Integration and Synthesis Summary for Plants

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

Assessment Groups 6 & 10

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined 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 6 & 10) rely on biotic pollination vectors, are capable or self-fertilization and/or vegetative reproduction and can use these methods to reproduce successfully and maintain their populations over time.

Vulnerability

For the plant species that we or EPA determined are "likely to be adversely affected" by the proposed action, we considered several factors for each listed plant to 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. 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. For species where there are additional exposure considerations, we adjust the overall exposure ranking to reflect this additional information, as appropriate. 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.

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 Usage 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 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 (corresponds to the developed and open space developed UDLs) 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 1000 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.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Toxicity

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

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

Bird and mammal pollinators/seed dispersers are less sensitive to carbaryl exposure than insects. While carbaryl exposure in birds and mammals can cause 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

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

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

Summary of Assessment Groups 6 & 10 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. We expect the registration of carbaryl, as proposed, will jeopardize the continued existence of northern wild monkshood, Walker's manioc, Lewton's polygala, clay-loving wild buckwheat, Schweinitz's sunflower, Michaux's sumac, relict trillium, Garrett's mint, Leedy's roseroot, and Florida ziziphus 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.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

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

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 6 & 10 with low exposure informed by low overlap with agricultural uses.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Acanthomintha ilicifolia	San Diego thornmint	Medium	Low	High	1.3	No Jeopardy
Amphianthus pusillus	Little amphianthus	Medium	Low	Low	2.7	No Jeopardy
Arabis hoffmannii	Hoffmann's rock-cress	Medium	Low	High	2.1	No Jeopardy
Arabis macdonaldiana	McDonald's rock-cress	Medium	Low	High	0.2	No Jeopardy
Asclepias welshii	Welsh's milkweed	High	Low	Medium	0.1	No Jeopardy
Astragalus brauntonii	Braunton's milk-vetch	High	Low	High	0.6	No Jeopardy
Astragalus phoenix	Ash meadows milk-vetch	Medium	Low	High	2.1	No Jeopardy
Astragalus tener var. *titi*	Coastal dunes milk-vetch	High	Low	High	2.0	No Jeopardy
Berberis pinnata ssp. *insularis*	Island Barberry	High	Low	Medium	0.9	No Jeopardy
Brodiaea filifolia	Thread-leaved brodiaea	Medium	Low	Medium	2.5	No Jeopardy
Brodiaea pallida	Chinese Camp brodiaea	Medium	Low	High	3.0	No Jeopardy
Bulbophyllum guamense	Cebello halumtano	High	Low	High	1.1	No Jeopardy
Chorizanthe robusta var. *robusta*	Robust spineflower	Medium	Low	Low	4.4	No Jeopardy
Cirsium vinaceum	Sacramento Mountains thistle	High	Low	Low	0.7	No Jeopardy

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Cordia bellonis	No common name	High	Low	High	1.6	No Jeopardy
Coryphantha scheeri var. *robustispina*	Pima pineapple cactus	High	Low	High	1.4	No Jeopardy
Cycladenia humilis var. *jonesii*	Jones Cycladenia	Medium	Low	Low	1.2	No Jeopardy
Dendrobium guamense	No common name	High	Low	High	1.2	No Jeopardy
Dudleya abramsii ssp. *parva*	Conejo dudleya	High	Low	High	3.6	No Jeopardy
Dudleya stolonifera	Laguna Beach liveforever	High	Low	High	0.1	No Jeopardy
Erigeron rhizomatus	Zuni fleabane	Low	Low	High	0.1	No Jeopardy
Eriogonum kennedyi var. *austromontanum*	Southern mountain wild-buckwheat	High	Low	High	0.9	No Jeopardy
Fremontodendron mexicanum	Mexican flannelbush	Medium	Low	High	0.8	No Jeopardy
Fritillaria gentneri	Gentner's Fritillary	High	Low	Medium	3.0	No Jeopardy
Geum radiatum	Spreading avens	High	Low	High	0.3	No Jeopardy
Hedeoma todsenii	Todsen's pennyroyal	Medium	Low	Low	0.9	No Jeopardy
Hedyotis purpurea var. *montana*	Roan Mountain bluet	High	Low	High	0.7	No Jeopardy
Hudsonia montana	Mountain golden heather	High	Low	High	0.2	No Jeopardy
Iliamna corei	Peter's Mountain mallow	High	Low	High	0.3	No Jeopardy
Leavenworthia texana	Texas golden Gladecress	High	Low	Medium	0.9	No Jeopardy
Lilaeopsis schaffneriana var. *recurva*	Huachuca water-umbel	Medium	Low	Medium	2.5	No Jeopardy
Lilium occidentale	Western lily	High	Low	Low	2.0	No Jeopardy

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Malacothrix squalida	Island malacothrix	High	Low	High	1.1	No Jeopardy
Monardella viminea	Willowy monardella	High	Low	High	1.8	No Jeopardy
Nitrophila mohavensis	Amargosa niterwort	High	Low	Low	2.1	No Jeopardy
Packera franciscana	San Francisco Peaks ragwort	High	Low	High	0.0	No Jeopardy
Penstemon debilis	Parachute beardtongue	High	Low	Medium	2.2	No Jeopardy
Penstemon penlandii	Penland beardtongue	High	Low	High	4.2	No Jeopardy
Peperomia wheeleri	Wheeler's peperomia	Medium	Low	Medium	1.5	No Jeopardy
Pilosocereus robinii	Key tree cactus	High	Low	High	0.0	No Jeopardy
Pogogyne nudiuscula	Otay mesa-mint	High	Low	High	1.6	No Jeopardy
Primula maguirei	Maguire primrose	High	Low	Medium	0.8	No Jeopardy
Rhododendron chapmanii	Chapman rhododendron	High	Low	Medium	1.7	No Jeopardy
Sibara filifolia	Santa Cruz Island rockcress	High	Low	High	0.3	No Jeopardy
Sidalcea pedata	Pedate checker-mallow	High	Low	High	0.9	No Jeopardy
Solidago spithamaea	Blue Ridge goldenrod	High	Low	High	0.4	No Jeopardy
Spiraea virginiana	Virginia spiraea	Medium	Low	Medium	3.5	No Jeopardy
Spiranthes delitescens	Canelo Hills ladies'-tresses	High	Low	Medium	0.1	No Jeopardy
Stephanomeria malheurensis	Malheur wire-lettuce	High	Low	High	0.1	No Jeopardy
Streptanthus niger	Tiburon jewelflower	High	Low	High	1.4	No Jeopardy

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Agricultural Use Overlap (% range)	Determination
Thysanocarpus conchuliferus	Santa Cruz Island fringepod	High	Low	High	0.3	No Jeopardy
Trichilia triacantha	Bariaco	High	Low	High	3.3	No Jeopardy
Trifolium amoenum	Showy Indian clover	High	Low	High	4.4	No Jeopardy
Verbesina dissita	Big-leaved crownbeard	High	Low	Low	0.2	No Jeopardy
Yermo xanthocephalus	Desert yellowhead	High	Low	Medium	0.3	No Jeopardy

In our review of the current status of the species and the environmental baseline and cumulative effects for the action area, we determined that the vulnerabilities of the species in Table 1 are medium or high with one exception, the Zuni fleabane that has a low vulnerability.

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, all plants in this appendix can rely, at least in part, on either self-fertilization and/or vegetative reproduction to reproduce, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to carbaryl. In addition, the plants in Table 1 use abiotic vectors for some or all seed dispersal and most can use a variety of insect species for pollination (i.e., pollinator generalists) and are likely to recover more quickly from temporary losses of a small portion of their pollinating insect species. Furthermore, several of the species in Table 1, Gentner's fritillary, Jones cycladenia, western lily, Todsen's pennyroyal, and Sacramento Mountains thistle, use birds in addition to insects to accomplish pollination. Bird pollinators experience low toxicity from exposure to carbaryl as described above in the Toxicity section. Thus, the likelihood of adverse effects to these plant species is smaller than for those species exclusively using insect pollination.

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

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 55 species in Table 1, we expect that most 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 20 species that we determined could occur on one or more non-agricultural use sites for which carbaryl is registered (for a list of species see Appendix E-A). However, for each of these species, we evaluated habitat use, occurrence information, and existing protections from recent Service documents and determined that exposure to non-agricultural carbaryl use is expected to be minimal based on the species' life histories, stressors, threats, and conservation measures in place as described above.

For example, Chapman rhododendron can be found in transitional areas between upland mesic or scrubby flatwoods and floodplain swamps or baygalls, mesic pine flatwoods, and lower elevations of sandhills in Florida. Many areas occupied by Chapman rhododendron are privately owned and managed for timber (USFWS 2024), placing the species within the carbaryl 'managed forests' use site. However, carbaryl was not used on U.S. Forest Service lands between 2016 - 2020 in Florida, where the species occurs, and we expect forestry pesticide use on private timberlands to be similar to use on Federal lands. Therefore, we expect exposure of the pollinators of Chapman rhododendron to carbaryl from non-agricultural uses to be minimal.

There are a few species that use a specialist pollinator and thus may be more sensitive to the loss of pollinators within their range. Penland beardtongue uses native bees (USFWS 1992), one of which is an unspecified Penstemon specialist, and pima pineapple cactus's major pollinator (*Diadasia rinconis*) is a ground-nesting, solitary, native bee (USFWS 2007). These two species have agricultural overlaps of less than 5%. In addition, Penland beardtongue occurs primarily on lands protected by The Nature Conservancy or managed by the Bureau of Land Management with this species' conservation in mind and does not occur on or in the vicinity of non-agricultural use sites of carbaryl. Pima pineapple cactus share their pollinators with other associated cactus species, and though they are primarily pollinated by *D. rinconis*, other bees also pollinate the cactus. Pima pineapple cactus is mainly found in Sonoran desert scrubland, desert-grassland, and transitions between the two. However, some of these habitats have been developed and may have developed and open-space developed non-agricultural use sites near a small portion of the species range and its pollinators. Such residential treatments are limited in their application methods that renders off-site spray drift unlikely and greatly reduce the areal extent that can be treated on many developed and open-space developed use sites (see "Exposure from Non-Agricultural Use Sites" section). Furthermore, as this cactus species is expected to occur in a variety of habitats, we anticipate that if small amounts of carbaryl were used residentially in a small portion of the species' range, it would result in no more than minimal loss of the pollinator community and resultant low levels of adverse reproductive effects to the species. As such, even though these species cannot rely on multiple pollinator species, we expect the extent of exposure from both agricultural and non-agricultural carbaryl usage to be very

small and not likely to cause appreciable reductions in the pollinator communities of these species and not more than low levels of resultant adverse reproductive effects to the species.

