Integration and Synthesis Summary for Plants

Monocot and dicot flowering plants that use biotic pollination vectors, additional reproductive characteristics unknown

Assessment Groups 7 & 11

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined would "likely be adversely affected" by the proposed action. Our jeopardy analysis of the proposed action's impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine individual species' rankings including environmental baselines, cumulative effects, exposure information, and expected toxic effects for all species, and a template worksheet to show how rankings were assessed and combined are in Appendix E. All plants in this appendix (plant assessment groups 7 & 11) utilize biotic vectors to accomplish pollination, such as insects, birds, and mammals; other aspects of their reproductive mechanism are unknown.

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

Our assessment of vulnerability focuses on seven factors: (1) the species listing status and recent 5-year status review recommendation (if available), (2) distribution, (3) number of populations, (4) species population trends, (5) if pesticides have been noted as a threat, (6) if pollinator loss has been noted as a threat, and (7) impacts from activities associated with environmental baseline and cumulative effects. We obtained the information to create the vulnerability summary from the Status of the Species accounts (Appendix B), overarching Environmental Baseline section of this Opinion, five-year species status reviews, species recovery plans, species status assessments, and other sources containing the best available scientific information for the species.

We scored each of the seven vulnerability components with high, medium, or low scores. We assigned a high vulnerability ranking to a species if all vulnerability components were scored as medium or high. We assigned a medium vulnerability ranking if a species' scores were a mix of high and low (though exceptions were allowed for species that have a low status score or have an uplisting recommendation). We assigned a low vulnerability ranking to species with only low or medium scores. Considerations regarding specific aspects of the species vulnerability, or beyond what was included in the vulnerability ranking were applicable for some species depending on unique aspects of their life history. This information is reflected in the rationales for conclusion below.

Exposure to Agricultural Uses

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

We characterize the expected level of exposure using overlaps between the species' ranges and agricultural land uses where carbaryl is registered for use (i.e., overlaps), past carbaryl usage data (when available; the amount and location where carbaryl has been used in the past), any species-specific considerations such as life history information (e.g., habitat preferences, pollinator preferences), and existing protections or conservation actions (e.g., existing label measures, conservation measures from the action agency). Species with greater than 10% overlap between their range and carbaryl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score. In addition to range overlaps with carbaryl use sites, we considered past carbaryl usage data within a species' range to determine how much of a species' range we expect to be treated with carbaryl each year of the proposed action. Except where otherwise noted, usage data is provided by EPA applying data from their National and State Summary Use and Usage Matrix, as described in the Usage Analysis section of this biological opinion. Species that data indicate will have a large portion of their range (>10%) treated with carbaryl each year are assigned a high usage score. Species that will have a medium portion of their range (5-10%) treated with carbaryl each year are assigned a medium usage score, and species that data indicate will have a low portion of their range (<5%) treated with carbaryl each year are assigned a low usage score. Agricultural uses of carbaryl in the state of Hawai`i are no longer registered; however, agricultural uses are still registered for other island territories.

We determine the overall exposure ranking by qualitatively considering both the total overlap and total usage, as well as any additional exposure considerations that might modify the level of exposure likely to occur. When overlap and usage scores are the same, we assign the overall exposure ranking the same score (e.g., if both overlap and usage is high, the overall exposure ranking is high). In cases where overlap is high and usage is medium or when overlap is medium and usage is low, we use the overlap score as the overall exposure ranking to maintain conservative exposure assumptions. As usage is a subset of overlap, the overlap score will always be greater than the usage score. In cases where overlap is high, but usage is low, we anticipate a moderate portion of the range may be treated over the duration of the proposed action even if only a small portion of the range is treated in any given year (particularly if the areas treated occur in different locations each year), leading to an overall exposure ranking of medium. Past usage data for carbaryl is not available for species located on Pacific or Caribbean islands, including Commonwealth of the Northern Mariana Islands, Guam, American Samoa, U.S. Virgin Islands, and Puerto Rico. Thus, in the absence of any additional exposure considerations for these species, our ranking is based on total overlap of carbaryl use sites for species that occur in these areas. For species where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate.

Exposure to Non-Agricultural Uses

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

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

Additionally, based on application information, we anticipate carbaryl use in these UDLs are restricted to small application areas that are treated infrequently over long periods of time. Use patterns like forestry, rangeland, or rights of way may also be geographically restricted as available past usage data indicate carbaryl usage only occurs in certain areas of the country, such as the western conterminous U.S. Available usage data from the U.S. Forest Service indicate that, over a five year period (from 2016-2020), the Forest Service treated 322 acres of forests in California and 557 acres of forests across three Forest Service Regions (covering North Dakota, Montana, South Dakota, Idaho, Kansas, Nebraska, Colorado, Wyoming, Utah, and Nevada), with the majority of applications taking place in small areas (less than 1 acre in size). Similarly, usage data from the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) show limited past carbaryl usage as well. From 2019-2023, APHIS as treated 92,309 acres of rangeland in seven states (Arizona, Idaho, Montana, Nevada, Utah, Washington, Wyoming) and 25 counties. While this represents a large area overall, when distributed across the areas within the seven states where usage occurs, we anticipate only a small percentage of any species' range is likely to be treated for this use pattern. Additionally, all but one of these applications were made using carbaryl bait, which we expect has a much lower risk profile as bait applications are not likely to cause off target exposures as there is no spray drift or contact exposure likely to occur.

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

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

Toxicity

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

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

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

We evaluate indirect effects by assessing (1) how critical biotic outcrossing is to the species, (2) the type of pollination vector required, (3) the type of seed dispersal vector required, and (4) how strict the pollinator and seed disperser requirement is for the species (e.g., can the species use a wide range of insect species or is the species a pollinator obligate or specialist?). Species that 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 Assessment Groups 7 & 11 Conclusions

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

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

We expect the registration of carbaryl, as proposed, will jeopardize the continued existence of Mead's milkweed, short-leaved rosemary, scrub mint, highlands scrub hypericum, lyrate bladderpod, papery whitlow-wort, beach jacquemontia, Howell's spectacular thelypody, and the Willamette daisy in the wild.

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

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

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

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

Table 1. Plant species in assessment groups 7 & 11 with low exposure informed by low overlap with agricultural uses

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Arctomecon humilis	Dwarf bear-poppy	High	Low	High	3.4	No Jeopardy
Astragalus cremnophylax var. *cremnophylax*	Sentry milk-vetch	High	Low	High	0.2	No Jeopardy
Astragalus tricarinatus	Triple-ribbed milk-vetch	Medium	Low	High	0.2	No Jeopardy
Baccharis vanessae	Encinitas baccharis	Medium	Low	Low	1.1	No Jeopardy
Banara vanderbiltii	Palo de ramon	High	Low	Low	0.8	No Jeopardy
Buxus vahlii	Vahl's boxwood	High	Low	Medium	1.7	No Jeopardy
Callicarpa ampla	Capa rosa	High	Low	High	0	No Jeopardy
Calyptranthes thomasiana	No common name	High	Low	Low	0.1	No Jeopardy
Calyptridium pulchellum	Mariposa pussypaws	High	Low	Medium	0.2	No Jeopardy
Calyptronoma rivalis	Palma de manaca	Medium	Low	Medium	1.1	No Jeopardy
Catesbaea melanocarpa	No common name	High	Low	High	0	No Jeopardy
Ceanothus ferrisae	Coyote ceanothus	High	Low	High	1.4	No Jeopardy
Ceanothus ophiochilus	Vail Lake ceanothus	High	Low	High	0.9	No Jeopardy
Ceanothus roderickii	Pine Hill ceanothus	High	Low	High	0.8	No Jeopardy
Centaurium namophilum	Spring-loving centaury	High	Low	Medium	0.5	No Jeopardy

