harper's beauty.

References:

Pitts-Singer, T.L., J. L. Hanula, and J. L. Walker. 2002. Insect pollinators of three rare plants in a Florida longleaf pine forest. Florida Entomologist 85(2): 9 pp.

U.S. Fish and Wildlife Service. 2022. Harper's beauty (*Harperocallis flava*) 5-Year Review: Summary and Evaluation. Panama City, Florida. 19 pp.

U.S. Fish and Wildlife Service. 2016. Harper's beauty (*Harperocallis flava*) 5-Year Review: Summary and Evaluation. Panama City, Florida. 24 pp.

U.S. Fish and Wildlife Service. 2016. Harper's beauty (*Harperocallis flava*) 5-Year Review: Summary and Evaluation. Panama City, Florida. 24 pp.

Rationale for Species Conclusion: Carter's mustard

Scientific Name:	Common Name:	Entity ID:
Warea carteri	Carter's mustard	1015

Conclusion:

Carter's mustard is an endangered, annual plant endemic to Polk, Highlands, and Lake Counties in the Lake Wales Ridge region of central Florida (USFWS 2021). It is found in xeric, shrub-dominated habitats in upland areas, primarily sandhills and scrubby flatwoods (USFWS 1999, 2021). The species relies on fire, and its populations fluctuate widely from year to year in response to fire regime. As of 2021, there were 29 species occurrences, three of which were believed to be in excellent condition, four were fair, and 15 were intermediate or difficult to classify. Nineteen occurrences have not been observed since the 1980s or 1990s, but aboveground surveys may not capture plants that still occur belowground. Twenty-three occurrences (79%) are on protected or managed land, and the largest population is at The Nature Conservancy's Tiger Creek Preserve. An overall decreasing trend has been observed at Tiger Creek. Threats to the species include habitat loss and fragmentation, effects of climate change, and fire suppression (USFWS 2021).

Carter's mustard flowers between September and October, and more flowers are observed on plants in open and recently burned areas. Plants can self-pollinate or cross-pollinate through several generalist pollinator species. Reproductive output is not likely to be limited by small population sizes or pollinators (USFWS 2021). Natural levels of fruit- and seed-set are high; self-pollinated flowers showed significantly lower fruit- and seed-set, suggesting that insect pollinators are essential for maintaining adequate fruits and seeds. Pollinators observed on Carter's mustard include solitary bees, bumblebees, syrphids, wasps, flies, and beetles. Within plant movements predominate over among-plant movements, further suggesting the species' reliance on self-pollination.

Seeds disperse through gravity and contain no specialized structures or other evidence suggesting other dispersal mechanisms (USFWS 1999). Seeds remain dormant in a seed bank for decades (USFWS 2021). As such, we do not anticipate adverse reproductive effects to the mustard from loss of seed dispersers due to methomyl exposure.

Like other species in this appendix, Carter's mustard uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. Pollinators are not required for Carter's mustard to fruit and produce viable seeds, and the species relies primarily on self-pollination. Seeds are believed to be dispersed via gravity and involvement of insects in seed dispersal is unknown. In addition, many known populations (79%) are on protected lands. Even though insect pollinators are expected to die within the range of this species (methomyl use sites overlap with 9.7% of the species' range and 5.1% of the range has been treated annually with methomyl in the past), we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that adverse effects to pollinators will not cause species-level effects to the Carter's mustard over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Carter's mustard.

References:

U.S. Fish and Wildlife Service. 2021. Carter's mustard (*Warea carteri*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 17 pp.

U.S. Fish and Wildlife Service. 1999. Multi-Species Recovery Plan. Atlanta, Georgia. 2172 pp.

Rationale for Species Conclusion: Relict trillium

Scientific Name:	Common Name:	Entity ID:
Trillium reliquum	Relict trillium	1042

Preliminary Conclusion:

Relict trillium is an endangered, long-lived spring ephemeral plant that occurs most often in relatively undisturbed rich wooded areas with mature hardwood overstory canopy in ravines and on stream terraces. It is endemic to four watersheds across Alabama, Georgia, and South Carolina. As of 2023, there were 44 extant, naturally occurring populations, 10 of which have high resiliency, 12 have moderate, 20 have low, and 2 have very low. Trend analysis was not possible with the available data, but qualitative and anecdotal information suggests that populations have been declining. Threats to the species include habitat destruction and modification from urbanization, agriculture, and silviculture; effects of climate change; forest structure alterations from storms like tornadoes; deer herbivory; impacts from feral hogs; and effects of small population sizes (USFWS 2023).