In summary, while many species listed in Table 1 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect 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 these adverse reproductive effects will result in adverse species-level reproductive effects due to low expected exposure to carbaryl, their ability to self-pollinate and/or reproduce vegetatively, 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. Chapman Rhododendron (*Rhododendron chapmanii*) 5-Year Status Review: Summary and Evaluation. Panama City, Florida. 14 pp.

U.S. Fish and Wildlife Service. 2007. 5-Year Review Pima Pineapple Cactus. Albuquerque, New Mexico. 17 pp.

U.S. Fish and Wildlife Service. 1992. Osterhout milkvetch (*Astralagus osterhouti*) and penland beardtongue (*Penstemon penlandi*) Recovery Plan. Grand Junction, Colorado. 23 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Species with low exposure informed by low past usage from the California Department of Pesticide Regulation 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 6 & 10 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	Determination
Allium munzii	Munz's onion	High	Low	High	0.16	No Jeopardy
Clarkia franciscana	Presidio clarkia	High	Low	High	0.00	No Jeopardy
Clarkia imbricata	Vine Hill clarkia	High	Low	Low	0.42	No Jeopardy
Cordylanthus maritimus ssp. *maritimus*	Salt marsh bird's-beak	Medium	Low	Medium	0.04	No Jeopardy
Eriodictyon altissimum	Indian Knob mountainbalm	High	Low	High	0.04	No Jeopardy
Erysimum menziesii	Menzies' wallflower	High	Low	High	0.00	No Jeopardy
Gilia tenuiflora ssp. *arenaria*	Monterey gilia	Medium	Low	Medium	0.90	No Jeopardy
Lilium pardalinum ssp. *pitkinense*	Pitkin marsh lily	High	Low	High	0.10	No Jeopardy
Limnanthes floccosa ssp. *californica*	Butte County meadowfoam	High	Low	Low	0.38	No Jeopardy
Navarretia fossalis	Spreading navarretia	Low	Low	Medium	0.02	No Jeopardy
Piperia yadonii	Yadon's piperia	High	Low	Medium	0.85	No Jeopardy
Rorippa gambellii	Gambel's watercress	High	Low	High	0.07	No Jeopardy

In our review of the current status of the species and the environmental baseline and cumulative effects for the action area, we determined that the vulnerabilities of the species in Table 2 are medium or high with one exception, the spreading navarretia that has a low vulnerability.

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, all plants in this

appendix can rely, at least in part, on either self-fertilization, and/or vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to carbaryl. In addition, all plants in Table 2 use abiotic vectors for some or all seed dispersal, they can use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists), and they are likely to recover more quickly from temporary losses of a small portion of their pollinating insect species.

While the species listed in Table 2 mostly 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 12 species in Table 2, we expect that most 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 6 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, Menzies' wallflower and Yadon's piperia can be found on rights of way and golf courses (USFWS 2008, 2021), but we expect carbaryl usage on these land uses to be low and infrequent. Furthermore, as both these species are expected to occur in a variety of habitats, we anticipate that if small amounts of carbaryl usage did occur in rights of way or on golf courses within the species' ranges, it would result in no more than low levels of effects to these species. An additional example is Presidio clarkia, primarily found in suburban or urban recreational areas (e.g., parks), and most occupied lands are protected (e.g., Golden Gate National Recreation Area and Presidio Trust; East Bay Regional Park District; USFWS 2024). Thus, while these species' vulnerability and toxicity rankings may be medium or high, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to carbaryl from agricultural or non-agricultural uses.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

In summary, while many species listed in Table 2 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect the pollinators of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of agricultural overlap within these species' ranges and low exposure resulting from non-agricultural uses. As a result, we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure.

We do not expect that these adverse effects will cause species-level adverse effects due to low expected exposure to carbaryl, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

References:

U.S. Fish and Wildlife Service. 2024. 5-Year Review Presidio Clarkia (*Clarkia franciscana*). Sacramento, California. 20 pp.

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

U.S. Fish and Wildlife Service. 2008. Menzies' Wallflower (*Erysimum menziesii*) 5-Year Review: Summary and Evaluation. Arcata, California. 42 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Species with low exposure (informed by low past usage - from 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 6 & 10 with low exposure informed by low past usage from USDA's Census of Agriculture (CoA)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Arenaria paludicola	Marsh sandwort	High	Low	High	4.5	No Jeopardy
Astragalus applegatei	Applegate's milk-vetch	High	Low	High	0.8	No Jeopardy
Campanula robinsiae	Brooksville bellflower	High	Low	Low	2.1	No Jeopardy
Clematis socialis	Alabama leather flower	High	Low	High	3.3	No Jeopardy
Coryphantha sneedii var. *leei*	Lee pincushion cactus	High	Low	High	1.3	No Jeopardy
Coryphantha sneedii var. *sneedii*	Sneed pincushion cactus	High	Low	High	2.4	No Jeopardy
Dalea foliosa	Leafy prairie-clover	Medium	Low	High	3.8	No Jeopardy
Echinacea laevigata	Smooth coneflower	Medium	Low	High	3.2	No Jeopardy
Eriogonum gypsophilum	Gypsum wild-buckwheat	High	Low	High	1.3	No Jeopardy
Eriogonum ovalifolium var. *williamsiae*	Steamboat buckwheat	High	Low	Medium	0.0	No Jeopardy
Helonias bullata	Swamp pink	Medium	Low	Medium	4.3	No Jeopardy
Iris lacustris	Dwarf lake iris	Medium	Low	High	0.9	No Jeopardy
Isotria medeoloides	Small whorled pogonia	Medium	Low	Medium	2.0	No Jeopardy
Mimulus michiganensis	Michigan monkey-flower	High	Low	High	2.2	No Jeopardy
Pinguicula ionantha	Godfrey's butterwort	Low	Low	High	1.7	No Jeopardy

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	% Range Treated	Determination
Pityopsis ruthii	Ruth's golden aster	High	Low	Low	0.2	No Jeopardy
Ptilimnium nodosum	Harperella	Medium	Low	Medium	3.6	No Jeopardy
Ribes echinellum	Miccosukee gooseberry	High	Low	High	1.5	No Jeopardy
Sagittaria fasciculata	Bunched arrowhead	High	Low	Low	1.7	No Jeopardy
Sagittaria secundifolia	Kral's water-plantain	Medium	Low	Low	2.1	No Jeopardy
Sarracenia oreophila	Green pitcher-plant	Medium	Low	Medium	2.8	No Jeopardy
Sarracenia rubra ssp. *jonesii*	Mountain sweet pitcher-plant	High	Low	Medium	0.7	No Jeopardy
Silene polypetala	Fringed campion	Medium	Low	High	1.2	No Jeopardy
Spiranthes parksii	Navasota ladies-tresses	High	Low	Medium	2.9	No Jeopardy

Many species in Table 3 have medium or high vulnerability rankings (with one exception, the Godfrey's butterwort) indicating that they may not be able to withstand additional stressors in their environment, including reduced reproductive capacity of individuals through a reduction in the pollinator and seed disperser communities from carbaryl exposure.

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, all plants in this appendix can rely, at least in part, on either self-fertilization, and/or vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to carbaryl. In addition, plants in Table 3 use abiotic vectors for some or all seed dispersal and most can use a variety of insect species for pollination (i.e., pollinator generalists) and are likely to recover more quickly from temporary losses of a small portion of their pollinating insect species.

While 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 low insecticide usage in the past across their ranges. Low CoA usage indicates that very little agricultural insecticide usage occurred 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 24 species in Table 3, we expect that many of these species and their pollinator communities are unlikely to occur on or in close proximity to non-agricultural use sites of carbaryl. There are 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, small whorled pogonia can be found in forests managed for timber in the eastern U.S. (USFWS 2022). Carbaryl was not used for forestry on U.S. Forest Service lands between 2016 - 2020 in these states (U.S. Forest Service regions 8 and 9), and we expect forestry pesticide use on private timberlands to be similar to use on federal lands. As the small whorled pogonia is expected to occur in a variety of habitats, we anticipate that if small amounts of carbaryl usage did occur in managed forests within its range, it would result in no more than minimal loss of the pollinator community and resultant low levels of reproductive effect to this species. Therefore, we expect, at most, a low level of adverse reproductive effects from the minimal carbaryl exposure expected for the small whorled pogonia.

A few species in Table 3 use specialized pollinators, for example fringed campion's pollinators are unknown, but we believe they may be specialists (USFWS 2021). Only 1.2% of the fringed campion's range has been treated with any insecticide for agricultural uses in the past. The fringed campion is associated with drainage systems such as streams and ravines and requires mesic habitats such as upland dry sites, forest, and cleared lands. Logging in some of the habitats where the species occurs is common, but no carbaryl has been used for federal forestry efforts in the past from 2016 – 2020 where the species occurs, indicating that forests in the species' range are not likely treated with carbaryl. Even though the species cannot rely on multiple pollinators, we expect the extent of exposure from agricultural and non-agricultural usage of carbaryl to be very small and not likely to cause appreciable reductions in the pollinator community and minimal resultant reproductive effects to the species.