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Cercocarpus traskiae	Catalina Island mountain-mahogany	High	Low	High	0.3	No Jeopardy
Chamaesyce garberi	Garber's spurge	High	Low	High	4.5	No Jeopardy
Chorizanthe orcuttiana	Orcutt's spineflower	High	Low	High	0.4	No Jeopardy
Chorizanthe robusta var. *hartwegii*	Scotts Valley spineflower	Medium	Low	High	2.5	No Jeopardy
Clematis morefieldii	Morefield"s leather flower	Medium	Low	High	3.1	No Jeopardy
Daphnopsis helleriana	No common name	High	Low	High	3.3	No Jeopardy
Deeringothamnus rugelii	Rugel's pawpaw	Medium	Low	Medium	2.8	No Jeopardy
Dudleya traskiae	Santa Barbara Island liveforever	High	Low	High	0	No Jeopardy
Erigeron parishii	Parish's daisy	Medium	Low	High	0.9	No Jeopardy
Eugenia bryanii	No common name	High	Low	Medium	1.3	No Jeopardy
Eugenia woodburyana	No common name	High	Low	High	3.9	No Jeopardy
Euphorbia telephioides	Telephus spurge	Medium	Low	High	0.8	No Jeopardy
Galium californicum ssp. *sierrae*	El Dorado bedstraw	High	Low	High	0.9	No Jeopardy
Geocarpon minimum	No common name	Low	Low	Medium	3.1	No Jeopardy
Gonocalyx concolor	No common name	High	Low	Medium	0	No Jeopardy
Graptopetalum bartramii	Bartram's stonecrop	Medium	Low	Medium	0	No Jeopardy
Grindelia fraxinipratensis	Ash Meadows gumplant	High	Low	Medium	2.1	No Jeopardy

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Harperocallis flava	Harper's beauty	High	Low	High	0.3	No Jeopardy
Hedyotis megalantha	Paudedo	High	Low	High	0.5	No Jeopardy
Helianthus paradoxus	Pecos (=puzzle, =paradox) sunflower	Medium	Low	High	3.6	No Jeopardy
Heritiera longipetiolata	Ufa-halomtano	High	Low	Medium	1.3	No Jeopardy
Ilex cookii	Cook's holly	High	Low	Low	0.6	No Jeopardy
Ilex sintenisii	No common name	High	Low	Low	0	No Jeopardy
Ivesia kingii var. *eremica*	Ash Meadows ivesia	High	Low	Medium	2.1	No Jeopardy
Leptocereus grantianus	No common name	High	Low	High	0	No Jeopardy
Lesquerella kingii ssp. *bernardina*	San Bernardino Mountains bladderpod	High	Low	High	0.5	No Jeopardy
Lesquerella tumulosa	Kodachrome bladderpod	High	Low	High	0.2	No Jeopardy
Lupinus tidestromii	Clover (Tidestrom"s) lupine	High	Low	Medium	4.3	No Jeopardy
Maesa walkeri	No common name	Medium	Low	High	1.3	No Jeopardy
Malacothamnus fasciculatus var. *nesioticus*	Santa Cruz Island bush-mallow	High	Low	High	1.3	No Jeopardy
Mentzelia leucophylla	Ash Meadows blazingstar	High	Low	High	2.1	No Jeopardy
Mitracarpus maxwelliae	No common name	High	Low	High	0	No Jeopardy
Mitracarpus polycladus	No common name	High	Low	High	0	No Jeopardy
Myrcia paganii	No common name	High	Low	High	1.4	No Jeopardy

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Nesogenes rotensis	No common name	High	Low	High	0.6	No Jeopardy
Osmoxylon mariannense	No common name	High	Low	Low	1.5	No Jeopardy
Ottoschulzia rhodoxylon	Palo de rosa	High	Low	Medium	3.5	No Jeopardy
Oxytheca parishii var. *goodmaniana*	Cushenbury oxytheca	High	Low	High	1.1	No Jeopardy
Pectis imberbis	Beardless chinchweed	High	Low	Medium	0.1	No Jeopardy
Pediocactus (=Echinocactus, =Utahia) sileri	Siler pincushion cactus	High	Low	High	0.3	No Jeopardy
Pediocactus peeblesianus ssp. *peeblesianus*	Peebles Navajo cactus	High	Low	High	0.1	No Jeopardy
Penstemon haydenii	Blowout penstemon	High	Low	High	3.9	No Jeopardy
Phyllanthus saffordii	No common name	High	Low	Medium	0.5	No Jeopardy
Physaria pallida	White bladderpod	High	Low	High	0.7	No Jeopardy
Pleodendron macranthum	Chupacallos	High	Low	Low	0	No Jeopardy
Polygonum hickmanii	Scotts Valley polygonum	High	Low	Medium	2.5	No Jeopardy
Psychotria malaspinae	Aplokating-palaoan	High	Low	Medium	1.3	No Jeopardy
Schoenocrambe argillacea	Clay reed-mustard	High	Low	High	2.7	No Jeopardy
Schoenocrambe suffrutescens	Shrubby reed-mustard	High	Low	High	1.5	No Jeopardy
Schoepfia arenaria	No common name	High	Low	High	2.8	No Jeopardy
Scutellaria floridana	Florida skullcap	Medium	Low	High	1.2	No Jeopardy
Solanum drymophilum	Erubia	High	Low	High	0	No Jeopardy
Sphaeralcea gierischii	Gierisch mallow	High	Low	High	1.0	No Jeopardy

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Stahlia monosperma	Cobana negra	High	Low	High	0.9	No Jeopardy
Streptanthus bracteatus	Bracted twistflower	Medium	Low	High	2.8	No Jeopardy
Styrax platanifolius ssp. *texanus*	Texas snowbells	Medium	Low	Medium	0.6	No Jeopardy
Styrax portoricensis	Palo de jazmin	High	Low	Medium	0.8	No Jeopardy
Tabernaemontana rotensis	No common name	Medium	Low	Low	1.4	No Jeopardy
Taraxacum californicum	California taraxacum	High	Low	High	0.5	No Jeopardy
Ternstroemia luquillensis	Palo colorado	High	Low	Medium	0	No Jeopardy
Ternstroemia subsessilis	No common name	High	Low	Medium	0	No Jeopardy
Thelypodium stenopetalum	Slender-petaled mustard	High	Low	High	1.0	No Jeopardy
Thlaspi californicum	Kneeland Prairie penny-cress	High	Low	High	0	No Jeopardy
Tuberolabium guamense	No common name	High	Low	High	1.1	No Jeopardy
Varronia rupicola	No common name	High	Low	High	2.8	No Jeopardy
Vernonia proctorii	No common name	High	Low	Medium	0.9	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, we determined that the vulnerabilities for species in Table 1 vary from low to high. Toxicity is expected to be medium or high for most of the plant species in this group, mainly due to their reliance on insect pollinators for successful reproduction. However, most of the plants in Table 1 use abiotic vectors for some or all seed dispersal. We are not aware of any species in Table 1 that use a specialist pollinator and will assume they are able to use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists), as most flowering plants are pollinator generalists as opposed to specialists. This characteristic suggests they are likely to recover from temporary losses of a small portion of the pollinating community. Furthermore, several of the species in Table 1, *Ilex sintenisii, Ilex cookii*, and *Encinitas baccharis,* have low toxicity rankings because they use some combination of birds, mammals, and/or insects and abiotic vectors for pollination and seed dispersal. Vertebrate pollination vectors experience low or no toxicity from exposure to carbaryl as described above in the Toxicity section, and the likelihood of adverse effects to the species is lower than for those species exclusively using insect pollination.

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

For non-agricultural uses of carbaryl, we qualitatively evaluated the potential for carbaryl exposure from use sites to individual species based on their preferred habitat and current known locations within the context of our expectation that overall, species will experience minimal exposure from non-agricultural carbaryl use sites (described in the Exposure section, above). Based on individual reviews of available life history information for each of the 81 species in Table 1, we expect that many of these species and their pollinator communities are unlikely to occur on, or near non-agricultural use sites of carbaryl. There are 47 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species, see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, threats, and conservation measures in place as described above in the non-agricultural use section. For example, the Florida skullcap mainly grows in fire dependent habitats like longleaf pine wet forests and meadows. In addition, it can be found in road and transmission rights of way (USFWS 2024) where non-agricultural use of carbaryl may occur. However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. As the Florida skullcap is expected to predominantly occur in wet forests and meadows, we anticipate that if small amounts of carbaryl usage did occur in rights of way within the species' ranges, it would result in no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species.

In summary, while many species listed in Table 1 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect the pollinators of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of agricultural overlap within these species' ranges and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects to the species due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure.

We do not expect that these adverse reproductive effects will result in adverse species-level reproductive effects due to low expected exposure of pollinators to carbaryl, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 1.

References:

U.S. Fish and Wildlife Service. 2024. *Scutellaria floridana* (Florida skullcap) 5-Year Status Review: Summary and Evaluation. Panama City, Florida. 14 pp.

