Integration and Synthesis Summary for Plants, Non-lower 48

Monocot and dicot flowering plants that use biotic pollination vectors, but other characteristics of their reproductive mechanisms are unknown

Assessment Groups 7 & 11

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will "likely be adversely affected" by the proposed action. Our jeopardy analysis of the proposed action's impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine individual species' rankings and a template worksheet to show how rankings were assessed and combined are in Appendix E. All plants in this appendix (plant assessment groups 7 & 11) utilize biotic vectors to accomplish pollination, such as insects, birds and mammals; other aspects of their reproductive mechanism are unknown. Seed dispersal for the species in this group is achieved by biotic (dispersal by animals) and/or abiotic (dispersal by wind, water or gravity) means. All species in this assessment group are found entirely outside the conterminous United States (i.e., non-lower 48 or NL48; includes all U.S. states and territories of the Pacific and Caribbean Islands).

Vulnerability

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

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

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

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

Exposure

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

We characterize the expected level of exposure using overlap data, past methomyl usage data, and any species-specific considerations such as life history information (e.g., habitat preferences, pollinator preferences) and existing protections or conservation actions. Species with greater than 10% overlap between their range and methomyl use sites are assigned a high overlap score, species with 5-10% overlap are assigned a medium overlap score, and species with less than 5% total overlap are assigned a low overlap score.

We determine the overall exposure ranking by qualitatively combining total overlap with any additional exposure considerations that might modify the level of exposure likely to occur. In the absence of any relevant exposure modifiers, the overall exposure ranking is the same as the overlap score (e.g., high overlap score with no exposure modifiers results in a high overall exposure ranking). In situations where we are aware of additional factors that influence the level of exposure likely to occur, we adjust the overall exposure ranking as appropriate (e.g., a species that only occurs in remote areas away from use sites can have a medium or low exposure ranking despite having a high overlap score or a species known to grow near agricultural areas can have a high exposure ranking despite having a low overlap score). Past methomyl usage data on Pacific or Caribbean islands is unavailable. However, prior reporting data indicate that annual treatment with insecticides occurs on 8-45% of agricultural crops per island in Hawai'i and 20-70% of crops per municipality in Puerto Rico. We use these data broadly as confirmation that insecticide usage occurs on these islands, with methomyl presumably among these insecticides. Where appropriate (e.g., species with more spatially refined range maps), we use these data as an additional exposure modifier to estimate the extent that a species' range is likely to be treated with insecticides, which we consider an upper bound for methomyl usage.

Toxicity

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

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

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

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

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

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

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

Summary of Conclusions for Plants in Assessment Groups 7&11, NL48

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

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

Species with low concern of adverse effects

The species in Table 1 are grouped together as they have low concern of adverse effects due to either 1) low exposure and low toxicity with high vulnerability or, 2) low exposure with low or medium vulnerability and variable toxicity. While we present some specific information about the species in Table 1 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Plant species in groups 7 and 11 (i.e., biotic pollination vectors with other reproductive mechanisms unknown) with medium or high vulnerability, low to high toxicity, and low concern of adverse effects due to low exposure as informed by low overlap between the species' range and agricultural land uses where methomyl is registered for use.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Cyanea copelandii ssp. copelandii	Haha	High	Low	Low	0.17	No Jeopardy
Cyanea mauiensis	Haha	High	Low	Low	0.10	No Jeopardy
Cyanea tritomantha	`aku	High	Low	Low	2.26	No Jeopardy
Cyrtandra limahuliensis	Ha`iwale	High	Low	Low	0.11	No Jeopardy
Hibiscadelphus hualalaiensis	Hau kuahiwi	High	Low	Low	0	No Jeopardy
Ilex sintenisii	No common name	High	Low	Low	0	No Jeopardy
Lipochaeta waimeaensis	Nehe	Medium	Low	Medium	<0.1	No Jeopardy
Lobelia niihauensis	No common name	Medium	Low	Low	1.51	No Jeopardy
Maesa walkeri	No common name	Medium	Low	High	2.86	No Jeopardy
Osmoxylon mariannense	No common name	High	Low	Low	3.45	No Jeopardy
Pritchardia bakeri	Loulu	High	Low	Low	0	No Jeopardy