Relict trilliums can live for possibly hundreds of years, with one end of their rhizome continuing to grow and develop shoots as the other end withers and dies. Relict trillium reproduces primarily sexually by seed, but they are capable of asexual reproduction through vegetative offshoots and apomixis (i.e., asexual formation of a seed from maternal tissues of an ovule, thus bypassing meiosis and fertilization). They are also capable of self-fertilization, though self-fertilization is believed to be infrequent. Vegetative reproduction via offshoots is slow and limited. Therefore, the species has a flexible reproductive strategy, but primarily relies on sexual reproduction and cross-pollination. Pollinators include flies and beetles, as evidenced by the flowers putrid smell and dark colors (i.e., red and purple). Specifically, blowflies (Calliphoridae), long-legged flies (Dolichopodidae), phorid flies (Phoridae), tiny scarab beetles (Scarabaeidae), tumbling flower beetles (Mordellidae), sap beetles (Nitidulidae), and shining flower beetles (Phalacridae) were observed landing on relict trillium flowers. In addition, several species of ants and ground beetles were seen removing fruits and seeds and therefore are believed to disperse seeds (acrobat ant [*Crematogaster ashmeadi*], Paratrchina [*Paratrechina faisonensis*], myrmicine ant [*Aphaenogaster* spp.], night ant [*Camponotus chromaiodes*], and fungus-growing ant [*Trachymyrmex septentrionalis*]).

We anticipate high adverse effects to the species due to the reduction in pollinating and seed dispersal insects that will result in reduced reproductive success. Spray drift areas from methomyl use sites overlap with 44.83% of the species' range and 20% of the range has been treated annually with methomyl in the past. On field exposure to pollinators is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species. Though relict trillium is self-compatible, the species relies on sexual reproduction involving flies and beetles for pollination and ants and beetles for seed dispersal. We anticipate adverse, species-level effects in the form of a high loss of reproductive success due to methomyl exposure that we expect to occur over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

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 relict trillium 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 relict trillium 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 and seed dispersers of the relict trillium 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 relict trillium.

References:

U.S. Fish and Wildlife Service. 2023. Species status assessment report for the relict trillium (*Trillium reliquum*). Version 1.1. Atlanta, Georgia. 116 pp.

Rationale for Species Conclusion: Leedy's roseroot

Scientific Name:	Common Name:	Entity ID:
Rhodiola integrifolia ssp. *leedyi*	Leedy's roseroot	1150

Preliminary Conclusion:

Leedy's roseroot is a threatened, perennial, terrestrial stonecrop species that occurs in Minnesota, New York, and South Dakota on cliff faces. There were three populations in New York (Glenora Cliffs, Glenora Falls, and Watkins Glen State Park). As of 2021, Glenora Cliffs was believed to be stable with about 4,600 plants. Glenora Falls has had 45-50 plants since 2017, and the one individual at Watkins Glen was inadvertently removed during trail construction in 2018. In Minnesota, there are four populations: Whitewater Wildlife Management Area, Simpson Cliffs, Deer Creek, and Bear Creek. Between 1997-2020, numbers appeared to decline at Whitewater and they appeared to be stable at all other sites. There is one population in South Dakota (Harney Peak in Black Hills National Forest) with 50-100 individuals (USFWS 2021). Most populations are unprotected; a small parcel with few individuals at Glenora Cliffs is protected by Finger Lakes Land Trust and the Glenora Falls population is inaccessible to the public and not likely to be developed (USFWS 2015). Threats to the species include effects of small, isolated populations; development, including shoreline access-related construction and pipe installation; invasive plant species; cliff erosion from logging, heavy rains, and poor soil conservation practices above occupied sites; inherent cliff instability; contamination of seepage and groundwater (specifically, the usage of pesticides at Whitewater); effects of climate change, mainly changes in precipitation; and stochastic events (USFWS 2021).

Leedy's roseroot is dioecious, meaning males and females are separate plants. Flowering occurs in early June, and bees and syrphus flies serve as pollinators. Seeds are adapted for wind dispersal (i.e., they have wings). New growth on the long-lived rootstocks have broken off to form clones, which lived for 36+ years in cultivation. Their vegetative growth strategy is not commonly used (USFWS 1998). Genetic diversity is relatively low compared to healthy populations of other species in the same genus. Pollen vectors likely transport pollen no more than 1,000 m, evidenced by geographic separation and genetic diversity studies (USFWS 2015).