U.S. Fish and Wildlife Service. 2021. *Callicarpa ampla* / (Capá rosa), *Ilex sintenisii* / (no common name), *Styrax portoricensis*/ Palo de jazmín, *Ternstroemia luquillensis*/ Palo Colorado, *Ternstroemia subsessilis*/ (no common name). 5-Year Review: Summary and Evaluation. Boquerón, Puerto Rico. 32 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

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

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

Table 2. Plant species in groups 7 & 11 with low exposure informed by low past usage from California Department of Pesticide Regulation Pesticide Use Reporting data.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Astragalus clarianus	Clara Hunt's milk-vetch	High	Low	High	0.01	No Jeopardy
Castilleja campestris ssp. *succulenta*	Succulent owl's-clover	Low	Low	High	0.35	No Jeopardy
Castilleja mollis	Soft-leaved paintbrush	High	Low	Medium	0	No Jeopardy
Caulanthus californicus	California jewelflower	Medium	Low	High	0.36	No Jeopardy
Chamaesyce hooveri	Hoover's spurge	Low	Low	High	0.26	No Jeopardy
Chlorogalum purpureum	Purple amole	Medium	Low	High	0.07	No Jeopardy
Chorizanthe howellii	Howell's spineflower	High	Low	Medium	0	No Jeopardy
Chorizanthe pungens var. *pungens*	Monterey spineflower	Medium	Low	Medium	0.55	No Jeopardy
Chorizanthe valida	Sonoma spineflower	High	Low	Medium	0.04	No Jeopardy
Cirsium fontinale var. *obispoense*	Chorro Creek bog thistle	High	Low	Medium	0.01	No Jeopardy
Cirsium hydrophilum var. *hydrophilum*	Suisun thistle	High	Low	High	0	No Jeopardy
Cirsium loncholepis	La Graciosa thistle	High	Low	Medium	0.24	No Jeopardy
Clarkia speciosa ssp. *immaculata*	Pismo clarkia	High	Low	Medium	0.04	No Jeopardy
Clarkia springvillensis	Springville clarkia	High	Low	Medium	0.47	No Jeopardy

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CalPUR)	Determination
Delphinium luteum	Yellow larkspur	High	Low	Low	0.03	No Jeopardy
Dudleya setchellii	Santa Clara Valley dudleya	Medium	Low	High	0.05	No Jeopardy
Eriodictyon capitatum	Lompoc yerba santa	High	Low	High	0.18	No Jeopardy
Eriogonum apricum (incl. var. *prostratum)*	Ione (incl. Irish Hill) buckwheat	High	Low	High	0.10	No Jeopardy
Eryngium constancei	Loch Lomond coyote thistle	Medium	Low	Medium	0	No Jeopardy
Monolopia (=Lembertia) congdonii	San Joaquin wooly-threads	Medium	Low	Medium	0.62	No Jeopardy
Navarretia leucocephala ssp. *pauciflora (=N. pauciflora)*	Few-flowered navarretia	High	Low	Medium	0	No Jeopardy
Navarretia leucocephala ssp. *plieantha*	Many-flowered navarretia	High	Low	Medium	0.01	No Jeopardy
Parvisedum leiocarpum	Lake County stonecrop	High	Low	Medium	0	No Jeopardy
Phacelia insularis ssp. *insularis*	Island phacelia	High	Low	High	0	No Jeopardy
Plagiobothrys strictus	Calistoga allocarya	High	Low	High	0	No Jeopardy
Sidalcea keckii	Keck's checker-mallow	High	Low	High	0.12	No Jeopardy
Sidalcea oregana ssp. *valida*	Kenwood marsh checker-mallow	High	Low	High	0	No Jeopardy

Most species listed in Table 2 have medium or high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capability of individuals from carbaryl exposure. Toxicity is expected to be medium or high for the plant species in this group, mainly due to their reliance on insect pollinators for successful reproduction (with one exception, the yellow larkspur, that can also use birds for pollination and thus has a low toxicity ranking). However, most of the plants in Table 2 use abiotic vectors for some or all seed dispersal. We are not aware of any species in Table 2 that use a specialist pollinator and will assume they are able to use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists), suggesting they are likely to recover from temporary losses of a small portion of the pollinating community.

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

For non-agricultural uses of carbaryl, we qualitatively evaluated the potential for carbaryl exposure from use sites to individual species based on their preferred habitat and current known locations within the context of our expectation that overall, species will experience minimal exposure from non-agricultural carbaryl use sites (described in the "Exposure to Non-Agricultural Uses" section, above). Based on individual reviews of available life history information for each of the 27 species in Table 2, we expect that many of these species and their pollinator communities are unlikely to occur on, or in close proximity to non-agricultural use sites of carbaryl. There are 18 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, and threats, and conservation measures in place as described above in the non-agricultural use section.

For example, Kenwood Marsh checker-mallow occurs in two privately-owned marshes in eastern Sonoma County, California (USFWS 2024). They are on pastureland and a vineyard. Carbaryl has not been used on federal rangelands in California, and the vineyard has exclosures around the Kenwood Marsh checker-mallow plants to protect them, thus we expect carbaryl exposure is unlikely for this species. In addition, CalPUR data include all agricultural usage and certain non-agricultural uses, such as those performed by professional commercial applicators. While these data do not capture all non-agricultural usage, such as residential applications by consumers, given our broad understanding of carbaryl usage, general information on non-agricultural use practices, and existing conservation measures we expect limited exposure from these uses of carbaryl. Thus, while these species' vulnerability and toxicity rankings may be medium or high, we have high confidence that the pollinators and seed dispersers of the plant species in Table 2 will have minimal exposure to carbaryl from agricultural or non-agricultural uses.

In summary, while species listed in Table 2 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect these species are likely to experience no more than low levels adverse reproductive effects from small losses of pollinators from carbaryl exposure based on the low level of past carbaryl usage indicated by CalPUR data and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success of the species from carbaryl exposure. We do not expect that these adverse reproductive effects will cause adverse species-level reproductive effects due to low expected exposure, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

References:

U.S. Fish and Wildlife Service. 2024. 5-Year Review Kenwood Marsh checker-mallow (*Sidalcea oregana* ssp. *valida*). Sacramento, California. 11 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

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

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

Table 3. Plant species in assessment groups 7 & 11 with low exposure informed by low past usage according to the USDA's Census of Agriculture (CoA)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Arabis perstellata	Braun's rock-cress	Medium	Low	High	1.7	No Jeopardy
Auerodendron pauciflorum	No common name	High	Low	High	2.6	No Jeopardy
Cardamine micranthera	Small-anthered bittercress	High	Low	High	1.1	No Jeopardy
Chamaesyce deltoidea ssp. *deltoidea*	Deltoid spurge	High	Low	High	2.7	No Jeopardy
Consolea corallicola	Florida semaphore cactus	High	Low	High	1.4	No Jeopardy
Hexastylis naniflora	Dwarf-flowered heartleaf	Low	Low	High	2.1	No Jeopardy
Justicia cooleyi	Cooley's water-willow	High	Low	Low	2.0	No Jeopardy
Leavenworthia exigua laciniata	Kentucky glade cress	Medium	Low	High	0.8	No Jeopardy
Lesquerella perforata	Spring Creek bladderpod	High	Low	High	0.4	No Jeopardy
Limnanthes pumila ssp. *grandiflora*	Large-flowered woolly meadowfoam	High	Low	Medium	1.7	No Jeopardy
Linum arenicola	Sand flax	High	Low	High	1.4	No Jeopardy
Lomatium cookii	Cook's lomatium	High	Low	Medium	1.0	No Jeopardy
Physaria thamnophila	Zapata bladderpod	High	Low	High	1.8	No Jeopardy
Platanthera integrilabia	White fringeless orchid	Medium	Low	Medium	1.5	No Jeopardy
Ranunculus aestivalis (=acriformis)	Autumn buttercup	High	Low	Medium	2.4	No Jeopardy

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated (CoA)	Determination
Scutellaria montana	Large-flowered skullcap	Low	Low	Low	0.9	No Jeopardy
Sideroxylon reclinatum ssp. austrofloridense	Everglades bully	Low	Low	Medium	1.4	No Jeopardy
Sisyrinchium dichotomum	White irisette	High	Low	High	1.0	No Jeopardy

Many species listed in Table 3 have medium or high vulnerability rankings, indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capability of individuals from carbaryl exposure. Toxicity is expected to be medium or high for the plant species in this group (with two exceptions, the large-flowered skullcap and Cooley's water-willow), mainly due to their reliance on insect pollinators for successful reproduction. However, all plants in Table 3 use abiotic vectors for some or all seed dispersal. We are not aware of any species in Table 3 that use a specialist pollinator and will assume they are able to use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists), suggesting they are likely to recover from temporary losses of a small portion of the pollinating community.