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Pritchardia napaliensis	Lo`ulu	High	Low	Low	0	No Jeopardy
Pritchardia remota	Lo`ulu	High	Low	Low	0	No Jeopardy
Pteralyxia macrocarpa	Kaulu	High	Low	Low	0.99	No Jeopardy
Tabernaemontana rotensis	No common name	Medium	Low	Low	3.11	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, we determined that the vulnerability of the species in Table 1 is high or medium. Our evaluation of the effects of the proposed action on these species indicates a low extent of exposure due to the low overlap of the action area within the range of these species. Toxicity is variable for the plant species in this group. Plants in this group rely on insect pollinators for successful reproduction but use abiotic vectors or a combination of abiotic and birds and/or mammals for seed dispersal. As described in the Effects of the Action section in this appendix, birds or mammals are less sensitive to methomyl than insects and unlikely to experience a reduction of their abundance. In addition, plants in Table 1 are likely to use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists) and therefore are likely to recover more quickly from temporary losses of a small portion of the pollinator community.

While toxicity is high or medium for several species in Table 1, given that exposure is anticipated to be low, the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is low. Furthermore, the species with medium vulnerability are more likely to be able to withstand additional stressors in their environment, including temporary declines in their pollinator and seed disperser populations in very small portions of their ranges from methomyl exposure. All species with high vulnerability also have both low exposure and toxicity. As such, even though these species may be less likely to be able to withstand additional stressors in their environment, their likelihood of toxic effects in the unlikely event of exposure, is low. Therefore, we anticipate a minimal level of adverse reproductive effects for all species in this group.

As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from methomyl exposure, we do not expect that these adverse effects will cause species-level effects due to low expected exposure of pollinators and seed dispersers, the plant species' ability to withstand temporary declines in pollinator and seed dispersers in very small portions of their ranges, and reliance on a variety of pollinator species and abiotic vectors for successful reproduction. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 1.

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

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

Table 2. Plant species in groups 7 and 11 (i.e., biotic pollination vectors with other reproductive mechanisms unknown) with high vulnerability, medium or high toxicity, and low exposure as informed by low overlap between the species' range and agricultural land uses where methomyl is registered for use.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Achyranthes splendens var. *rotundata*	Round-leaved chaff-flower	High	Low	Medium	4	No Jeopardy
Banara vanderbiltii	Palo de Ramon	High	Low	Medium	1.4	No Jeopardy
Bidens campylotheca waihoiensis	Koʻokoʻolau	High	Low	Medium	0.8	No Jeopardy
Bidens hillebrandiana ssp. *hillebrandiana*	kookoolau	High	Low	Medium	0.0	No Jeopardy
Bidens micrantha ssp. ctenophylla	Koʻokoʻolau	High	Low	Medium	3	No Jeopardy
Buxus vahlii	Vahl's boxwood	High	Low	Medium	2.6	No Jeopardy
Canavalia pubescens	ʻAwikiwiki	High	Low	High	5	No Jeopardy
Charpentiera densiflora	Papala	High	Low	Medium	4.4	No Jeopardy