In summary, while many species listed in Table 3 have medium or high vulnerability rankings and are likely to experience loss of pollinators if exposed, we expect all of these species are likely to experience no more than low levels of exposure to carbaryl based on the low level of agricultural overlap within these species' ranges and low exposure resulting from non-

agricultural uses. As a result, we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from carbaryl exposure.

We do not expect these adverse effects will cause adverse species-level reproductive effects due to low expected exposure to carbaryl, their ability to self-pollinate and/or reproduce vegetatively, 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. 2022. Small Whorled Pogonia (*Isotria medeoloides*) 5-Year Review: Summary and Evaluation. Annapolis, Maryland. 39 pp.

U.S. Fish and Wildlife Service. 2021. Fringed Campion (*Silene catesbaei* (= *polypetala*)) 5-Year Review: Summary and Evaluation. Athens, Georgia. 32 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Species recommended for de-listing

Table 4. Plant species in assessment groups 6 & 10 that have been recommended for delisting due to recovery.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Change in listing status	Determination
Bonamia grandiflora	Florida bonamia	Low	High	Medium	Recommended delisting	No Jeopardy
Lespedeza leptostachya	Prairie bush-clover	Low	High	Medium	Recommended delisting	No Jeopardy

Rationale for Species Conclusion: Florida bonamia

Scientific Name:	Common Name:	Entity ID:
Bonamia grandiflora	Florida bonamia	892

Conclusion

Florida bonamia is a perennial vine in the morning-glory family with large showy blue flowers occurring on xeric sandy soils in scrub and sandhill habitats endemic to central Florida ridges. It occurs in six counties within the central portion of its historic range with 55 populations on protected, managed conservation lands including ownership on federal, state, county, and city properties. Many of these populations are within contiguous tracts of land that provide for connectedness between populations. The species is particularly abundant in Ocala National Forest. These metrics exceed the target numbers, distribution, and management of the species' populations described in the recovery plan. Seventeen of these populations have been ranked as having an excellent estimate of viability and another 24 populations were documented with a good estimate of viability. Given this, the species was recommended for delisting in the 2023 5-Year Status Review (USFWS 2023).

Habitat destruction, modification, and degradation still threatens populations on private lands. Fire suppression and habitat conversion to urban uses continues to negatively affect the species in non-protected habitat. The overwhelming majority of populations on public lands are being managed to benefit this species and other early successional scrub and sandhill community species (USFWS 2023).

Florida bonamia flowers from spring to summer (May through August). The funnel-shaped flowers are deep blue or bluish purple with a white center up to 10 cm long and 8 cm across. The flowers open in the mornings and wilt by early afternoon. The capsule fruit normally contains four pale brown or greenish-brown seeds. The vine has a mixed mating system: it is highly self-compatible, can self-pollinate, and can produce seeds without fertilization. Pollinators are essential to ensure substantial seed production by self- and cross-fertilization. However, the self-

pollination and setting seeds without fertilization allows the species to persist during times or in areas where additional plants will be unavailable for cross-pollination (USFWS 2023).

The mode of dispersal is undocumented for this species, but seeds may be dispersed by animals (e.g., herbivores or insects), wind, or water dispersal as seen in other members of the morning glory family. Thus, the species can use a variety of seed dispersal vectors.

Like other species in this appendix, the Florida bonamia uses two methods of reproduction, pollen transfer between individual plants and self-pollination. There is 24.5% overlap between agricultural use sites of carbaryl and the species' range, and past usage data indicate that up to 24.5% of the species' range has been treated with carbaryl annually. Florida bonamia may occasionally occur in rights of way (along roads), and many populations occur in the Ocala National Forest. Both rights of way and managed forests are considered carbaryl non-agricultural use sites. We do not anticipate the species will occur in other non-agricultural use sites for which carbaryl is registered, including developed, open space developed, nurseries, or rangeland areas. Available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. 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 Florida bonamia's range for rights of way uses. Similarly, available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the species. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). As a result, even though the species occurs in large numbers on U.S. Forest Service lands (Ocala National Forest), we anticipate minimal to no exposure of pollinators for this species to carbaryl in these areas.

Based on the low likelihood of usage within rights of way and managed forests, we do not anticipate exposure from non-agricultural uses will meaningfully add to the overall level of anticipated exposure to this species and its pollinating community.

While mortality is expected for insects exposed to carbaryl, the Florida bonamia successfully reproduces using self-pollination, suggesting that its reliance on insect pollinators is low. In addition, most populations exist on protected lands where carbaryl exposure is unlikely, population trends are positive, and threats are being reduced across the range. As such, we do not expect a loss of pollinating insects will lead to significant adverse effects to the reproductive capacity of this species. We anticipate that adverse effects to pollinators will not cause species-level reproductive effects to the Florida bonamia 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 Florida bonamia.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

References:

U.S. Fish and Wildlife Service. 2023. Florida bonamia (*Bonamia grandiflora*) 5-Year Review: Summary and Evaluation. Gainesville, Florida. 14 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: prairie bush-clover

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

Conclusion:

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

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

Like other species in this appendix, the prairie bush-clover uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. The species primarily relies on self-pollination, which has caused the species to have low genetic diversity across its range. Even so, the species has recovered since listing and many of the populations (>50) are protected; many others (28) are in good to excellent condition. Thus, even though overlap of the range with agricultural use sites of carbaryl is high at 21% and the percent of the range treated with carbaryl is 14%, we do not expect a loss of pollinating insects will lead to significant adverse effects to

the reproductive capacity of this species because its primary reproductive strategy is through self-pollination, which does not require insect pollinators. In addition, the species does not typically occur on non-agricultural use sites of carbaryl, and we do not expect these use sites to add meaningfully to the overall level of anticipated carbaryl exposure of this species. As such, we anticipate that adverse effects to pollinators will not cause species-level reproductive effects to the prairie bush-clover over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the prairie bush-clover.

References

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Species with Individual Integration and Synthesis Summaries

For the species in Table 5, 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 5. Plant species in groups 6 & 10 with moderate to high adverse effects anticipated from the proposed action

Scientific Name	Common Name	Determination
Aconitum noveboracense	Northern wild monkshood	Jeopardy
Hoffmannseggia tenella	Slender rush-pea	No Jeopardy
Manihot walkerae	Walker's manioc	Jeopardy
Polygala lewtonii	Lewton's polygala	Jeopardy
Chionanthus pygmaeus	Pygmy fringe-tree	No Jeopardy
Clitoria fragrans	Pigeon wings	No Jeopardy
Eriogonum pelinophilum	Clay-Loving wild buckwheat	Jeopardy
Eryngium cuneifolium	Snakeroot	No Jeopardy
Erythronium propullans	Minnesota dwarf trout lily	No Jeopardy
Helianthus schweinitzii	Schweinitz's sunflower	Jeopardy
Nolina brittoniana	Britton's beargrass	No Jeopardy
Oxypolis canbyi	Canby's dropwort	No Jeopardy
Rhus michauxii	Michaux's sumac	Jeopardy
Schwalbea americana	American chaffseed	No Jeopardy
Warea carteri	Carter's mustard	No Jeopardy
Trillium reliquum	Relict trillium	Jeopardy
Dicerandra christmanii	Garrett's mint	Jeopardy
Rhodiola integrifolia ssp. *leedyi*	Leedy's roseroot	Jeopardy
Ziziphus celata	Florida ziziphus	Jeopardy
Spigelia gentianoides	Gentian pinkroot	No Jeopardy
Polygala smallii	Tiny polygala	No Jeopardy
Lindera melissifolia	Pondberry	No Jeopardy

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Northern wild monkshood

Scientific Name:	Common Name:	Entity ID:
Aconitum noveboracense	Northern wild monkshood	620

Conclusion

The northern wild monkshood is a perennial herb found in three disjunct populations: in and adjacent to unglaciated portions of Iowa and Wisconsin, in northeastern Ohio, and in the Catskill Mountains of New York (USFWS 1983). This distribution highly suggests it is a glacial relict species, meaning as the glaciers retreated during the Pleistocene, this species only survived in a microhabitat that mimicked its habitat during this cooler era. The most significant common habitat factor appears to be the cold soil environment associated with the cliffs, talus slopes, and spring/headwater streams where the species occurs. In most occupied areas, there is either active and continuous cold air drainage or cold ground water flowage out of nearby bedrock. The largest concentrations are in Wisconsin and Iowa, with 19 and 84 known sites respectively. There are eleven extant occurrences in New York and only two or three in Ohio. The majority of land where the species occurs is unprotected and/or not managed for the species (NatureServe 2024). Threats are predominantly related to habitat loss or degradation. Possible threats include contamination and filling of sinkholes, grazing and trampling by livestock and deer, human foot traffic, logging, maintenance of highways and powerlines, and misapplication of herbicides (USFWS 2023).

Reproduction is primarily from collateral tubers that arise from the parent tuber, but also sometimes reproducing from below-ground aerial bulbils or adventitious buds from lateral roots (vegetative reproduction). However, sexual reproduction does occur and is facilitated by bumble bee pollination, bumble bees being adapted to prying open blossoms to collect nectar and pollen. Seeds are, in part, dispersed by water (Wisconsin DNR 2024). There appears to be very little gene flow, if any, among the isolated populations. Seed germination is poor and transplanted plants seldom survive (Ohio DNR 2024).

We do not expect northern wild monkshood to occur on non-agricultural carbaryl use sites, so we anticipate a low likelihood of exposure and subsequent adverse reproductive effects from non-agricultural uses of carbaryl. Northern wild monkshood has a large percent overlap (54.4%) between agricultural carbaryl use sites and its range, and the range has high levels of agricultural carbaryl usage (50%) based on past usage data. Northern wild monkshood uses an abiotic vector (water) for seed dispersal, at least in part, and relies on insect pollinators (bumble bees) to increase genetic diversity, even though it can reproduce vegetatively through bulbils and buds.