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

For non-agricultural uses of carbaryl, we qualitatively evaluated the potential for carbaryl exposure from use sites to individual species based on their preferred habitat and current known locations within the context of our expectation that overall, species will experience minimal exposure from non-agricultural carbaryl use sites (described in the "Exposure from Non-Agricultural Uses" section, above). Based on individual reviews of available life history information for each of the 18 species in Table 3, we expect that one of these species and its pollinator communities are unlikely to occur on, or in close proximity to non-agricultural use sites of carbaryl. There are 17 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, threats, and conservation measures in place as described above in the non-agricultural use section.

For example, most white irisette populations occur at mid-elevations on scattered mountain slopes in western North Carolina and northern South Carolina. A few sub-populations occur in electric transmission rights of way (USFWS 2024). However, available usage information indicates that carbaryl is used infrequently in rights of way, such that usage within the range of any individual species is unlikely, or at most, expected to be minimal. As the white irisette is expected to predominantly occur on thin soils in open areas downslope of the tree canopy, we anticipate that if small amounts of carbaryl usage did occur in rights of way within the species' ranges, it would result in no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species from exposure to non-agricultural uses of carbaryl. Therefore, we expect, at most, a low level of adverse reproductive effects from the minimal carbaryl exposure expected for the white irisette.

In summary, while many species listed in Table 3 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect pollinators are likely to experience no more than low levels of exposure to carbaryl based on the low level of general insecticide usage within these species' ranges and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure. We do not expect that these adverse reproductive effects will result in adverse species-level reproductive effects due to low expected exposure, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 3.

References:

U.S. Fish and Wildlife Service. 2024. White Irisette (*Sisyrinchium dichotomum*) 5-Year Status Review: Summary and Evaluation. Asheville, North Carolina. 9 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Species with Individual Integration and Synthesis Summaries

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

Table 4. Plant species in groups 7 & 11 with moderate to high adverse effects anticipated from the proposed action

Scientific Name	Common Name	Determination
Asclepias meadii	Mead's milkweed	Jeopardy
Conradina brevifolia	Short-leaved rosemary	Jeopardy
Dicerandra frutescens	Scrub mint	Jeopardy
Hypericum cumulicola	Highlands scrub hypericum	Jeopardy
Lesquerella lyrata	Lyrate bladderpod	Jeopardy
Paronychia chartacea	Papery whitlow-wort	Jeopardy
Thalictrum cooleyi	Cooley's meadowrue	No Jeopardy
Jacquemontia reclinata	Beach jacquemontia	Jeopardy
Thelypodium howellii ssp. *spectabilis*	Howell’s spectacular thelypody	Jeopardy
Hymenoxys texana	Texas prairie dawn-flower	No Jeopardy
Erigeron decumbens	Willamette daisy	Jeopardy

Rationale for Species Conclusion: Mead's milkweed

Scientific Name:	Common Name:	Entity ID:
Asclepias meadii	Mead's milkweed	636

Conclusion

Mead's milkweed historically occurred in the tallgrass upland prairie of 46 counties throughout Kansas, Missouri, Illinois, Iowa, Indiana, and Wisconsin. At the time of listing, it was considered extirpated from Wisconsin and Indiana, and from 7 counties in Illinois. Before 2012, nineteen reintroductions occurred in Illinois (7), Indiana (1), and Wisconsin (11). Since then, additional plantings have occurred in Missouri and Illinois, resulting in a total of 375 recorded populations across 15 physiographic regions and two plant community types. There was a total of 29 reintroductions as of 2022. However, a major issue for the continued management and restoration of Mead's milkweed across its range is the lack of long-term data and regular surveys. Nearly one-third of all populations have not had observations or have not been surveyed in 30 years. Given poor recruitment, previous population declines, and changing environmental conditions, it's likely some populations have disappeared (USFWS 2022).

The Mead's milkweed can spread clonally (vegetatively), but also requires pollination primarily by large bees, including the European honey bee (*Apis melifera*), rusty patched bumble bee (*Bombus affinis*), brown-belted bumble bee (*B. griseocollis*), Southern Plains bumble bee (*B. fraternus)* and the chimney bee (*Anthrophora abrupta*). In North America, losses of bees in grasslands commenced in the early 19th century, while a largescale bee decline in the U.S. Midwest occurred as agriculture practices intensified between the 1940s and 1960s. Mead's milkweed pollinators, particularly bumble bees, have declined throughout the United States. The Southern Plains bumble bee suffered population declines across 70% of its range and is considered at high risk for extinction due to its small geographic range. The brown-belted bumble bee remains in only 72% of its historical range. Furthermore, rusty-patched bumble bee, previously identified as a pollinator of Mead's milkweed, has experienced a large decline across its range and was listed as endangered in 2017 (82 FR 3186 3209). Recovery efforts for pollinators are ongoing through a variety of partnerships across the nation and maintaining pollinator populations will be essential for the recovery of Mead's milkweed. Seeds are dispersed by wind (USFWS 2003).

The mosaic agricultural landscape of the species' range currently presents a barrier to gene flow among populations of Mead's milkweed, preventing pollinator dispersal and reducing the likelihood that attempted dispersals will result in successful transport of gametes elsewhere. Furthermore, a loss of fecundity is reported for the species. Herbicide and pesticide use are described as a threat to the species. Indirect effects of increased pesticide use can result in the direct decline of the Mead's milkweed primary pollinators (USFWS 2022).

The primary habitat for the Mead's milkweed is moderately wet to moderately dry tallgrass prairie or glade habitats. Mead's milkweed occurs on some non-agricultural carbaryl use sites containing suitable habitat including rights of way, roadsides, and old cemeteries. Available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied annually to roadways nationally. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within one species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl will be used within the Mead's milkweed's range for rights of way uses. Similarly, available usage data indicate only low levels of past carbaryl usage in open space developed areas (including cemeteries), with, at most, up to 2.4% of the species' range likely to be treated each year. As the Mead's milkweed is expected to predominantly occur on tallgrass prairie and glade habitats, we anticipate that if small amounts of carbaryl usage did occur in rights of way and open space developed use sites within the species' ranges, it would result in no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species.

Overlap of agricultural carbaryl use sites with the range of the species is 35.5% and past agricultural usage data indicate that up to 17.4% of the species' range has been treated with carbaryl annually, leading us to conclude there will be high exposure of mead's milkweed pollinators within the range from agricultural use. We expect pollinators to die in portions of the range exposed to carbaryl on agricultural use sites or via spray drift. The pre-existing decline in pollinators of this species and lack of pollinator dispersal is likely to be exacerbated by the loss of insect pollinators from exposure to carbaryl. As this species relies on a relatively narrow spectrum of pollinator species (large bees) that are already reduced in numbers, further loss from carbaryl exposure in a large portion of the range is likely to have a significant effect on the reproductive capacity of the species because it cannot use other species of insect for pollination, and it is already experiencing reproductive declines.

We anticipate that mortality of pollinators will cause species-level reproductive effects to the Mead's milkweed over the duration of the action. The species' reproductive success is dependent upon the presence of particular insect pollinators for reproduction which are already in decline. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the northern Mead's milkweed.

References:

U.S. Fish and Wildlife Service. 2022. 5-Year Review Mead's milkweed (*Asclepias meadii*). Columbia, Missouri. 36 pp.

U.S. Fish and Wildlife Service. 2003. Mead's Milkweed (*Asclepias meadii*) Recovery Plan. Fort Snelling, Minnesota. 131 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Short-leaved rosemary

Scientific Name:	Common Name:	Entity ID:
Conradina brevifolia	Short-leaved rosemary	675

Conclusion

Short-leaved rosemary is endemic to central Florida and restricted to the xeric scrub habitats of the Lake Wales Ridge in central Highlands and Polk counties where habitat destruction from development continues to occur and development pressure remains high (USFWS 2019). The species occurs at approximately 20 sites whose total area is less than 2,400 hectares (6,000 acres) in the Sebring-Avon Park area of Highlands and Polk Counties (USFWS 1999). Although there are 21 Element Occurrence Records recognized by Florida Natural Areas Inventory, there are virtually no data on population trends in short-leaved rosemary. There are also little data on population sizes, age structure, vital rates, and the extent of natural recruitment, with limited monitoring data collected only at one site. Therefore, it is unclear if populations are stable, increasing, or decreasing (USFWS 2021).