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Daphnopsis hellerana	No common name	High	Low	High	4.2	No Jeopardy
Eugenia bryanii	No common name	High	Low	Medium	2.5	No Jeopardy
Euphorbia remyi var. *kauaiensis*	ʻAkoko	High	Low	High	1.5	No Jeopardy
Euphorbia remyi var. *remyi*	ʻAkoko	High	Low	High	1.5	No Jeopardy
Exocarpos menziesii	Menzies ballart	High	Low	High	2.0	No Jeopardy
Hedyotis megalantha	Paudedo	High	Low	High	1.1	No Jeopardy
Heritiera longipetiolata	Ufa-halomtano	High	Low	Medium	2.9	No Jeopardy
Hibiscus brackenridgei	(=Native yellow hibiscus) maʻo hau hele	High	Low	High	3.1	No Jeopardy
Kadua fluviatilis	Kampuaʻa	High	Low	High	1.6	No Jeopardy
Korthalsella degeneri	Hulumoa	High	Low	Medium	2.8	No Jeopardy
Lipochaeta venosa	No common name	High	Low	High	2.4	No Jeopardy
Mitracarpus maxwelliae	No common name	High	Low	High	0.0	No Jeopardy
Mitracarpus polycladus	No common name	High	Low	High	0.4	No Jeopardy
Nesogenes rotensis	No common name	High	Low	High	0.0	No Jeopardy
Nototrichium humile	Kuluʻi	High	Low	Medium	4.6	No Jeopardy
Ochrosia kilaueaensis	Holei	High	Low	Medium	4.7	No Jeopardy
Ottoschulzia rhodoxylon	Palo de rosa	High	Low	Medium	2.2	No Jeopardy
Peucedanum sandwicense	Makou	High	Low	Medium	3.4	No Jeopardy
Phyllanthus saffordii	No common name	High	Low	Medium	1.1	No Jeopardy

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Phyllostegia brevidens	No common name	High	Low	High	1.6	No Jeopardy
Phyllostegia floribunda	No common name	High	Low	High	2.8	No Jeopardy
Phyllostegia haliakalae	No common name	High	Low	High	0.4	No Jeopardy
Pittosporum hawaiiense	No common name	High	Low	High	3.7	No Jeopardy
Pittosporum napaliense	Hoʻawa	High	Low	High	4.8	No Jeopardy
Portulaca villosa	Ihi	High	Low	Medium	3.3	No Jeopardy
Pritchardia lanigera	Loʻulu	High	Low	Medium	4.8	No Jeopardy
Pseudognaphalium (=Gnaphalium) sandwicensium var. *molokaiense*	ʻEnaʻena	High	Low	Medium	4	No Jeopardy
Santalum haleakalae var. *lanaiense*	Lanai sandalwood (=`iliahi)	High	Low	High	3.3	No Jeopardy
Santalum involutum	No common name	High	Low	High	2.4	No Jeopardy
Scaevola coriacea	Dwarf naupaka	High	Low	Medium	4.5	No Jeopardy
Schiedea salicaria	No common name	High	Low	High	3.3	No Jeopardy
Silene lanceolata	No common name	High	Low	High	1.3	No Jeopardy
Solanum nelsonii	Popolo	High	Low	High	3.8	No Jeopardy
Stenogyne angustifolia angustifolia	No common name	High	Low	High	2.9	No Jeopardy

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Tuberolabium guamense	No common name	High	Low	High	2.2	No Jeopardy
Viola chamissoniana ssp. *chamissoniana*	Pamakani	High	Low	Medium	0.2	No Jeopardy
Zanthoxylum dipetalum var. *tomentosum*	Aʻe	High	Low	Medium	3.5	No Jeopardy
Zanthoxylum hawaiiense	Aʻe	High	Low	High	3.5	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the vulnerability rankings of the species in Table 2 are high. Our evaluation of the effects of the proposed action on these species indicates a low extent of exposure due to the low overlap of the action area with the range of these species. Toxicity is expected to be medium or high for the plant species in this group, mainly due to their reliance on insect pollinators for successful reproduction. However, except for the popolo (of which >99%, of individuals occur on the uninhabited island of Nihoa where agriculture does not occur), all of the plants in Table 2 use abiotic vectors for some or all seed dispersal. In addition, it's likely that most plants in Table 2 can use a variety of insect species for pollination (i.e., pollinator generalists) and will recover more quickly from temporary losses of a small portion of their pollinating insect species. Several species in this group, such as 'aiea, ufa-halomtano, Eugenia bryanii, Phyllanthus saffordii, and ma ʻo hau ʻhele use birds and or mammals for pollination, thus further decreasing the likelihood of adverse effects to their reproduction as birds and mammals are less sensitive than insects to methomyl exposure as explained in the Effects of the Action section above.