We anticipate high adverse effects to the species due to the reduction in pollinating and seed dispersal insects that will result in reduced reproductive success. Spray drift areas from methomyl use sites overlap with 65.12% of the species' range and 17% of the range has been treated annually with methomyl in the past. On field exposure to pollinators is expected to be minimal as there is no on-field overlap with methomyl registered crops with the range of the species. Though Leedy's roseroot can reproduce clonally, this strategy is uncommon. The species relies on sexual reproduction involving bees and syrphus flies for pollination, which will be affected by methomyl use in the species' range. We anticipate adverse, species-level effects in the form of a high loss of reproductive success due to methomyl exposure that we expect to occur over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

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 Leedy's roseroot 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 Leedy's roseroot 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 Leedy's roseroot 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 Leedy's roseroot.

References:

U.S. Fish and Wildlife Service. 2021. 5-Year Review Leedy's Roseroot (*Rhodiola integrifolia* spp. *leedyi*). Bloomington, Minnesota. 14 pp.

U.S. Fish and Wildlife Service. 2015. 5-Year Review Leedy's Roseroot (*Rhodiola integrifolia* spp. *leedyi*). Bloomington, Minnesota. 25 pp.

U.S. Fish and Wildlife Service. 1998. Leedy's Roseroot Recovery Plan (*Rhodiola integrifolia* spp. *leedyi*). Ft. Snelling, Minnesota. 39 pp.Rationale for Species Conclusion: Yadon's piperia

Scientific Name:	Common Name:	Entity ID:
Piperia yadonii	Yadon's piperia	1171

Preliminary Conclusion:

Yadon's piperia is an endangered perennial herb in the Orchidaceae (orchid) family. It occurs in Monterey pine forest and maritime chaparral from Palo Colorado Canyon to Elkhorn Slough around the Monterey Peninsula in California. They senesce each year to a tuber and may not express leaves or inflorescences in any given year. The greatest concentration of Yadon's piperia is found on the Monterey Peninsula on land owned and managed by either the Pebble Beach Company or the Del Monte Forest Conservancy. There are several populations organized into four recovery units. Populations greatly vary in abundance each year, and several appear to be stable. Several populations are protected by conservation easements, Presidio of Monterey U.S. Army installation, and Point Lobos Ranch State Park, and several populations are under private ownership. Threats to the species include development (e.g., habitat loss and fragmentation), invasive species, deer herbivory, fire suppression, and effects of climate change (e.g., drought) (USFWS 2021). A number of factors have been shown to reduce the reproductive potential of the species, including high rates of herbivory that have significantly affected the populations of Yadon's piperia over time by reducing the ability of individual plants to survive and reproduce (USFWS 2019).

Yadon's piperia flowers from mid-June to early August. Flowers are capable of outcrossing or geitonogamy (i.e., fertilization of a flower by pollen from another flower on the same plant), but flowers are incapable of fertilizing themselves. The number of fruit increases with outcrossing, but the most common form of fertilization for Yadon's piperia is through pollinator-facilitated selfing. Pollinators are mostly nocturnal moths, which are attracted to nectar advertised through pheromones released at dusk. Nineteen species of moths were identified as pollinators, none of which are believed to be rare. Nocturnal moths are believed to be necessary for initiating seed set in fruits. Yadon's piperia has broad mycorrhizal fungal associates that are widespread and common, similar to other orchids (Service 2021), and this fungal association is necessary for seed germination. Seeds are believed to be dispersed through wind (USFWS 2004).

We anticipate moderate adverse effects to the species due to the reduction in pollinating insects that will result in reduced reproductive success. Methomyl use sites overlap with 22.2% of the species' range and 8.8% of the range has been treated annually with methomyl in the past. 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.

Though Yadon's piperia can self-pollinate, they rely on nocturnal moth pollinators for viable seed production; self-pollination is not common for this species. The necessity of nocturnal moths to initiate seed set in fruits suggests that the continued sustainability of existing populations and/or the possibility of population expansion could be limited if nocturnal moths decline within Yadon's piperia range (USFWS 2021). Even though they are mostly present at night and Yadon's piperia suitable habitat is not immediately near agricultural fields (Kern at el. 2024), moth pollinators are expected to travel among suitable habitat locations and die within the range of this species. We expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that moderate adverse effects to pollinators will cause species-level effects to the Yadon's piperia over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

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 Yadon's piperia 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 Yadon's piperia 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 Yadon's piperia 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 Yadon's piperia.