As discussed in the 2019 Lake Wales Ridge Plants Recovery Plan Amendments, very little is known about the biology or ecology of short-leaved rosemary. Anecdotal information presented in the 1999 Recovery Plan suggests that asexual reproduction is unlikely for this species, meaning it would rely on outcrossing by pollinators to reproduce successfully. Insects are the most likely pollinator of this species and are expected to experience mortality wherever exposed to carbaryl.

Short-leaved rosemary relies on a variety of seed dispersers to maintain populations and colonize new sites in its range. It can disperse seeds using biotic vectors such as birds, insects, and mammals in addition to abiotic vectors such as wind and water. Similar to insect pollinators, insect seed dispersers are expected to die wherever exposed to carbaryl. However, limited adverse effects are expected for mammal and bird dispersers (as described above in the Toxicity section). Given that this species can rely on a variety of seed dispersal vectors, we do not anticipate effects to its seed dispersers will cause significant adverse effects to the reproductive capacity of this species.

Overlap of agricultural carbaryl use sites with the range of the species is 25.6% and past agricultural usage data indicate that up to 12.1% of the species' range has been treated with carbaryl annually, leading us to conclude there will be high exposure and mortality of the species' pollinators within its range. We expect pollinators to die in the large portion of the range exposed to carbaryl on agricultural use sites or via spray drift. The limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of the species (USFWS 2019). Furthermore, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lienert, T. 2004; Spira, t. 2001; Lennartson, T. 2002, Setsuko, S. et al 2013). As such, we anticipate that loss of insect pollinators in a large portion of the range from agricultural carbaryl use is likely to have a significant adverse effect on the reproductive capacity of the species due to its low numbers and population isolation making it difficult for pollinators to locate and travel among individuals. We do not expect short-leaved rosemary to occur on non-agricultural carbaryl use sites. Due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, we anticipate a low likelihood of exposure and subsequent adverse effects to pollinators of the short-leaved rosemary from non-agricultural uses of carbaryl.

We anticipate that significant pollinator mortality will cause species-level adverse reproductive effects to the short-leaved rosemary over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the short-leaved rosemary.

References:

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

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

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

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

U.S. Fish and Wildlife Service. 1999. South Florida Multi-Species Recovery Plan. Vero Beach, FL. 1227 pp.

U.S. Fish and Wildlife Service. 2019. Lake Wales Ridge Plants Recovery Plan Amendment. Atlanta, GA. 23 pp.

U.S. Fish and Wildlife Service. 2021. 5-Year Review short-leaved rosemary (*Conradina brevifolia*). Vero Beach, FL. 16 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Scrub mint

Scientific Name:	Common Name:	Entity ID:
Dicerandra frutescens	Scrub mint	695

Conclusion

The scrub mint is endemic to yellow sand scrub habitat of the Lake Wales Ridge in Highlands County, Florida. In the most recent Florida Natural Assessment Inventory in 2015, scrub mint was known from 14 occurrences, 7 of which were within managed areas. The other seven occurrences were located on private land and their status was unknown. Based on aerial images, it appeared that four occurrences were likely extirpated or heavily disturbed and another five were possible still extant. Most occurrences are in native vegetation surrounded by agricultural and residential areas (USFWS 2019). Habitat destruction from development continues to occur and development pressure remains high in Highlands County.

Scrub mint is not an obligate out-crosser; it is self-compatible and insect pollinated. However, the species requires insect visits for seed production (USFWS 2009). *Exprosopa fasciata*, a common and generalist bee-fly, is the dominant pollinator for this species, accounting for 95 percent of all visits. Additional pollinators may be important at other sites that support the scrub mint (USFWS 2009).

Fruit and seed dispersal is limited to a few meters from the parent plant and no specialized mechanism for animal mediated dispersal has been identified. In fact, limited dispersal capability of scrub mint is noted as one of the primary threats to the species (USFWS 2009). Because dispersal of this species is limited to a few meters and can occur by abiotic means, we do not anticipate effects to seed dispersers from carbaryl would cause adverse effects to the reproductive capacity of this species.

Overlap of agricultural carbaryl use sites with the range of the species is 25.6% and past agricultural usage data indicate that up to 12.1% of the species' range has been treated with carbaryl annually, leading us to conclude there will be high exposure of scrub mint pollinators within the range from agricultural use. We expect pollinators to die in those portions of the range exposed to carbaryl from agricultural usage. Additionally, the limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of this species (USFWS 2019). Furthermore, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lienert, T. 2004; Spira, t. 2001; Lennartson, T. 2002, Setsuko, S. et al 2013). As such, mortality of pollinators due to carbaryl exposure from agricultural usage in a large portion of the range of the species is likely to have a significant adverse effect on the reproductive capacity of the scrub mint.

Where appropriate habitat exists, scrub mint may occur on roadsides and adjacent to residential areas. However, based on past carbaryl usage and established conservation measures, we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects to the species from these non-agricultural uses of carbaryl. Available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied annually to roadways nationally. While this may result in a large treatment footprint if all rights of way usage were concentrated in one location or within one species' range, we expect this is highly unlikely to occur and rather expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl, at most, will be used within the scrub mint's range for rights of way uses. Similarly, we anticipate low levels of exposure from residential uses. Label measures limit many residential uses of carbaryl to spot, crack-and-crevice, or narrow perimeter bands around urban structures (from 1 inch to 6 feet in width), which we expect to limit the extent of carbaryl usage on these sites and reduce the likelihood of off-site transport. As such, we do not anticipate non-agricultural uses will meaningfully add to the overall level of anticipated exposure or risk of adverse effects to the species.

We anticipate that mortality of pollinators will result in adverse species-level reproductive effects to the scrub mint over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the scrub mint.

References:

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

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

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

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

U.S. Fish and Wildlife Service. 2009. Scrub mint (*Dicerandra frutescens*) 5-Year Review: Summary and Evaluation. Vero Beach, FL. 25 pp.

U.S. Fish and Wildlife Service. 2019. Lake Wales Ridge Plants Recovery Plan Amendment. Atlanta, GA. 23 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Highlands scrub hypericum

Scientific Name:	Common Name:	Entity ID:
Hypericum cumulicola	Highlands scrub hypericum	740

Conclusion

Highlands scrub hypericum is a small, short-lived perennial herb reaching 20-70 cm (0.7-2.3 ft) in height. With the exception of one site on the Winter Haven Ridge at Lizzie Lake (Archbold Biological Station), the species is restricted to scrub on the Lake Wales Ridge in Polk and Highlands counties, from just north of Sunray, Polk County to the south end of the Lake Wales Ridge in Highlands County (USFWS 2019). The 2015 Florida Natural Areas Inventory Element Tracking Summary reported 60 occurrences of this species, 28 of which were within managed areas. This was a 9% decline from the occurrences reported in the 2008 5-Year Status Review. Additionally, habitat destruction from development continues to occur and development pressure remains high in Highlands County.

Small native solitary bees of the genus *Dialictus* were the main flower visitors to highlands scrub hypericum, making 99 percent of all observed visits (USFWS 2021). These bees harvested pollen, and their movements suggest they are efficient pollinators. Visitation rates increased with flower density and populations that had higher visitation rates had higher average seed set. Since flowering density decreases with time since last fire, long-unburned patches of Highlands scrub hypericum suffer lower fecundity and are likely more susceptible to inbreeding depression. Highlands scrub hypericum is self-compatible; however, there is little seed set without insect visitation (USFWS 2021).

Highlands scrub hypericum likely has dispersal limitations as indicated by its absence in some areas of suitable habitat, though seed dispersal mechanisms have not been documented (USFWS 2021). Seed dispersal in other Hypericum species can occur by a variety of methods, including wind and gravity, consumption by birds or mammals, or transport by insects. Given this species has dispersal limitations, it is more likely to be dispersed by gravity or insects than wind or birds and mammals as the latter three vectors are more likely to result in longer-distance dispersal.

Overlap of agricultural carbaryl use sites with the range of the species is 25.6% and past agricultural usage data indicate that up to 12.1% of the species’ range has been treated with carbaryl annually, leading us to conclude there will be high exposure of Highland scrub hypericum pollinators and seed dispersers within its range. We expect pollinators and insect seed dispersers to die in those portions of the range exposed to carbaryl from agricultural usage. Additionally, the limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of this species (USFWS 2019). Furthermore, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lienert, T. 2004; Spira,

t. 2001; Lennartson, T. 2002, Setsuko, S. et al 2013). As such, mortality of pollinators and potentially insect seed dispersers, due to carbaryl exposure from agricultural usage in a large portion of the range of the species is likely to have a significant adverse effect on the reproductive capacity of the highland scrub hypericum.