We anticipate significant adverse effects to the species due to the reduction in pollinating insects across a large portion of the range that will result in reduced reproductive success. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction and maintenance of genetic diversity. A significant loss of pollinating insects within its range from agricultural exposure to carbaryl is likely to exacerbate

existing reproductive deficiencies of this species due to its highly fragmented range and isolated populations. For these reasons, we anticipate adverse, species-level effects in the form of significant loss of reproductive success due to carbaryl exposure that we expect to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the northern wild monkshood.

References:

NatureServe Explorer. Accessed Sept. 19, 2024 at: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.149181/Aconitum_noveboracense

Ohio Department of Natural Resources. Accessed Sept. 19, 2024 at: https://ohiodnr.gov/discover-and-learn/plants-trees/flowering-plants/northern-monkshood.

U.S. Fish and Wildlife Service. 1983. National Recovery Plan for Northern Monkshood (*Aconitum noveboracense*). Madison, Wisconsin. 83 pp.

U.S. Fish and Wildlife Service. 2023. Accessed Sept. 19, 2024 at: https://www.fws.gov/species/northern-wild-monkshood-aconitum-noveboracense

Wisconsin Department of Natural Resources. Accessed Sept. 19, 2024 at: https://apps.dnr.wi.gov/biodiversity/Home/detail/plants/8836)

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Slender rush-pea

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

Conclusion

Slender rush-pea is a narrow endemic known from two counties in Texas where it remains on rare patches of undisturbed prairie habitat. It has a high vulnerability based on its endangered status and limited distribution. Row-crop agriculture is prominent within its range and is the main cause of the loss of native short-grass prairie this species relies upon. There are eleven known populations, seven of which are on private land with no protections. Some populations occur on rights of way, roadsides, and developed lands (e.g., cemetery). The populations on private lands are highly threatened by habitat loss and fragmentation from agricultural and residential development, invasive pasture grasses, and localized disturbances such as mowing and road construction (USFWS 2008, 2018, 2022).

The 2018 Recovery Plan states effective pollinators of the slender rush-pea have not been observed in the field or in a greenhouse setting. The rush-pea is thought to rely completely on self-pollination as the rate of fruit set is high despite the lack of observed floral visitors, and bagged flowers (i.e., when bags are placed over flowers to isolate them from pollinators) still produced fruit and viable seed (USFWS 2018). The slender rush-pea, like most legumes, likely relies on forcible or gradual dehiscence (ejection of the seeds from seed pods) for seed dispersal. As such, we do not anticipate adverse reproductive effects to the slender rush-pea from loss of seed dispersers due to carbaryl exposure.

Slender rush-pea can occur on some non-agricultural carbaryl use sites, including rights of way (along roads) and open space developed (a cemetery). Based on the low likelihood of usage and existing conservation measures (as described in the Exposure to Non-Agricultural Uses section) within these areas, we do not anticipate exposure from non-agricultural uses will meaningfully add to the overall level of anticipated exposure. In addition, insect pollinators are expected to die in agricultural use areas which overlap a large portion of the species' range (50.2% overlap with agricultural sites and up to 32.5% of the species range to be treated based on past carbaryl usage data). However, the species primarily relies on self-pollination for reproduction, and thus a loss of pollinating insects in its range is not anticipated to lead to significant adverse effects to the reproductive capacity of this species.

This species is a narrow endemic, primarily threatened by loss and modification of preferred prairie habitat and invasive non-native grasses. We anticipate carbaryl usage on agriculture in up to 32.4% of the species range and some non-agricultural use sites, especially in unprotected areas. However, the slender rush-pea is able to reproduce successfully by self-pollination and therefore is not reliant on the presence of a large number of pollinators within its range in order to reproduce. As a result, we do not expect species-level reproductive effects from carbaryl exposure due to the slender rush-pea's ability to rely on self-pollination and abiotic seed

dispersal for reproduction. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the slender rush-pea.

References

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

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Walker's manioc

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

Conclusion

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

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

While most Walker's manioc individuals occur in native shrublands in southern Texas, plants are occasionally found within rights of way (roadsides), a non-agricultural carbaryl use site. Based on the low likelihood of usage within these areas, we do not anticipate exposure from non-agricultural uses will meaningfully add to the overall level of anticipated exposure of pollinators of this species. Available usage information indicates that carbaryl is used infrequently in rights of way, with less than 500 pounds of carbaryl applied to roadways nationally each year. 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 Walker's manioc range for rights of way uses. Walker's manioc has a large percent overlap (44.8%) between agricultural carbaryl use sites and its range, and the range has high levels of agricultural carbaryl usage (30%) based on past usage data. We

do not expect significant use of carbaryl on protected sites, but that only constitutes about 1.6% of the species' range (Kern et al. 2023). Walker's manioc uses both abiotic and biotic vectors for seed dispersal and relies on insect pollinators to increase genetic diversity, even though it can reproduce asexually through underground tubers.

We anticipate significant adverse effects to the species due to the reduction in pollinating and seed dispersing insects across a large portion of the range that will result in reduced reproductive success. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators and seed dispersers for reproduction and maintenance of genetic diversity. A significant loss of pollinating and seed dispersing insects within its range is likely to exacerbate existing reproductive deficiencies of this species due to its highly fragmented and restricted range. For these reasons, we anticipate adverse, species-level effects in the form of significant loss of reproductive success due to carbaryl exposure that we expect to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Walker's manioc.

References:

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

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Lewton's polygala

Scientific Name:	Common Name:	Entity ID:
Polygala lewtonii	Lewton's polygala	803

Conclusion

Lewton's polygala is a narrow endemic species found in six counties in the Lake Wales Ridge region of central Florida. According to the 2019 Recovery Plan Amendment, Lewton's polygala exists in 44 occurrences, 28 of which are on protected, managed lands. Loss and modification of the native scrub habitat and lack of appropriate fire regimes primarily threaten the remaining, unprotected occurrences.

Lewton's polygala is one of the few species exhibiting amphicarpy (mixed reproduction strategy) via three types of flowers: aboveground open-pollinated (chasmogamous) flowers, aboveground self-pollinated closed (aboveground cleistogamous) flowers, and belowground self-pollinated closed (belowground cleistogamous) flowers. Its complex mating system results in flowering and fruiting at various times during the year and over the plant's lifetime and is thought to be an adaptation for ensuring successful reproduction in uncertain environments. How much the species relies on above- and underground self-fertilization is unknown, but fine scale genetic patterns suggest most seedling recruits are the result of self-fertilization. Other amphicarpic plants follow a different reproductive pattern, which raises questions about why so much effort is put into outcrossing if self-pollination results in higher fitness and survival and what factors limit successful chasmogamous reproduction. A recent study showed low pollinator visitation rates to the open aboveground flowers and hypothesized that low pollinator visitation could be due to a range shift or declines or extinction of one or more of the primary pollinators: bee-flies, flower flies, and leaf-cutter bees (USFWS 2021).

At least eight species of ant are thought to be critical to the dispersal of this species' seeds, though seeds are not dispersed far (3-4 meters). Both these low dispersal distances and the high rate of self-fertilization are contributing to genetic inbreeding (USFWS 2021).

While Lewton's polygala mainly occurs in sandhill and scrub habitat within the Lake Wales Ridge ecosystem, some populations do occur in sandhill and scrub clearings within managed forests (mainly Ocala National Forest), a non-agricultural carbaryl use site. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service in Florida. Where applications have taken place, the majority of treatments have involved small areas (<1 acre), such that we would anticipate limited exposure within the range of any individual species. As such, we anticipate a low likelihood of exposure and subsequent adverse reproductive effects from non-agricultural uses of carbaryl. In contrast, Lewton's polygala has a large percent overlap (14.3%) between agricultural carbaryl use sites and the species' range, and the range has medium levels of agricultural carbaryl usage (6.8%) based on past usage data. As such, we anticipate a high degree of adverse reproductive effects to the species due to the reduction in pollinating and seed dispersing insects across a

significant portion of the range. This is anticipated to exacerbate the existing reproductive declines from low pollinator visitation rates, limited seed dispersal, and resultant genetic inbreeding. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators and seed dispersers for reproduction and maintenance of genetic diversity. For the reasons described, we anticipate adverse, species-level effects in the form of significant loss of reproductive success due to carbaryl exposure that we expect to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Lewton's polygala.

References:

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

U.S. Fish and Wildlife Service. 2021. Lewton's polygala (Polygala lewtonii) 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 24 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Pygmy fringe-tree

Scientific Name:	Common Name:	Entity ID:
Chionanthus pygmaeus	Pygmy fringe-tree	901

Conclusion

The pygmy fringe tree is a member of the olive family endemic to central Florida and found mainly on the Lake Wales Ridge and to a smaller extent on the Winter Haven and Mount Dora ridges. The Lake Wales ridge is a narrow ridge of ancient sand dunes that runs down the central peninsula of Florida and harbors a large diversity of endemic plants and animals. The pygmy fringe-tree is a long-lived, clonal, woody perennial whose lifespan is unknown but is likely measured in decades. The species is confirmed in Desoto, Highlands, Hillsborough, Lake, Manatee, Osceola, Polk, Sarasota, and Seminole counties. The Florida Natural Areas Inventory (FNAI) in 2019 reported additional unvouchered occurrences in Hardee and Orange counties. FNAI reports a total of 49 element occurrence records, 26 of which occur on conservation lands. Although pygmy fringe-tree is protected in 15 conservation sites, protection of pygmy fringe-tree is inadequate in the northern limit of its range in Lake, Orange, and Osceola counties. Only one of five known occurrences at the northern end of the species range is currently protected, and the species may be extirpated from Osceola County (USFWS 2021). The remaining unprotected occurrences are primarily threatened by development, fire suppression, off-road vehicle use and invasive non-native plant species (USFWS 2010). Most of the large populations are in protected areas, including the Flamingo Villas unit of the Lake Wales Ridge National Wildlife Refuge, Carter Creek unit of the Lake Wales Ridge Wildlife and Environmental Area, and the Nature Conservancy's Saddle Blanket and Tiger Creek preserves (USFWS 2021).