References:

Kern, M., S.Kay, D. Christian, and E. Tandy. 2024. Methomyl Effects Assessment of the Yadon's Piperia (*Piperia yadonii*) for Risk Management of Methomyl Agricultural Uses. TKI-2024-EAM-046. 47 pp.

U.S. Fish and Wildlife Service. 2021. Yadon's piperia (*Piperia yadonii*) 5-Year Review. Ventura, California. 19 pp.

U.S. Fish and Wildlife Service. 2019. Recovery Plan for Five Plants from Monterey County, California. Ventura, California. 18 pp.

U.S. Fish and Wildlife Service. 2004. Recovery Plan for Five Plants from Monterey County, California. Portland, Oregon. 175 pp.

Rationale for Species Conclusion: Pondberry

Scientific Name:	Common Name:	Entity ID:
Lindera melissifolia	Pondberry	960

Conclusion:

Pondberry is a deciduous shrub native to south-central and the southeast U.S. Pondberry is found in southern Missouri, eastern Arkansas, and across the southeast in Mississippi, Alabama, Georgia, and the Carolinas. There are currently up to 73 natural populations potentially extant. However, only 35 of these populations have been confirmed extant by recent observations and the statuses of the remaining 38 are uncertain, of which four in Mississippi may have been extirpated while one population in North Carolina may be historical. In addition, one population in Arkansas no longer exists in the wild.

As of the 2021 5-Year Review, 46 natural pondberry populations are known entirely or in part from conservation lands that receive at least some protections in 6 of the 7 states where extant populations occur. Of these populations, 39 are known from state and federally owned/managed lands, and seven populations occur on private properties owned and managed by nongovernmental conservation organizations and/or protected by conservation easements established under various mechanisms and authorities. Overall, populations on conservation lands may be protected from outright habitat destruction, but do not necessarily receive adequate habitat management. Finally, occurrence of plants on conservation lands does not preclude extirpations and population declines, as evidenced by the potential extirpation of four populations on federal lands in Mississippi, and substantial population declines on federal lands in Mississippi and South Carolina, and state lands in Georgia. The most recent status of pondberry characterizes the species as stable to declining with suspected extirpations and declines even from conserved sites (USFWS 2021).

Documented threats include habitat destruction, altered hydrologic conditions, small population sizes, population fragmentation, biased sex ratios, and laurel wilt disease that all influence the long-term viability of populations. The 2014 5-Year Review also mentions the threat of agricultural pesticide use to two populations in Mississippi.

Pondberry is a strongly clonal plant, with population recruitment dominated by vegetative, asexual production of new shoots. Most of the shrubs in any pondberry population are clones or genets of a much smaller number of genetically unique individuals. Therefore, the persistence of existing pondberry populations is mostly affected by the vegetative production and survival of stems and shoots. However, the species does reproduce sexually and is dioecious (each plant is either a male or a female) and produce clusters of small, yellow flowers. As male and female flowers are on separate plants, the species requires insect pollinators to transport pollen between them. Skewed sex ratios at some sites may limit pollination success, thus resulting in poor fruit production and subsequent seedling recruitment. Hermit thrushes, *Catharus guttatus*, are the only known animal dispersal agent of pondberry, although seeds have survived gut passage through other animal species (USFWS 2014).

We anticipate substantial methomyl exposure to pollinators and seed dispersers of the species in a large portion of the range as the overlap of methomyl use sites with the species range is 40% and past usage data indicate that up to 9.2% of the species' range has been treated with methomyl annually. However, even though exposure may be high, we anticipate low adverse reproductive effects to the species from pollinator and seed disperser loss for the following reasons. First, the species is broadly distributed across multiple states and a significant number of populations are found on federal, state, or conservation lands where we anticipate agricultural use of methomyl is unlikely. Second, the pondberry is strongly clonal and can reproduce vegetatively in the absence of insect pollinators, and lastly, the species uses birds for seed dispersal, so methomyl is unlikely to diminish their availability as described in the Effects of the Action section, above.

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 pondberry.

C-B3. CONUS Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

References:

U.S. Fish and Wildlife Service. 2021. Pondberry (*Lindera melissifolia*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi. 24 pp.

U.S. Fish and Wildlife Service. 2014. Pondberry (*Lindera melissifolia*) 5-Year Review: Summary and Evaluation. Jackson, Mississippi. 42 pp.