Highlands scrub hypericum also has potential exposure from non-agricultural carbaryl use, as it can occur on roadsides. However, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied annually to roadways nationally. We expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl, if any, will be used within the Highlands scrub hypericum's range for rights of way uses, resulting in no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species. As such, we do not anticipate non-agricultural uses will meaningfully add to the overall level of anticipated exposure or risk of adverse effects to the species.

We anticipate that loss of pollinators and insect seed dispersers from carbaryl exposure will cause adverse species-level reproductive effects to the highlands scrub hypericum over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the northern highlands scrub hypericum.

References:

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

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

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

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

U.S. Fish and Wildlife Service. 2021. Highlands scrub hypericum *(Hypericum cumulicola*) 5-Year Review: Summary and Evaluation. Vero Beach, FL. 23 pp.

U.S. Fish and Wildlife Service. 2019. Lake Wales Ridge Plants Recovery Plan Amendment. Atlanta, GA. 23 pp.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Lyrate bladderpod

Scientific Name:	Common Name:	Entity ID:
Lesquerella lyrata	Lyrate bladderpod	750

Conclusion

Lyrate bladderpod is a threatened, early successional annual endemic to three counties in northern Alabama. Known populations are found adjacent to limestone outcrops supporting cedar glades, all of which are disturbed (i.e., they are all cultivated fields, roadsides, and cattle pastures). There are three known extant populations, one in each of the three counties where the species exists (Colbert, Franklin, and Lawrence Counties). There is only one site in Colbert County recently confirmed to exist, it is small and consists of 100-200 plants in areas that are periodically mowed. The other two sites may be extirpated, one was sprayed with herbicides, and the other site was developed and is subject to lawn maintenance. There are two sites in Franklin County and both occur along roadsides adjacent to glade areas and total 300-400 plants. This population is greatly influenced by right of way maintenance practices, particularly mowing and herbicide use, and are declining overall. The third population exists in Lawrence County on three sites. By far the largest site, with thousands of plants, is on The Nature Conservancy property. This property is managed for the benefit of lyrate bladderpod. Additional plants occur adjacent to this property and efforts are underway to establish a Wildlife Cooperative Extension Agreement with new property owners (USFWS 2024). Lyrate bladderpods are threatened by habitat loss and fragmentation (e.g., agriculture including herbicide use, development, road construction) and effects of small populations (USFWS 2019).

Flowering occurs from mid-March to April, and seeds are dispersed from April until mid-May. Other details of its reproductive strategy, self-compatibility, and potential reliance on insect dispersers or pollinators is unknown. Due to the lack of more specific information, we assume the species depends on insect pollinators and seeds dispersers for reproduction. Lyrate bladderpod has a long-lived (10+ years) seed bank and seeds typically germinate after disturbance when seeds are brought to the ground's surface (e.g., mowing, fire, grazing, plowing) (USFWS 1996, 2019).

There is a high overlap between the species' range and agricultural carbaryl use sites (33.9%), and past annual agricultural carbaryl usage indicates a high portion of the range (17.5%) has been treated annually, leading us to determine there will be high exposure to insect pollinators from agricultural use of carbaryl. In addition to the exposure expected from agricultural uses of carbaryl, exposure of the pollinator community within the range of the species is expected to occur from carbaryl use on rights of way, given one of only three possibly extant populations occur within rights of way (e.g., roadsides). As such, we expect high insect pollinator mortality across a large portion of the range. In summary, loss of insect pollinators is expected within a large portion of the range of this species from agricultural and non-agricultural use of carbaryl, leading to adverse effects to the reproductive capacity of this species, particularly given its isolated populations and declining trends of some populations. Overall, we anticipate that the loss of pollinators will cause adverse species-level reproductive effects to the lyrate bladderpod over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the lyrate bladderpod.

References:

U.S. Fish and Wildlife Service. 2024. Lyrate bladderpod (*Paysonia* (=*Lesquerella) lyrata*) 5-Year Review: Summary and Evaluation. Daphne, Alabama. 10 pp.

U.S. Fish and Wildlife Service. 2019. Lyrate bladderpod (*Lesquerella lyrata*) 5-Year Review: Summary and Evaluation. Daphne, Alabama. 15 pp.

U.S. Fish and Wildlife Service. 1996. Recovery Plan for the Lyrate bladderpod (*Lesquerella lyrata*). Atlanta, Georgia. 33 pp.

Rationale for Species Conclusion: Papery whitlow-wort

Scientific Name:	Common Name:	Entity ID:
Paronychia chartacea	Papery whitlow-wort	789

Conclusion

Papery whitlow-wort is a short-lived dioecious (has separate male and female plants) herb that forms small mats and is endemic to central and northern Florida. There are two geographically isolated varieties of this plant, *Paronychia chartacea var. chartacea* that occurs in scrub habitats in central Florida on the Lake Wales Ridge and adjacent uplands, and *P.c. var. minima* that occurs on the margins of karst ponds in a small area of the Florida panhandle. The two varieties differ in microhabitat preferences, disturbance regimes, threats, life history characteristics, and management needs. *P.c. var. chartacea* is nearly ubiquitous in protected scrub sites on the Lake Wales Ridge and 40 occurrences are very large and classified as viable. While this variety appears to be doing well, there are 40 additional occurrences classified as having uncertain viability or that are non-viable (19 occurrences). These populations on unprotected lands are particularly susceptible to habitat loss through agricultural and urban development, a prominent threat. In addition, occurrences of this variety have a very limited distribution and are fragmented, making it more difficult for pollinators to find and travel between occurrences (USFWS 2021).

P.c. var. minima is poorly protected, with over half the occurrences (fewer than two dozen) outside the one protected area. Management needs of this variety are poorly known, populations fluctuate widely in response to hydrology, and development or habitat modification could destroy all occurrences on privately owned lands (USFWS 2021).

While little is known about the reproductive biology of the species, it is diecious, meaning it has separate male and female plants. As such, we assume the species requires biotic pollinators to carry pollen from male to female individuals to facilitate successful reproduction. Seed dispersal vectors are unknown and while carpenter ants have been observed collecting the seeds, they were poor dispersers (USFWS 2021).

There is a high overlap between the species' range and agricultural carbaryl use sites (16.1%), and past annual agricultural carbaryl usage indicates a moderate portion of the range (7.3%) has been treated annually, leading us to determine there will be high exposure and resultant mortality of insect pollinators in a large portion of the range from agricultural usage. While specific pollinator species are unknown, given the high expected pollinator mortality, and the species' reliance on sufficient pollinators within the range to achieve pollen transfer among male and female plants in a highly fragmented landscape, we expect the loss of pollinating insects from carbaryl use from agricultural usage within the range will lead to significant adverse effects to the reproductive capacity of this species. Papery whitlow-wort also has potential exposure from non-agricultural carbaryl use, as it can occur on roadsides. However, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally on an annual basis. We expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl, if any, will be used within the papery whitlow-wort's range for rights of way uses, resulting in no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species from this use type. As such, we anticipate a low likelihood of exposure and subsequent adverse reproductive effects from non-agricultural uses of carbaryl. Overall, we anticipate that mortality of pollinators will cause adverse species-level reproductive effects to the papery whitlow-wort. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the papery whitlow-wort.

References:

U.S. Fish and Wildlife Service. 2021. Papery whitlow-wort *(Paronychia chartacea*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 21 pp.

Rationale for Species Conclusion: Cooley's meadowrue

Scientific Name:	Common Name:	Entity ID:
Thalictrum cooleyi	Cooley's meadowrue	852

Conclusion

Cooley's meadowrue is an endangered perennial found in the Coastal Plain of Georgia, North Carolina, and possibly Florida. It is typically found in wet pine savannas, grass-sedge bogs, and savanna-like areas, often at the border of intermittent drainages or swamp forests. There are 24 extant subpopulations across ten populations and one extirpated population in North Carolina; four subpopulations did not have observable plants during the last site visit. Five subpopulations (four populations) in North Carolina are protected by State, non-profit, or conservation programs. In Georgia, there are two populations (seven species occurrences) and one is monitored regularly and managed by The Nature Conservancy (Dry Creek Swamp Preserve). There was one population in Florida that was burned in 2008 and the population had an unknown status in 2020. The Florida population is on Nokuse Plantation, which is protected by a conservation easement. The primary threat to Cooley's meadowrue is habitat modification or destruction (e.g., fire suppression, succession, timber operations, herbicide use, mowing, development, land conversion) (USFWS 2020).