The species is deciduous, with leaf-out occurring mid-March and flowering peaking in March and April. The reproductive biology of pygmy fringe-tree has not been thoroughly investigated. Pygmy fringe-tree reproduces most often by root sprouts, and seedlings are rarely encountered (USFWS 1999). In the closely related American fringe tree (*C. virginicus*), flowers appear to be functionally dioecious (individual plants are either male or female), and female flowers have reduced, usually non-functional anthers. Preliminary research found that this is likely true for pygmy fringe-tree as well. Insect pollinators are important to dioecious plants because pollen must be transported from one plant to another to achieve fertilization. The pygmy fringe-tree relies on insect species for pollination, including honeybees and bee flies. Little additional pollinator data is available (USFWS 2010; USFWS 2021).

Little is known about pygmy fringe-tree seed dispersal. In the wild, seeds have been observed to germinate in late summer. Specific seed dispersal vectors for this species are unknown, though a variety of birds and mammals are likely dispersers. Given that this species may be able to rely on a variety of seed dispersal vectors, we do not anticipate the effects to its avian or mammalian seed dispersers to cause significant adverse effects to the reproductive capacity of this species as described in the Toxicity section, above (USFWS 2010).

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

We do not expect the pygmy fringe tree to occur on non-agricultural carbaryl use sites, so we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects from non-agricultural uses of carbaryl. The pygmy fringe tree has a large percent overlap (17.1%) between agricultural carbaryl use sites and its range, while the range has a low to medium level of agricultural carbaryl usage (5.5%) based on past usage data. As such, we expect a moderate loss of insect pollinators within the range of the species from carbaryl exposure. We do not expect significant use of carbaryl on protected sites, which represents approximately half of the species' occurrences, including those with the largest numbers of individuals. While the pygmy fringe tree relies on insect pollinators to increase genetic diversity, it mainly reproduces vegetatively through clonal root shoots.

While we anticipate a moderate loss of insect pollinators within the range of the species from carbaryl exposure, we do not anticipate this loss to result in appreciable adverse reproductive effects to the species due to its ability to rely on clonal reproduction, at least half the occurrences are on protected lands where there is a low likelihood of carbaryl exposure, and the lack of adverse effects to seed dispersers. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the pygmy fringe tree.

References:

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

U.S. Fish and Wildlife Service. 2010. Pygmy fringe tree (*Chionanthus pygmaeus)* 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 29 pp.

U.S. Fish and Wildlife Service. 2021. Pygmy fringe tree (*Chionanthus pygmaeus)* 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 23 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Pigeon wings

Scientific Name:	Common Name:	Entity ID:
Clitoria fragrans	Pigeon wings	907

Conclusion

Pigeon wings is an erect perennial herb endemic to scrub habitat in five counties in the Lake Wales Ridge region of central Florida. Protected areas now encompass over two-thirds (roughly 70 percent) of the known populations throughout most of the historical range of the species. The status of the unprotected sites is largely unknown. Additional surveys are needed to assess the status of these unprotected sites. Populations on unprotected lands are subject to threats from development and fragmentation of scrub habitat and inadequate fire regimes (USFWS 2020).

Individual plants of this species possess some flowers that can self-fertilize and others that require pollen transfer, via insect pollinators, for fruit production. While specific pollinator species are unknown, insects are suspected. Studies reported in the 2008 5-year review found that very few fruits have been recorded from outcrossed (those requiring pollen transfer) flowers; most fruits result from self-pollination. In addition, most flowers produced by the species are self-pollinating (USFWS 2020). As a result, it is unlikely that pigeon wings rely heavily on pollinating insects for successful reproduction and survival.

Seed dispersal mechanisms for pigeon wings are unknown, but it's likely a combination of gravity (seeds dropping from seed pods) and dispersal by birds and/or mammals based on dispersal characteristics of similar species. As such, we do not anticipate significant effects to the seed dispersers of this species from carbaryl exposure as described in the Toxicity section, above.

We do not expect pigeon wings to occur on non-agricultural carbaryl use sites, so we anticipate a low likelihood of exposure and subsequent adverse reproductive effects from non-agricultural uses of carbaryl. However, pigeon wings has a large percent overlap (16.5%) between agricultural carbaryl use sites and its range, while the range has a medium level of agricultural carbaryl usage (7.23%) based on past usage data. We expect a significant loss of insect pollinators within the range of the species from carbaryl exposure. However, we do not expect significant use of carbaryl on protected sites, which represents approximately two thirds of the species' occurrences. While the pygmy fringe tree relies on insect pollinators to increase genetic diversity, it mainly reproduces through self-pollination and this mechanism produces most of the viable fruit set by this species.

While we anticipate a moderate loss of insect pollinators within areas of the species' range that are unprotected, we do not anticipate this loss will result in appreciable adverse reproductive effects to the species due to its ability to rely on self-fertilization, the protection of at least two thirds of occurrences where there is a low likelihood of carbaryl exposure, and lack of adverse effects to seed dispersers. After adding the effects of the action and cumulative effects to the

environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the pigeon wings.

References:

U.S. Fish and Wildlife Service. 2008. Pigeon wings (*Clitoria fragrans)* 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 18 pp.

U.S. Fish and Wildlife Service. 2020. Pigeon wings (*Clitoria fragrans)* 5-Year Review: Summary and Evaluation. Vero Beach, Florida. 22 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Clay-Loving wild buckwheat

Scientific Name:	Common Name:	Entity ID:
Eriogonum pelinophilum	Clay-Loving wild buckwheat	930

Conclusion

Clay-loving wild buckwheat is a low growing, rounded, densely branched subshrub in the buckwheat family (Polygonaceae). It has dark green leaves that roll inward and appear needle-like. Though it only grows 6 to 8 inches tall, it is known to live for more than 18 years. Clay-loving wild buckwheat is endemic to the rolling clay (adobe) hills and flats immediately adjacent to the communities of Delta and Montrose, Colorado. These white alkaline clay barrens are derived from the Mancos Shale Formation, deposits from an ancient inland sea. These barrens are inhospitable to only but the most adapted species. Many of these populations occur on private lands.

Clay-loving wild buckwheat is now known to exist across 15 occurrences and potentially exists at six additional historical occurrences. Despite the recent discovery of new occurrences, annual monitoring efforts by the Bureau of Land Management (BLM) (about 45% of the range occurs on BLM lands) have documented declines in plant density across the species' range, particularly over the last five years. Some occurrences experienced declines greater than 70% when compared to estimated densities from 2013 (USFWS 2022). Stressors include incompatible livestock grazing, presence of invasive species, off-highway vehicle use, commercial and residential development, irrigation operations, development and maintenance of utility corridors, and climate change (USFWS 2022).

Clay-loving wild buckwheat requires a pollinator and has a mixed breeding system with some pollination occurring between flowers on the same plant and some pollination occurring between flowers from different plants (USFWS 2022). Over 50 species of insects (including bees, ants, and beetles) have been found to visit clay-loving wild buckwheat. In several studies cited in the 2009 5-year review, over 50 species of insect visited buckwheat flowers, many of which were native bee and ant species. Ants may be a particularly important pollinator and were also found to be potential seed dispersers for this species. Pollinators for this species cover a wide array of taxonomic and functional types of insects with no single pollinator being especially important for the buckwheat (USFWS 2009).

Clay-loving wild buckwheat occurs only in white clay alkaline barrens. However, roads cut through some of this habitat and a portion is used as rangeland. As such, some individuals are found on these non-agricultural carbaryl use sites (rangelands and rights of way along roads). 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 each year. 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 clay-loving wild buckwheat's range for rights of way uses. Furthermore, we anticipate all rangeland applications of carbaryl will be carried out in association with USDA APHIS as part of their grasshopper and Mormon cricket suppression program (USFWS 2024), which includes conservation measures meant to protect clay-loving wild buckwheat from exposure. Measures in place are a one mile aerial and ground buffer from suitable habitat for the species from May through September, the bloom time for the species. As such, based on past carbaryl usage and established conservation measures, we anticipate a low likelihood of exposure and subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl.

The clay-loving wild buckwheat has a large percent overlap (55.5%) between agricultural carbaryl use sites and its range, and the range also has a high percent range treated (55.5%) based on past agricultural carbaryl usage data. As such, we anticipate a high degree of adverse effects to the species due to a large reduction in pollinating and seed dispersing insects across a large portion of the range. The species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators and seed dispersers for reproduction and maintenance of genetic diversity. Despite the species' ability to use multiple pollinator species, the large, anticipated reduction in pollinators and seed dispersers across over half the species range, in addition to the observed decline in density of many occurrences, leads us to anticipate adverse, species-level effects in the form of significant loss of reproductive success due to carbaryl exposure. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 clay-loving wild buckwheat.

References:

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

U.S. Fish and Wildlife Service. 2009. Clay-loving wild buckwheat (*Eriogonum pelinophilum)* 5-Year Review: Summary and Evaluation. Grand Junction, Colorado. 51 pp.

U.S. Fish and Wildlife Service. 2022. Clay-loving wild buckwheat (*Eriogonum pelinophilum)* 5-Year Review: Summary and Evaluation. Lakewood, Colorado. 27 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Snakeroot

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

Conclusion

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

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

While most snakeroot populations occur in various types of scrub habitat, some individuals of a few populations could occur in rights of way (for this species, along roadsides), a non-agricultural carbaryl use site. Available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. 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 snakeroot's range for rights of way uses. As such, we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl. However, there is 28.6% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 23.6% of the species' range has been treated with carbaryl annually. While mortality is expected for insects exposed to carbaryl, the snakeroot successfully reproduces using self-pollination, suggesting that its reliance on insect pollinators is

low. In addition, most populations exist on protected lands where carbaryl exposure is unlikely. As such, we do not expect a loss of pollinating insects will lead to appreciable adverse effects to the reproductive capacity of this species. As such, we anticipate that mortality of some pollinators will not cause species-level reproductive effects to the snakeroot over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the snakeroot.