While all species listed in Table 2 have high vulnerability rankings and toxicity is high or medium, given that exposure is anticipated to be low (as demonstrated by the low percent overlap between the action area and species' ranges), the risk of indirect adverse reproductive effects to the listed plants from loss of pollinators and/or seed dispersers is low. Furthermore, the total overlap metric we use is a conservative estimate of exposure as it does not fully account for redundancy between use site layers, assumes exposure is occurring in all possible overlapping areas, and does not consider information on past methomyl usage. Thus, while these species' vulnerability and toxicity rankings may be high, we have high confidence that the pollinators and seed dispersers of these plant species will have minimal exposure to methomyl.

As a result, while we anticipate minimal adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from methomyl exposure, we do not expect that these adverse effects will cause species-level effects due to low expected exposure to methomyl, reliance on a variety of pollinator species for successful reproduction, and use of abiotic or bird and/or mammalian vectors for some or all seed dispersal. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.

Species with initial rankings of medium exposure, low toxicity, and high vulnerability

We grouped together species in Table 3 that we initially determined had a medium exposure ranking, while also having low toxicity. However, we determined there are life history characteristics of these species that warrant further discussion; therefore, we have included separate rationales for these species below. While we present some specific information about the species in Table 3 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 3. Plant species in groups 7 and 11 (i.e., biotic pollination vectors with other reproductive mechanisms unknown) with high vulnerability, low toxicity, and medium exposure.

Scientific Name	Common Name	Vulnerability Ranking	Exposure Ranking	Toxicity Ranking	Total Action Area Overlap (%)	Determination
Hibiscadelphus giffardianus	Hau kuahiwi	High	Low	Low	3.77	No Jeopardy
Joinvillea ascendens ssp. *ascendens*	‘Ohe	High	Low	Low	2.96	No Jeopardy
Neraudia ovata	No common name	High	Medium	Low	5.90	No Jeopardy

Rationale for Species Conclusion: Hau kuahiwi

Scientific Name:	Common Name:	Entity ID:
Hibiscadelphus giffardianus	Hau kuahiwi	560

Conclusion:

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Hibiscadelphus giffardianus, of the Malvaceae (mallow) family, is a large, long-lived perennial tree endemic to the island of Hawai'i. There are no known wild individuals as the only known tree died in 1930. However, seeds were collected and propagated ex situ and approximately 181 individuals have been outplanted in protected areas of Hawai'i Volcanoes National Park. Hawai'i Volcanoes National Park monitors all reintroduced individuals and high survival rates of reintroductions are observed, with recruitment of two seedlings. There is complete genetic representation of the last known individual, and continued reintroduction is planned in suitable protected habitat within Hawai'i Volcanoes National Park (USFWS 2020).

Flowers are typically solitary in the axils of the leaves (where the leaves join the stems) and have stalks 1.5 to 4 cm long. The overlapping petals form a curved bisymmetrical flower with the upper petals longer, typical of bird pollinated flowers. The fruit is woody with star-shaped hairs which likely means the seeds are either dispersed by wind or are carried in the fur or feathers of mammals or birds, respectively (USFWS 1998).

While the overlap of the species' range with methomyl use sites is medium at 6.6%, prior reporting data indicate that annual treatment with all insecticides across the island of Hawai'i occurs on up to 35% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 35% figure, we determine that 2.3% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. In addition, the species relies on birds as pollinators and likely uses birds and mammals as seed dispersers, therefore we anticipate minimal loss of pollinators and seed dispersers within the species' range, due to the relative insensitivity of these taxa groups to methomyl as described in the Effects of the Action section, above. Thus, we anticipate minimal adverse reproductive effects to the species. Methomyl use is also highly unlikely within Hawai'i Volcanoes National Park where all extant individuals of this species occur and are likely to occur over the duration of this consultation.

Because the exposure to methomyl is low, the species only occurs in protected areas of Hawai'i Volcanoes National Park, is unlikely to occur outside the park over the duration of the consultation, and the species uses pollinator and seed disperser taxa that are expected to experience minimal effects if exposed to methomyl, we do not anticipate species-level effects from the loss of reproductive success. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 *Hibiscadelphus giffardianus*.