Cooley's meadowrue flowers from mid-June to early July. Plants that are mowed or burned during the growing season have been observed resprouting and flowering later in the same season. Fruits mature in August and September and remain on the plant until at least October. The plants are likely polygamodioecious, meaning they have male, female, and bisexual flowers. They show characteristics of wind pollination (e.g., smooth pollen, elaborate stigma, reduced perianth, terminal inflorescences in an open habitat) and only some suggestion of insect pollination (e.g., conspicuous stamens with somewhat expanded filaments), but pollinators only visit male flowers. Therefore, we and others believe pollination is primarily abiotic (Fortner et al. 2016). Cooley's meadowrue is also known to spread through rhizomes; small plants discovered in the field were offshoots of rhizomes from nearby, larger plants (rather than seedlings). Seeds are short-lived and there is no known seed bank for Cooley's meadowrue (USFWS 1994). The species appears to lack seed dispersal mechanisms (USFWS 1989).

There is a high overlap between the species' range and agricultural carbaryl use sites (38.4%), and past annual agricultural carbaryl usage indicates a high portion of the range (26.3%) has been treated annually, leading us to determine there will be high exposure to insect pollinators. However, Cooley's meadowrue exhibits characteristics consistent with wind pollination and is not likely to be pollinated or dispersed by insects. Cooley's meadowrue also occurs on some non-agricultural carbaryl use sites (i.e., managed forests and utility rights of way). Overall, we do not expect a loss of pollinating insects will lead to adverse effects to the reproductive capacity of this species. We anticipate that loss of pollinators will not cause species-level adverse reproductive effects to the Cooley's meadowrue 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 Cooley's meadowrue.

References:

Fortner, A.R., C. L. Jolls, and C. Goodwillie. 2016. Important biological knowledge for management of Cooley's meadowrue (*Thalictrum cooleyi*), a Federally endangered endemic of pine savannas. Natural Areas Journal 36(3): 288-301.

U.S. Fish and Wildlife Service. 2020. Cooley's Meadowrue (*Thalictrum cooleyi*) 5-Year Review: Summary and Evaluation. Raleigh, North Carolina. 30 pp.

U.S. Fish and Wildlife Service. 1994. Recovery Plan Cooley's Meadowrue (*Thalictrum cooleyi* Ahles). Atlanta, Georgia. 34 pp.

U.S. Fish and Wildlife Service. 1989. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for *Thalictrum Cooleyi* (Cooley's Meadowrue). Final Rule. Federal Register 54(24):5935-5938.

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Beach jacquemontia

Scientific Name:	Common Name:	Entity ID:
Jacquemontia reclinata	Beach jacquemontia	953

Conclusion

Beach jacquemontia is an endangered perennial vine of the morning glory family (Convolvulaceae). They are found in coastal strand and other open dune habitats, typically on leeward sides and crests of stable dunes in southern Florida, including the Florida Keys. There are eight extant natural populations with an estimated 734 individuals. There are also twelve extant introduced populations. Few populations are monitored regularly, but most populations show declining trends and small abundances (<6 plants). Five additional populations were extirpated after 2007. The largest natural population (Crandon Park: 589 plants) increased in abundance and had positive recruitment between 2007-2021. At Crandon Park, hardwood and exotic species are removed from the stabilized dune habitat, allowing beach jacquemontia to persist. Over 2,000 plants have been introduced to 13 sites across the species historic range, and introduced populations outnumber natural populations. Two introduced populations increased (Bill Baggs Cape Florida State Park: 865 plants; Virginia Key Coastal Hammock: 229 plants) and one introduced population is extirpated. Because of the species' dynamic habitat, population sizes fluctuate over time. Threats to the species include vegetation encroachment, invasion of non-native plants, habitat loss from development and lack of appropriate management, and effects of climate change (USFWS 2021).

Beach jacquemontia flowers from November to May and may vegetatively propagate all year. At some sites, beach jacquemontia sets fruit and disperses seed prolifically; however, few seedlings or young plants are ever found near adult plants (USFWS 1999). Beach jacquemontia uses a generalist pollination system and at least twenty insect species have been observed visiting flowers. Pollinators were primarily from the orders Hymenoptera (bees and wasps; 94%), Diptera (flies; 4%) and Lepidoptera (butterflies and skippers; 2%). Beach jacquemontia has relatively low genetic diversity. The species is capable of self-fertilization, though outcrossing between different populations had greater pollination success and greater genetic diversity. Determined through plant introduction studies, plant survival and growth are greater for progeny from mixed-populations than for single-source populations, further indicating the species' reliance on pollinators for reproductive success. Remaining habitat for this species is heavily fragmented, which could prevent pollinators from dispersing among populations (USFWS 2021). Seed dispersal is through dehiscence (ejection of the seeds from seed pods).

Beach jacquemontia uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. Insect pollinators are necessary for beach jacquemontia reproduction, and cross-pollination increases progeny survival and growth, seed set, and genetic diversity. There is 27.8% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 14.3% of the species' range has been treated with carbaryl annually, indicating high exposure and resultant mortality of insect pollinators in a large portion of the range from agricultural usage. Even though the species can use a variety of pollinators, given the high expected pollinator mortality, and the species' reliance on sufficient pollinators within the range to achieve outcrossing in a highly fragmented landscape, we expect the loss of pollinating insects from agricultural use of carbaryl within the range will lead to significant adverse effects to the reproductive capacity of this species. We do not expect beach jacquemontia to occur on non-agricultural carbaryl use sites. Thus, due to the limited usage, small treatment areas, and application methods associated with non-agricultural uses within the species' range, we anticipate a low likelihood of pollinator exposure and subsequent adverse reproductive effects to the beach jacquemontia from non-agricultural uses of carbaryl.

Overall, we anticipate that loss of pollinators will cause adverse species-level reproductive effects to the beach jacquemontia. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the beach jacquemontia.

References:

U.S. Fish and Wildlife Service. 2021. Beach jacquemontia (*Jacquemontia reclinata*) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 29 pp.

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

Rationale for Species Conclusion: Howell's spectacular thelypody

Scientific Name:	Common Name:	Entity ID:
Thelypodium howellii ssp. spectabilis	Howell's spectacular thelypody	1008

Conclusion

Howell's spectacular thelypody is a threatened, herbaceous biennial endemic to mesic, alkaline habitats in the Baker-Powder River Valley region of northeast Oregon. Some populations occur near pasturelands. The current range is restricted to about 175 sq. km. and includes 15 occurrences loosely comprising six populations (five naturally occurring and one introduced). The Oregon Department of Agriculture's Native Plant Conservation Program monitored most sites between 2021-2023, and all surveyed sites either declined or disappeared over the last 10-25 years. The Clover Creek Valley population is inaccessible on private lands. At the North Powder Population, one site declined from >36,000 plants in 2000 to 17,500 plants in 2023, two sites were not accessed, three sites occur on transportation rights-of-way (only one had plants), and one additional site was surveyed, and no plants were found. At the Haines Population, one site had confirmed presence and a larger protected site had 10,681 plants in 2021 and 13,500 plants in 2023. The North Baker Population has not been accessed since the 1990s. For the Pocahontas Road Population, no plants were visible from the access point on a nearby road (private, inaccessible property). The Baldock Slough Introduced Population had about 120 plants across five areas surveyed in 2021 and 2022. Threats to the species include livestock grazing, urban and agricultural development and activities, road maintenance and construction, hydrological alterations, non-native species invasion, habitat fragmentation, and herbicide and pesticide use (USFWS 2023). We mentioned in the recovery plan (USFWS 2002) that pesticide use could impact thelypody pollinators, as can spraying to control noxious weeds.

Howell's spectacular thelypody flowers in late May through July and sets seed in July. They reproduce entirely by seeds, which are released by pods splitting open to discharge seeds. A variety of seed dispersers are used to maintain populations and colonize new sites in its range, including birds, insects, mammals, wind, and water. Although this taxon is self-compatible, successful reproduction occurs primarily by outcrossing facilitated by insect vectors such as bumble bees (*Bombus* spp.). Its seeds are dispersed through the dehiscing of siliques (i.e., splitting open of the pods to discharge the seeds) (USFWS 2002).