References:

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Minnesota dwarf trout lily

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

Conclusion

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

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

We believe the Minnesota dwarf trout lily primarily uses vegetative reproduction, and most (71%) of the known individuals are on protected lands. Minnesota dwarf trout lily is a forest wildflower, thus it can occur in managed forests, a non-agricultural carbaryl use site. However, the majority of forests where the species occurs are protected and managed for the species. In addition, available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016 - 2020 indicate no carbaryl has been used by the Forest Service in any areas within the region containing the Minnesota dwarf trout lily's range. Where applications have taken place, the majority of treatments have involved small areas (<1 acre), such that we would

anticipate limited exposure within the range of any individual species. As such we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl. Even though overlap of the range with agricultural carbaryl use and the percent of the range treated with carbaryl for agricultural purposes are high, and insect pollinators are expected to die in a large portion of the range of this species, we do not expect a loss of pollinating insects will lead to appreciable adverse effects to the reproductive capacity of this species because its primary reproductive strategy is vegetative and does not require insect pollinators. As such, we do not anticipate species-level reproductive effects to the Minnesota dwarf trout lily over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Minnesota dwarf trout lily.

References

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

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Schweinitz's sunflower

Scientific Name:	Common Name:	Entity ID:
Helianthus schweinitzii	Schweinitz's sunflower	945

Conclusion

The Schweinitz's sunflower is a perennial plant endemic to the piedmont of North and South Carolina. Historically, it likely occurred in prairie-like habitats or savannas maintained by fires set by lightning or native Americans. Loss of this open habitat due to fire restriction and urbanization has resulted in the decline of the species and its reduction to marginal and very vulnerable sites such as roadside rights of way (USFWS 1994). Habitat for the species continues to become increasingly fragmented with the rapid urbanization of the Charlotte, North Carolina metropolitan area. The greater Charlotte-Gastonia-Concord area of North and South Carolina was identified as one of 35 fastest growing large metropolitan areas in the country in a recent report examining the effects of sprawl upon endangered species (USFWS 2019).

As of 2019, the species' distribution included 13 North Carolina counties and two South Carolina counties. Unfortunately, very few sites have been monitored consistently; therefore, assessments of trends in abundance in the species' range are difficult to interpret. Low levels of genetic variation among populations have been detected, and genetic differentiation among sites was not correlated with geographic distance. This supports a hypothesis of relative fragmentation of a formerly large, contiguous population into more isolated groups (USFWS 2019).

Studies described in the 2019 5-Year Status Review assessed a total of 167 sites and found 156 (93.4%) occur in rights of way where they are inherently in danger of inappropriate management and possible extirpation. Vegetation management practices pose a threat to these occurrences in rights of way, in that inappropriately timed mowing (e.g., during the growing season, prior to seed set) or excessive herbicide application have adversely impacted the species at several of these locations. The NCDOT has a program in which roadside occurrences of federally listed plant species are posted with signs prohibiting growing season mowing or herbicide application. Despite these efforts, 28 of 63 NCDOT sites containing *H. schweinitzii* were reportedly adversely impacted at least once as of 2003. As such, recovery efforts are now focused upon relocating plants from these inherently vulnerable right of way habitats into adjacent areas with the potential for adequate management and the appropriate suite of associated native vegetation thought to comprise the natural plant communities of the Carolina piedmont ecoregion (USFWS 2019).

Like other species in this appendix, the Schweinitz's sunflower uses at least two methods of reproduction, pollen transfer and seed production and vegetative spreading through tubers or rhizomes. Little else is known about the reproductive biology of the species. As many species in the sunflower family use insects for pollination, we assume that Schweinitz's sunflower does as well. The species can also reproduce from entire or partial underground tubers. However, the

relative importance of sexual (by seed, via insect pollination) and asexual (by rhizome/tuber) reproduction is not known in this species. Seed dispersal methods have not been documented for Schweinitz's sunflower, though many species in the same genus (Helianthus) disperse seeds using wind and/or birds and small mammals and we will assume the same for this species (USFWS 2019). As such, we do not anticipate adverse reproductive effects to the species from loss of seed dispersers since birds as mammals are not highly sensitive to direct carbaryl exposure as described in the Toxicity section, above.

There is 23% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 11% of the species' range has been treated with carbaryl annually. In addition to the exposure expected from agricultural uses of carbaryl, exposure of the pollinator community within the range of this species is expected to occur from carbaryl use on rights of way, given the vast majority of the species' occurrences (93.4%) are within rights of way and roadsides (i.e., non-agricultural carbaryl use sites). As such, we expect high insect pollinator mortality across a relatively large portion of the range.

The species is a narrow endemic and we assume its reproductive success is dependent upon the presence of insect pollinators for reproduction and maintenance of genetic diversity, given the significance of vegetative reproduction is unknown. The species occurrences are also highly fragmented, making it difficult for pollinators to locate and travel among individuals and maintain genetic diversity. A significant reduction in the pollinator community from carbaryl exposure will exacerbate this issue. As such, we anticipate adverse, species-level effects in the form of significant loss of reproductive success due to carbaryl exposure. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Schweinitz's sunflower.

References:

U.S. Fish and Wildlife Service. 1994. Recovery Plan: Schweinitz's sunflower (*Helianthus schweinitzii*). Atlanta, Georgia. 35 pp.

U.S. Fish and Wildlife Service. 2019. Schweinitz's sunflower (*Helianthus schweinitzii*) 5-Year Review: Summary and Evaluation. Asheville, North Carolina. 53 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Britton's beargrass

Scientific Name:	Common Name:	Entity ID:
Nolina brittoniana	Britton's beargrass	974

Conclusion

Britton's beargrass is a perennial herb in the agave family with a moderate to long life span (>10 years). The species is a habitat generalist and occurs in multiple xeric upland communities, including scrub and sandhill in central Florida (USFWS 1990).

As of 2019, the species had 111 total populations of which 72 populations were located on a minimum of 30 conservation lands in Highlands, Polk, Lake, Manatee, Hillsborough, Hardee, Pasco, and Marion counties. Britton's beargrass occurs principally on five of the central peninsular ridges (Mount Dora, Orlando, Lake Wales, Lake Henry, and Winter Haven) from Marion County south through Highlands County. The species is also present west of these ridges along the west coast of central Florida in five counties. All conservation lands have management plans for the long-term preservation and conservation of the species, albeit funding, limited personnel availability, and the location on the landscape (smoke management constraints) may preclude management activities at times. At present, it does not appear that habitat loss and fragmentation has resulted in a substantive loss of genetic structure in this species (USFWS 2019).

Britton's beargrass is clonal, producing new rosettes at the end of short runners. The species is also effectively dioecious, meaning that it has separate male and female plants (with a few exceptions) and needs pollinators to transport pollen between plants of different sexes. Seed is produced only through pollination and the species exhibits a generalist pollination syndrome, being pollinated throughout the day by a variety of floral visitors (USFWS 1990). Seeds are evidently wind dispersed because of their inflated, winged capsules. As such we do not anticipate adverse effects to the seed dispersal capacity of this species from carbaryl exposure.

Like other species in this appendix, Britton's beargrass uses two methods of reproduction, pollen transfer between individual plants and vegetatively through clones. We do not expect Britton's beargrass to occur on non-agricultural carbaryl use sites, so we anticipate a low likelihood of exposure and subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl. There is 26% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 17% of the species' range has been treated with carbaryl annually. While mortality is expected for insects exposed to carbaryl, Britton's beargrass can reproduce vegetatively, reducing the species' reliance on insect pollinators, and genetic diversity within the species remains high, suggesting that successful seed production via pollination remains intact even in a fragmented habitat. In addition, many populations exist on protected lands managed for the species and where carbaryl exposure is unlikely. Lastly, seed dispersal capacity is not anticipated to decline from carbaryl use within the range due to wind dispersal. As such, we do not expect a loss of pollinating insects will lead to appreciable adverse

effects to the reproductive capacity of this species. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Britton's beargrass.

References:

U.S. Fish and Wildlife Service. 1990. Recovery Plan: Nineteen Scrub and High Pineland Plant Species. Atlanta, Georgia. 142 pp.

U.S. Fish and Wildlife Service. 2019. Britton's Beargrass (*Nolina brittoniana)* 5-Year Review: Summary and Evaluation. Jacksonville, Florida. 23 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Canby's dropwort

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

Conclusion

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

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

Like other species in this appendix, Canby's dropwort uses two methods of reproduction: pollen transfer between individual plants (outcrossing) and vegetatively through rhizome spread. Canby's dropwort primarily relies on asexual vegetative reproduction through rooting at the nodes of the rhizomes, but their flower structure (protandrous) and genetic diversity indicate reliance on outcrossing by unknown insect pollinators to some degree. The flowers are bisexual and/or unisexual and appear from mid-August to early October (USFWS 1990). There may be some self-pollination, but the flowers are protandrous (anthers release their pollen before the stigma of the same flower is receptive, so an individual flower cannot pollinate itself), indicating some outcrossing does occur. Furthermore, Canby's dropwort has high genetic diversity compared to other rare herbaceous species. As high genetic diversity in a plant population often arises from successful outcrossing, this adds to evidence that the species relies on insect pollinators to some degree and that pollinators have been present within the range in sufficient numbers to maintain genetic diversity (USFWS 2022). Pollinators for this species are unknown, but Canby's dropwort is a favorite food plant for the larval black swallowtail butterfly (*Papilio polyxenes asterius*) and adults may visit flowers and serve as pollinators. Seed germination takes a year or longer (USFWS 2022), and seeds are believed to be dispersed via wind. There may be other, unknown sources of seed dispersal (USFWS 1990).