References:

U.S. Fish and Wildlife Service. 2020. *Hibiscadelphus giffardianus* (hau kuahiwi) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 8 pp.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

U.S. Fish and Wildlife Service. 1998. Big Island II: Addendum to the Recovery Plan for the Big Island Plant Cluster. Portland, Oregon. 115 pp.

Rationale for Species Conclusion: ʻOhe

Scientific Name:	Common Name:	Entity ID:
Joinvillea ascendens ssp. *ascendens*	ʻOhe	1709

Conclusion:

Joinvillea ascendens ssp. *ascendens* is a short-lived perennial herb endemic to the islands of Hawai'i, Oʻahu, Maui, Kauaʻi, and Molokaʻi. Historically it was widespread on these islands until the introduction of non-native, feral ungulates, rats, and invasive plants that have destroyed and degraded its habitat. A number of populations are fenced for protection from ungulates. There are currently 21 populations comprised of 117-147 wild individuals across all the islands where it occurs. Ex situ propagation and reintroduction is also occurring, with 635 individuals planted, but low survival has been observed. In addition, seed viability and soil amendment experiments are ongoing (USFWS 2022).

Observed reproduction is rare and it is not clear if the present distribution and rarity of reproduction is typical or if it has been caused by a factor related to the disturbance of native habitat. Flowers are usually not in dense heads and are thought to be self-pollinated or pollinated by bees or wind. Although the fruits lack wind dispersal characteristics, they are light enough that dispersal could occur during high velocity storm winds. There is no evidence of bird dispersal, though it has been suggested.

Lack of, or low levels of, regeneration (reproduction and recruitment) in the wild has been observed. The reasons for this are not well understood; however, seed predation, inbreeding depression, lack of pollinators, and possibly a lack of soil mycorrhizae are thought to play a role (USFWS 2021).

While the overlap of the species' range with methomyl use sites is relatively low at 4.8%, prior reporting data indicate that annual treatment with all insecticides across the main islands in the State of Hawai'i occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 2.2% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, the species is likely to self-pollinate or can rely on insects and/or wind for pollination, and the only information available on seed dispersal indicates it is likely wind dispersed. We anticipate a small loss of insect pollinators within the species' range. However, given this species can also rely on self-fertilization and wind for pollination and seed dispersal, a temporary loss of insect pollinators within a small portion of its range is anticipated to result in minimal adverse reproductive effects.

Because the species can utilize wind and self-fertilization for pollination in addition to insects and wind for seed dispersal, we do not anticipate species-level effects from a minimal loss of reproductive success. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 *Joinvillea ascendens* ssp. *ascendens*.

References:

U.S. Fish and Wildlife Service. 2022. Recovery Plan for 50 Hawaiian Archipelago Species. Portland, Oregon. 207 pp.

U.S. Fish and Wildlife Service. 2021. *Joinvillea ascendens ssp. ascendens* (ʻohe) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 34 pp.

Rationale for Species Conclusion: No common name

Scientific Name:	Common Name:	Entity ID:
Neraudia ovata	No common name	581

Conclusion:

This short-lived perennial sprawling shrub and obligate outcrosser in the Urticaceae (nettle) family is endemic to the island of Hawai’i. Currently, there are four wild populations totaling 104 individuals on the island. All wild and reintroduced individuals are provided protection from feral ungulates (one of the main threats to the species) by exclosures; however, these must be monitored for ingress. Some non-native plant control is ongoing within exclosures. Seed and cuttings collection, propagation, and reintroduction are ongoing. Almost 2,000 plants have been reintroduced, but the survival of individuals and the amount of reproduction within those populations is unknown. Infestation by spittlebugs is observed to be a new threat with no known control for this insect (USFWS 2020).