Howell's spectacular thelypody uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. Though the species can be self-compatible, they rely primarily on outcrossing facilitated by insects, including bumble bees. As there is 78.5% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 56.5% of the species' range has been treated with carbaryl annually, we expect a large portion of the range to be exposed to carbaryl from agricultural usage. Because birds and mammals are less sensitive to carbaryl than other taxa groups, we do not expect that the proposed action is likely to appreciably diminish the availability of bird or mammal seed dispersers. However, we expect insect pollinators to die when exposed to carbaryl. Most of the known populations of Howell's spectacular thelypody are unprotected, and as such may be exposed to agricultural carbaryl use and experience insect pollinator and insect disperser declines. Howell's spectacular thelypody can occur on roadsides and rights of way. However, available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally on an annual basis. We expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl, if any, will be used within the Howell's spectacular thelypody's range for rights of way uses, resulting no more than low levels of mortality of pollinators and seed dispersers. As such, we anticipate a low likelihood of exposure to pollinators and seed dispersers and low subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl.

Overall, we expect that a large decrease in the insect pollinator and seed disperser community across a large portion of the range from agricultural usage will lead to significant adverse effects to the reproductive capacity of this species and we anticipate that these adverse reproductive effects will cause adverse species-level reproductive effects over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Howell's spectacular thelypody.

References:

U.S. Fish and Wildlife. 2023. 5-Year Review Howell's spectacular thelypody (*Thelypodium howellii* ssp. *spectabilis*). Oregon. 12 pp.

U.S. Fish and Wildlife. 2002. Recovery Plan for Howell's spectacular thelypody (*Thelypodium howellii* ssp. *spectabilis*). Portland, Oregon. 57 pp.

Rationale for Species Conclusion: Texas prairie dawn-flower

Scientific Name:	Common Name:	Entity ID:
Hymenoxys texana	Texas prairie dawn-flower	1045

Conclusion

Texas prairie dawn-flower has a medium vulnerability based on its status and distribution among 40 to 50 populations across six counties in eastern Texas. Several of the largest of these populations reside on private conservation properties in Harris County and Waller County. The populations known from Addicks and Barker Reservoirs controlled by the U.S. Army Corps of Engineers, have declined since 2005 due in part to competing recreational land use, lack of mowing restrictions, or lack of invasive species control (USFWS 2022). However, conservation protection mechanisms now cover 12 of the 13 confirmed sites of over 1,000 ac (404.7 ha) that support the species (USFWS 2015), and there is a current effort underway to study Texas prairie dawn-flower reproductive biology, genetics, pollinators, and seed dispersal mechanisms through ESA Section 6 funding from the Service to Texas Parks and Wildlife Department (see WSFR Grant F22AP03103-00, Ecosphere reference 2022-0024702).

While little has been confirmed about how the plant is pollinated, researchers believe there may be some correlation between the carpenter ant *Camponotus* spp. and the continued existence of the species (USFWS 2015). Other potential pollinators hypothesized for the species include composite thrips *Microcephalothrips abdominalis* and more recently, harvester ants in the genus *Pogonomyrmex*, were observed and recorded within many of the saline barrens supporting populations (USFWS 2022). Insects are expected to die within portions of the range of this species if exposed to carbaryl. However, conservation of many of these private lands, including active management on several sites reduces the concern of exposure for several important populations.

The species relies on a variety of seed dispersers to maintain populations and colonize new sites in its range. It can disperse seeds using biotic vectors such as birds, insects, and mammals in addition to abiotic vectors such as wind and water. While we anticipate insects to die from carbaryl exposure, we do not expect that the proposed action is likely to appreciably diminish the availability of bird or mammal seed dispersers. Given that this species can rely on a variety of seed dispersal vectors, we do not anticipate effects to its insect seed dispersers to cause significant adverse effects to the reproductive capacity of this species.

There is 19.6% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 19.6% of the species' range has been treated with carbaryl annually. We anticipate adverse effects to the species in the form of loss of reproductive capacity due to declines in insect pollinators from exposure to carbaryl from agricultural usage. Also, the Texas prairie dawn-flower occurs on rangelands and rights of way where non-agricultural use of carbaryl may occur but based on past carbaryl usage and established conservation measures, we anticipate a low likelihood of exposure of the pollinator community and subsequent adverse reproductive effects to the species from these non-agricultural uses of carbaryl.

However, twelve of the thirteen sites with over 1,000 individual plants are currently protected and we expect carbaryl exposure is unlikely in these areas. Overall, because of the number of populations and their resilience, and the large portion of occupied range that is currently protected and unlikely to experience carbaryl exposure, we do not expect the anticipated adverse reproductive effects will rise to the level of adverse species-level reproductive effects. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Texas prairie dawn-flower.

References:

U.S. Fish and Wildlife. 2022. 5-Year Review Texas prairie dawn-flower (*Hymenoxys texana*). Houston, Texas. 38 pp.

U.S. Fish and Wildlife. 2015. 5-Year Review Texas prairie dawn-flower (*Hymenoxys texana*). Houston, Texas. 34 pp.

Rationale for Species Conclusion: Willamette daisy

Scientific Name:	Common Name:	Entity ID:
Erigeron decumbens	Willamette daisy	1233

Conclusion

The Willamette daisy is a perennial herb endemic to the Willamette Valley of western Oregon. As of 2019, the species occurred in Benton, Lane, Linn, Marion, and Polk Counties. Population size may fluctuate substantially from year to year. Although the most recent range wide assessment indicates there have been some new populations discovered or established, and some populations have increased in abundance since the species was last evaluated in 2010, these gains are offset by the apparent extirpation of many of the smaller sites that were known at the time of listing or declines in other populations. Six Recovery Zones with a total of 81,346 +/- 25, 826 individuals exist in 46 sites. The Salem East recovery zone harbors fifty-nine percent of known extant individuals on private property. Seed collection and plant propagation efforts continue for Willamette daisy, and outplantings to augment or reintroduce the species in appropriate habitats within the Willamette Valley are ongoing. Although recovery efforts for the species are progressing, they have not yet resulted in a significant change in the status of the species across its range (USFWS 2019). Improperly applied pesticides are described as a threat to the species through indirect impacts to pollinators (USFWS 2010).

Appendix C-B4. Flowering Plants Biotic Pollination vector; other reproductive mechanisms unknown (Groups 7&11)

The Willamette daisy occurs as single plants or clumps of genetically identical ramets. Large plants appear to spread vegetatively, but this spread is localized around the established plant. The fruits are single-seeded achenes and have a number of small capillary bristles attached to the top, which allow them to be dispersed by the wind. A variety of insects have been observed to visit the flowers of the species; potential pollinators include solitary bees (C*eratina sp., Megachile sp., Nomada sp., Halictus ligatus,* and *Ashmeadiella sp*.), beetles (*Meligethes nigrescens* and *Acanthoscelides pauperculus*), flies (T*oxomerus marginata, T. occidentalis and Tachina* sp.), and butterflies (*Phyciodes campestris*). Populations with fewer than 20 individuals appear to suffer a high rate of reproductive failure due to inbreeding depression and reduced probability of being pollinated by a compatible mate (USFWS 2010). Seed dispersal is unknown for this species.

There is 57.7% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 37.9% of the species' range has been treated with carbaryl annually, leading us to conclude there will be significant carbaryl exposure of the Willamette daisy's pollinators within the range of the species from agricultural usage. Exposed pollinators will die, so we anticipate significant mortality of the pollinator community in a large portion of the range. In addition, the species' Recovery Plan describes the use of pesticides as a threat because of indirect impacts to pollinators. Furthermore, small populations have a pre-existing high rate of reproductive failure due in part to pollination failure. This reproductive failure is likely to be exacerbated by a decline in the insect pollinator community from exposure to carbaryl from agricultural usage. Even though this species relies on a relatively diverse spectrum of pollinator species, a substantial loss in the populations of these species in a large portion of the range is likely to have a proportionately large effect on the reproductive capacity of the species. Willamette daisy occurs on some non-agricultural carbaryl use sites (e.g., roadsides, rights of way). However, available usage information indicates that carbaryl is used infrequently in rights of way, with less than 500 pounds of carbaryl applied to roadways nationally on an annual basis. We expect rights of way usage is likely to be sporadic across the national landscape and only small amounts of carbaryl, if any, will be used within the Willamette daisy's range for rights of way uses, resulting no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species. As such, we do not anticipate non-agricultural uses will meaningfully add to the overall level of anticipated exposure or risk of adverse reproductive effects to the species.

We anticipate that significant mortality of the pollinator community will lead to adverse species-level reproductive effects to the Willamette daisy over the duration of the action. Pollinators of the species are expected to die across a significant portion of the range, leading to a substantial decline in reproductive success. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Willamette daisy.

References:

U.S. Fish and Wildlife Service. 2019. 5-Year Review Willamette daisy (*Erigeron decumbens*). Portland, Oregon. 40 pp.

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