Canby's dropwort occurs in wetlands, though a few of these wetlands may be within forested areas, thus a minimal number of individuals may occur on or near managed forests, a non-agricultural carbaryl use site. However, available data on past carbaryl usage in managed forests

from the U.S. Forest Service from 2016 - 2020 indicate no carbaryl has been used by the Forest Service in any areas within the region containing the Canby's dropwort's range. Where applications have taken place, the majority of treatments have involved small areas (<1 acre), such that we would anticipate limited exposure to pollinators within the range of any individual species. As such we anticipate a low likelihood of exposure to pollinators and subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl. Due to high overlap between the species' range and agricultural carbaryl use sites (38.5%) and moderate past agricultural carbaryl usage within the range (6% annually), insect pollinators are expected to experience moderate mortality within a large portion of the range of Canby's dropwort. However, we do not expect this loss of pollinating insects will lead to appreciable adverse effects to the reproductive capacity of this species because of the species' ability to reproduce primarily by vegetative spread, high genetic diversity indicating pollinator presence in the range, wind seed dispersal, and 11 of its 18 populations are at least partially protected and unlikely to experience carbaryl exposure. As such, we do not anticipate that the loss of pollinators will cause species-level reproductive effects to the Canby's dropwort 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 Canby's dropwort.

References:

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

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Michaux's sumac

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

Conclusion

Michaux's sumac is an endangered, usually dioecious (having separate male and female plants), shrub endemic to the inner coastal plain and piedmont of Virginia, the Carolinas, and Georgia where it occupies sandy or rocky open woods and is dependent on some form of disturbance to maintain its open habitat (USFWS 1993). As of 2014, there were 43 parent populations range wide. Many of the North Carolina populations occur on Fort Bragg Army Base and Camp Mackall and receive protection and appropriate management, especially through the use of prescribed fire to reduce shade and competition. At least 29 extant populations in North Carolina are partially or fully on protected/conservation lands. In Virginia, five populations occur on protected lands at Fort Pickett National Guard Training Center and on private conservation lands. Two Georgia populations are in conservation management at the Broad River Wildlife Management Area and the Covington Water Tower Preserve. In addition, there are two "safeguarding sites" for *R. michauxii* in Georgia at Panola Mountain State Park and Chattahoochee Nature Center. In total, many occupied sites occur on lands that receive protection and/or management and where carbaryl exposure is unlikely to occur (USFWS 2014).

Several populations of *R. michauxii* have suffered from habitat modification and/or destruction. This species is threatened by fire suppression and the ecological succession (competition and/or shading by woody species) that occurs in areas that are not burned on a regular basis. Forest populations are threatened by timber operations. Logging activities can crush plants and/or compact the soil where they grow. Sites located within utility rights-of-way are threatened by herbicide use, mowing during critical growth periods, and ground disturbing activities. Habitat destruction, the result of development or land conversion, also threatens this species (USFWS 2021).

Like other species in this appendix, the Michaux's sumac uses at least two methods of reproduction, pollen transfer between individual male and female plants and cloning through rhizome growth. Michaux's sumac populations are generally small and often consist completely of male or female plants. As the species is clonal, it is believed that many populations consist of multiple stems that are all connected by underground rhizomes, so therefore, they likely only contain one plant. These single plant or single sex populations do not produce seeds, limiting genetic variation in the species. Limited genetic variation within populations may contribute to the low rates of seed production observed in natural populations. In addition, it appears that seed viability is extremely low, and seed dispersal mechanisms are unknown (USFWS 2014). While pollination vectors are unknown for this species, we assume insect pollinators are necessary to transfer pollen (and its genetic material) between male and female plants and among populations of this diecious species. Other species of sumac are routinely visited by a variety of insect pollinators.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

There is 29.2% overlap between agricultural carbaryl use sites and the species' range, and past agricultural usage data indicate that up to 14.4% of the species' range has been treated with carbaryl annually, indicating high insect pollinator mortality across a large portion of the range from agricultural uses.

While Michaux's sumac prefers sandy or rocky open habitats maintained by disturbance, this disturbance often takes the form of managed forestry (i.e., logging), road, railroad and utility maintenance, and development. As such, many populations occur on or near the carbaryl non-agricultural use sites of managed forests, rights of way, and developed and open space developed areas. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of the species. Where applications have taken place, the majority of treatments have involved small areas (<1 acre). Thus, we do not anticipate carbaryl exposure from managed forests to contribute meaningfully to the overall level of anticipated exposure of this species' pollinators. In contrast, even though use is anticipated to be low in rights of way and developed areas (as discussed in the Exposure to Non-Agricultural Uses section, above), given many of the species' populations occur in or near these non-agricultural uses, we expect some additional exposure and mortality of the pollinator community of this species from these areas.

While many populations of the species occur on land that is unlikely to experience carbaryl exposure, the species has a severe pre-existing reproductive deficit due to single sex populations that do not produce seeds, low genetic diversity, and very low seed viability. As such, a large reduction in the insect pollinator community from exposure to both agricultural and non-agricultural uses of carbaryl across a large portion of the range is expected to lead to species level adverse reproductive effects given an already low rate of sexual reproduction. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 Michaux's sumac.

References:

U.S. Fish and Wildlife Service. 1993. Recovery Plan: Michaux's sumac (*Rhus michauxii*). Atlanta, Georgia. 35 pp.

U.S. Fish and Wildlife Service. 2014. Michaux's sumac (*Rhus michauxii*) 5-Year Review: Summary and Evaluation. Raleigh, North Carolina. 28 pp.

U.S. Fish and Wildlife Service. 2021. Michaux's sumac (*Rhus michauxii*) 5-Year Review: Summary and Evaluation. Raleigh, North Carolina. 45 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: American chaffseed

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

Conclusion

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

The American chaffseed uses several methods to reproduce, pollen transfer between individual plants, self-fertilization, and vegetative propagation. Pollinators are not required for American chaffseed to fruit and produce viable seeds, and seeds are believed to be dispersed primarily via wind. In addition, most known populations are on protected lands (95%). American chaffseed occurs on some non-agricultural carbaryl use sites (managed forests, and rights of way including roadsides and railroad crossings) but based on past carbaryl usage and established conservation measures, we anticipate a low likelihood of exposure of the pollinators of this species. In addition, no carbaryl has been used in the species' range for federal forestry uses based on past usage data, and we anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl. Even though insect pollinators are expected to die within the range of this species from high overlap and agricultural carbaryl use sites (37.8%) and moderate past agricultural usage (9.7%) within the range, we do not expect a loss of pollinating insects will lead to appreciable adverse effects to the reproductive capacity of this species for the reasons mentioned. As such, we anticipate that loss of pollinators will not result in species-level reproductive effects to the American chaffseed over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the American chaffseed.

References:

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

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Carter's mustard

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

Conclusion

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

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

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

Like other species in this appendix, Carter's mustard uses two methods of reproduction, pollen transfer between individual plants and self-fertilization. Pollinators are not required for Carter's mustard to fruit and produce viable seeds, and the species can rely on self-pollination. Seeds are believed to be dispersed via gravity and involvement of insects in seed dispersal is unknown. In addition, many known populations (79%) are on protected lands where it is unlikely exposure to carbaryl will occur. Carter's mustard occurs on some non-agricultural carbaryl use sites (e.g., roadsides and managed forests), but based on past carbaryl usage and established conservation measures, we anticipate a low likelihood of exposure of the pollinators of this species. In addition, no carbaryl has been used in the species' range for federal forestry uses based on past

usage data, and we anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl. Even though insect pollinators are expected to die within the range of this species (i.e., agricultural carbaryl use sites overlap with 16% of the species' range and 7% of the range has been treated annually with carbaryl in the past for agricultural purposes), we do not expect a loss of pollinating insects will lead to appreciable adverse effects to the reproductive capacity of this species due to its reproductive strategy and reliance on self-pollination. We anticipate that mortality of pollinators will not cause species-level reproductive effects to the Carter's mustard over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Carter's mustard.

References:

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Relict trillium

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

Conclusion

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

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

The relict trillium is a forest wildflower, thus it can occur in managed forests, a carbaryl non-agricultural use site. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016 - 2020 indicate no carbaryl has been used by the Forest Service in any areas within the region containing the Minnesota dwarf trout lily's range. Where applications have taken place, the majority of treatments have involved small areas (<1 acre), such that we would anticipate limited exposure within the range of any individual species. Thus, we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects to the species from non-agricultural uses of carbaryl. In contrast, carbaryl agricultural use sites overlap with a high portion of the range (25.3%) and a moderate portion (8.2%) of the range has been

treated annually with carbaryl in the past for agricultural purposes. As such, we anticipate high adverse effects to the species due to the reduction in pollinating and seed dispersing insects that will result in reduced reproductive success. Though relict trillium is self-compatible, the species relies on sexual reproduction involving flies and beetles for pollination and ants and beetles for seed dispersal. In addition, populations are small and likely have declining trends. As such, we anticipate adverse, species-level effects in the form of a loss of reproductive success due to high carbaryl exposure of pollinators and seed dispersers that we expect to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the relict trillium.

References:

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Garrett's mint

Scientific Name:	Common Name:	Entity ID:
Dicerandra christmanii	Garrett's mint	1046

Conclusion

Garrett's mint is an endangered, short-lived perennial woody shrub that occurs only in the xeric oak-history scrubs of Highlands County, Florida. It is endemic to the Lake Wales Ridge. As of 2009, there were five extant, naturally occurring populations, two of which occur on the same site. Only one of the five populations occurs on a protected area. The species is not well-studied but has a similar life history and fire ecology to that of the scrub mint. Garrett's mint is insect-pollinated and requires insect visits for seed production. Bee-flies, a generalist pollinator, tends to be the dominant pollinator of the Garrett's mint. The history of fire disturbance in Garrett's mint habitat impacts the type of pollinator and the frequency of visits. Studies of the scrub mint have shown that open sites (areas recently burned by wildfire) receive more pollinator visits than more canopy-shaded areas. Threats to the species include habitat modification and destruction, fire suppression, and to a lesser extent encroachment by invasive species.