All the plant species in this appendix, including *Neraudia ovata*, require biotic pollination vectors to reproduce successfully and this species is particularly dependent on outcrossing as it has separate male and female plants. However, the nettle family, Urticaceae, use wind as a pollination vector. The species has small male and female flowers, and the male flower is morphologically designed to forcefully expel pollen when dried or disturbed (Simpson 2019). As such, we do not anticipate adverse reproductive effects to this species from loss of pollinators due to methomyl exposure.

Seed dispersal vectors for this species are unknown and may include abiotic (gravity) and/or biotic (birds, insect, or mammals) vectors. Most plant species do not solely rely on insect seed dispersers, and given a lack of more specific information, we will assume the same is true for this species. As such, while there is moderate overlap of the species' range with potential methomyl use sites, given that the species is likely to rely on abiotic and/or birds or mammals as seed dispersers, for which we anticipate no or minimal adverse effects respectively, in addition to or instead of insects, we anticipate very minimal adverse reproductive effects to the species from loss of insect seed dispersers.

Because the species' does not use biotic pollinators and likely only relies partially on insect seed dispersers for population viability, we do not anticipate the minimal adverse effects to insect seed dispersers will cause species-level effects from the loss of reproductive success. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 *Neraudia ovata.*

References:

Simpson, Michael G. 2019. Plant Systematics (Third Edition). Academic Press, Cambridge Massachusetts. pp. 285-466.

U.S. Fish and Wildlife Service. 2020. *Neraudia ovata* (no common name) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 11 pp.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Species with Individual Integration and Synthesis summaries

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

Table 4. Plant species in groups 7 and 11 (i.e., biotic pollination vectors with other reproductive mechanisms unknown) with moderate to high adverse effects anticipated from the proposed action. We addressed each species in individual Integration and Synthesis summaries.

Scientific Name	Common Name	Determination
Euphorbia celastroides var. *kaenana*	ʻAkoko	No Jeopardy
Kadua cookiana	ʻAwiwi	No Jeopardy
Lipochaeta lobata var. leptophylla	Nehe	No Jeopardy
Portulaca sclerocarpa	Poʻe	No Jeopardy
Vigna o-wahuensis	No common name	No Jeopardy
Melanthera tenuifolia	Nehe	No Jeopardy
Sesbania tomentosa	ʻOhai	No Jeopardy
Schenkia sebaeoides	ʻAwiwi	No Jeopardy
Eugenia koolauensis	Nioi	No Jeopardy
Pleomele hawaiiensis (= *Chrysodracon hawaiiensis*)	Hala pepe	No Jeopardy
Pritchardia maideniana	Loʻulu	No Jeopardy
Spermolepis hawaiiensis	No common name	No Jeopardy
Canavalia napaliensis	ʻAwikiwiki	No Jeopardy
Cyrtandra nanawaleensis	Haiwale	No Jeopardy
Tetramolopium rockii	No common name	No Jeopardy
Pleomele forbesii	Hala pepe	No Jeopardy

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: ‘Akoko

Scientific Name:	Common Name:	Entity ID:
Euphorbia celastroides var. *kaenana*	‘Akoko	662

Conclusion:

Euphorbia celastroides var. *kaenana* is a short-lived perennial shrub in the spurge family endemic to the island of O‘ahu and found in dry coastal shrubland on windward talus slopes. Currently, there are 1,329 mature and 320 immature individuals in nine populations along the Wai‘anae coast and mountains of O‘ahu. Population size ranges from 2 to 880 mature individuals, with 66 percent of mature individuals in one population (in the Ka’ena Point Natural Area Reserve and surrounding Forest Reserve and Management Areas), leaving a large portion of the individuals of the species vulnerable to a catastrophic event such as a hurricane or flood. Only three populations have more than 100 individuals and the number of individuals is declining with the majority of plants found at the Ka‘ena population (USFWS 2019).

Thousands of seeds are in storage from six of the nine populations. Genetic storage goals have been reached for two populations, though no outplantings have occurred. All known occurrences are monitored, though several have not been monitored since 2010 and 2011. There are two fenced areas managed by the U.S. Army and one fenced area managed by the State of Hawai’i to control the destructive effects of feral ungulates on the species (USFWS 2019).