While Garrett's mint predominantly occurs in xeric scrub habitat in the Lake Wales Ridge ecosystem, some individuals may occasionally occur on or near rights of way (roadsides), a carbaryl non-agricultural use site. Available usage information indicates that carbaryl is used infrequently in rights of ways, with less than 500 pounds of carbaryl applied to roadways nationally each year. 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 Garret's mint's range for rights of way uses. In contrast, carbaryl agricultural use sites overlap with a high portion of the range (28.6%) and a high portion (23.6%) of the range has been treated annually with carbaryl in the past for agricultural purposes. As such, we anticipate high adverse effects to the species due to the large reduction in pollinating and seed dispersing insects that will result in reduced reproductive success. Though Garrett's mint is self-compatible, the species relies on sexual reproduction involving bee-flies for pollination and populations are small, fragmented, and likely have declining trends. As such, we anticipate adverse, species-level effects in the form of a high loss of reproductive success due to mortality of insect pollinators from carbaryl exposure that we expect to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Garrett's mint.

References:

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

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

U.S. Fish and Wildlife Service. 2009. 5-Year Review Garrett's Mint (*Dicerandra christmanii*). Vero Beach, Florida. 28 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Leedy's roseroot

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

Conclusion

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

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

We do not expect Leedy's roseroot to occur on non-agricultural carbaryl use sites, so we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects from non-agricultural uses of carbaryl. Agricultural carbaryl use sites overlap with a high percentage of the species' range (88.5%) and a high percentage (88.5%) of the range has been treated annually with carbaryl in the past for agricultural purposes. As such, we anticipate high adverse effects to the species due to the reduction in pollinating insects that will result in reduced reproductive success. Though Leedy's roseroot can reproduce clonally, this strategy is uncommon. The species relies on sexual reproduction involving bees and syrphus flies for pollination, which will be affected by carbaryl use in the species' range. We anticipate adverse, species-level effects in the form of a high loss of reproductive success due to loss of pollinators from carbaryl exposure that we expect to occur over the duration of the action. After adding the

effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Leedy's roseroot.

References:

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

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

U.S. Fish and Wildlife Service. 1998. Leedy's Roseroot Recovery Plan (*Rhodiola integrifolia* spp. *leedyi*). Ft. Snelling, Minnesota. 39 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Florida ziziphus

Scientific Name:	Common Name:	Entity ID:
Ziziphus celata	Florida ziziphus	1234

Conclusion

Florida ziziphus is an endangered, thorny, clonal shrub endemic to the Lake Wales Ridge. As of 2021, there are 13 remnant populations and 3 introduced populations in Highlands and Polk Counties in central Florida. One factor contributing to its rarity is the plant's restrictive reproductive strategy, which limits sexual reproduction to plants of different mating types and thus relies largely on cloning through vegetative spreading. Uniclonal populations cannot reproduce sexually, because the species requires out-crossing between different compatible genotypes for successful pollination. Populations that are not sexually reproducing rely on vegetative growth, which can reduce adaptive capacity through limitations in genetic variation. Uniclonal populations can further challenge efforts to conserve the species because counting individuals can be misleading, since above-ground stems thought to be different individuals can be connected underground and therefore actually belong to the same plant. Threats to the conservation of the Florida ziziphus include loss of habitat and increased development, limited protected areas where they reside, with several populations on private lands being extirpated in the past few years.

A significant number of Florida ziziphus individuals occur on rangelands, a carbaryl non-agricultural use site. However, data from USDA APHIS show limited past carbaryl usage on rangelands outside of seven western states, including Florida. The species is unlikely to occur on additional non-agricultural use sites. As such, we anticipate a low likelihood of exposure of pollinators and subsequent adverse reproductive effects to the species from this non-agricultural use of carbaryl.

Agricultural carbaryl use sites overlap with a high portion of the Florida ziziphus' range (25.6%) and a high portion (12.1%) of the range has been treated annually with carbaryl in the past for agricultural purposes. This species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction, especially given its highly fragmented range and existing lack of genetic diversity among populations and individuals. We anticipate adverse effects in the form of loss of insect pollinators and resultant loss of reproductive success of the species from exposure to carbaryl that would be expected to occur over the duration of the action. As such, we anticipate adverse, species-level effects in the form of a high loss of reproductive success due to loss of pollinators from carbaryl exposure that we expect to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is likely to jeopardize the continued existence of the Florida ziziphus.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

References:

U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Atlanta, Georgia. 2,172 pp.

U.S. Fish and Wildlife Service. 2021. 5-Year Review Florida ziziphus (*Ziziphus celata*). Vero Beach, Florida. 12 pp.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Gentian pinkroot

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

Conclusion

Gentian pinkroot is a perennial herb that can grow in small clumps or as solitary individuals. It occurs in predominately well-drained upland pinelands where it is a component of fire-maintained longleaf pine-wiregrass ecosystems. As of 2023, it is restricted to seven extant locations (two additional locations have been extirpated) within three counties west of the Apalachicola River: Calhoun, Jackson, and Washington counties in Florida and Geneva County, Alabama. Another population of *Spigelia* in Alabama is now considered a separate species (*S. alabamensis*). As of 2018, these sites supported about 3,900 plants and some populations appear to be increasing and others appear to be decreasing. Populations are located on both public and private lands; several populations are on land managed and protected by The Nature Conservancy. Gentian pinkroot is threatened by land conversion, fire suppression, urban development, catastrophic events like hurricanes, and invasive plants (USFWS 2023).

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

The Gentian pinkroot primarily uses self-pollination and dehiscence (i.e., spontaneous opening at maturity of a plant structure) for seed dispersal.

While the Gentian pinkroot typically occurs within the longleaf pine-wiregrass ecosystem, some portions of a few populations could occur in managed forests, a carbaryl non-agricultural use site. The species is not likely to occur on any additional non-agricultural use sites. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016 - 2020 indicate no carbaryl has been used by the Forest Service in any areas within the region containing the Gentian pinkroot's range. Where applications have taken place, the majority of treatments have involved small areas (<1 acre), such that we would anticipate limited exposure within the range of any individual species.

Even though insect pollinators are expected to die within the range of this species (i.e., there is 42.7% overlap of agricultural carbaryl use sites and the range and 25.6% of the range has been treated with carbaryl in the past for agricultural purposes), we expect this species to have a low reliance on pollinators, and thus do not expect a loss of pollinating insects will lead to appreciable adverse effects to the reproductive capacity of this species. We anticipate that

mortality of pollinators from carbaryl exposure will not cause species-level reproductive effects to the Gentian pinkroot over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gentian pinkroot.

References:

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

Rationale for Species Conclusion: Tiny polygala

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

Conclusion

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

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

We determined that the tiny polygala has high exposure as there is 29.5% overlap between the agricultural use areas and the species' range, and past usage data indicate that up to 16.3% of the species' range has been treated with carbaryl annually. Carbaryl use on non-agricultural use sites likely does not contribute meaningfully to the overall level of anticipated exposure of pollinators of this species. This is because tiny polygala only occurs in the rare and highly fragmented pine rocklands habitat of southern Florida, where non-agricultural use sites are unlikely to occur. However, these pine rockland fragments may be adjacent to developed or open space developed land use sites where carbaryl may be applied. Mitigations contained in the 2022 FIFRA Proposed Interim Decision and the 2024 NMFS biological opinion for carbaryl resulted in reducing off-site movement of carbaryl for certain types of applications. For example, 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 for these uses and greatly reduces the areal extent that can be treated on many use sites within these use sites. However, while mortality is expected for insects exposed to carbaryl, the tiny polygala is believed to primarily self-pollinate; pollinators were not observed visiting plants and the plants are able to transfer pollen from dehisced anthers to the stigma when flowers develop. We do not expect insect pollinators are significantly involved in tiny polygala reproduction. Though ants have been observed dispersing seeds, water is believed to be the primary dispersal method for tiny polygala. In addition, all populations are protected from development and are, at least partially, managed for conservation of tiny polygala.

We do not expect a loss of insects will lead to appreciable adverse effects to the reproductive capacity of this species. We do not anticipate that mortality of pollinators from carbaryl exposure will cause species-level reproductive effects to the tiny polygala over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the tiny polygala.

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

References:

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

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

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

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

Rationale for Species Conclusion: Pondberry

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

Conclusion

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

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

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

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

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

Pondberry may occur in managed forests, a carbaryl non-agricultural use site. It is not likely to occur on any additional non-agricultural use sites. Available data on past carbaryl usage in managed forests from the U.S. Forest Service from 2016-2020 indicate no carbaryl has been used by the Forest Service within the range of pondberry. Where applications have taken place, the majority of treatments have involved small areas (<1 acre), such that we would anticipate limited exposure within the range of any individual species. As such, we anticipate a low likelihood of exposure and subsequent adverse effects from non-agricultural uses of carbaryl. However, we anticipate high carbaryl exposure to pollinators and seed dispersers of the species in a large portion of the range because agricultural carbaryl use sites overlap 56.7% with the species' range and past agricultural usage data indicate that up to 13.8% of the species' range has been treated with carbaryl annually. Even though exposure may be high, we anticipate low adverse reproductive effects to the species from pollinator and seed disperser loss for the following reasons. First, the species is broadly distributed across multiple states and a significant number of populations are found on federal, state, or conservation lands where we anticipate agricultural use of carbaryl is unlikely. Second, the pondberry is strongly clonal and can reproduce vegetatively in the absence of insect pollinators, and lastly, the species uses birds for seed dispersal, so carbaryl is unlikely to diminish their availability as described in the Toxicity section, above.

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

References:

C-B3. Flowering Plants Biotic Pollination vectors with ability to reproduce asexually and_or by self-fertilization (Groups 6 & 10)

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

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