Dense clusters of tiny flowers (cyathia) are crowded on small side branches and have an unpleasant, foul odor indicating potential pollination by flies and possibly other insects. Red fruits mature in 3-4 weeks when they split to expel the seeds, indicating gravity is one form of seed dispersal (University of Hawai‘i 2009).

All the plant species in this appendix, including the ‘akoko, require biotic pollination vectors to reproduce successfully. The ‘akoko likely requires flies or other insect pollinators for successful reproduction.

While the overlap of the species’ range with methomyl use sites is medium at 9.1%, prior reporting data indicate that annual treatment with all insecticides across the island of O‘ahu occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 4.1% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, over 60% of ‘akoko individuals occur on a nature reserve and other nearby areas where methomyl use is unlikely, further decreasing our concern that the low level of methomyl exposure expected within the range will result in appreciable adverse reproductive effects to the species. Seeds of the species are likely dispersed by gravity from their capsules and do not require a biotic vector. Thus, we expect minimal adverse effects to reproduction from loss of seed dispersers.

Because of the low exposure to methomyl, a majority of individuals are located in areas where methomyl exposure is not anticipated, and the species' use of gravity for seed dispersal, we do not anticipate adverse, species-level effects to the ʻakoko from the loss of reproductive success from pollinator mortality due to methomyl exposure that will be expected to occur over the duration of the action. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is 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 akoko.

References:

University of Hawai'i. 2009. Native Plants of Hawaiʻi. Accessed online May 8, 2024 at: http://nativeplants.hawaii.edu/plant/view/Euphorbia_celastroides_kaenana/

U.S. Fish and Wildlife Service. 2019. *Euphorbia celastroides* var. *kaenana* (ʻakoko) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 9 pp.

Rationale for Species Conclusion: ʻAwiwi

Scientific Name:	Common Name:	Entity ID:
Kadua cookiana	ʻAwiwi	724

Conclusion:

Kadua cookiana is a short-lived perennial shrub on the Rubiaceae family (coffee family) endemic to the island of Kauaʻi. Currently, there are estimated to be fewer than 200 wild individuals of *Kadua cookiana* in two populations on Kauaʻi within the Na Pali Wilderness State Park (Waiahuakua Valley and Hanakoa falls area) (USFWS 2023; 68 FR 9141). The species generally grows in streambeds or on steep cliffs in inaccessible areas close to water sources in lowland wet forest communities (USFWS 1995).

Seed collection from individuals in living collections is ongoing; however, genetic representation is incomplete with fewer than 20 founders represented. No translocations or augmentations are underway. Threats include habitat degradation by feral ungulates, and impacts of non-native invasive plants, landslides, and low numbers. These threats are only partially addressed, and conservation of this species is hindered by the difficulty of outplanting or augmenting populations in locations that are relatively inaccessible, and hard to monitor or manage (USFWS 2023).

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

The species is gynodioecious (i.e., populations contain individuals that have either all female flowers or all hermaphroditic (bisexual) flowers). Fruits are top-shaped or spherical capsules that open at maturity to release wedge-shaped reddish-brown seeds. (USFWS 2010).

Many species in the Rubiaceae family are insect pollinated and the breeding system of this species indicates insects are likely pollinators and male and female flowers may be on separate individuals. Seed dispersal is likely through gravity, though biotic dispersal cannot be ruled out.

We determined that the ‘awiwi 8.3% overlap between the action area and its range. However, prior reporting data indicate that annual treatment with all insecticides on the island of Kaua‘i occurs on up to 7.7% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 7.7% figure, we determine that 0.64% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure of methomyl to the pollinators and seed dispersers of this species. Furthermore, the ‘awiwi is only found in two, relatively inaccessible locations within the State-owned Na Pali Wilderness Park, where agricultural use of methomyl is not likely. As such, we anticipate that exposure to methomyl from the proposed action will be low.

Because of the low anticipated exposure to methomyl and the species only occurs in inaccessible, protected areas of Kaua‘i, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator or seed disperser mortality due to methomyl exposure. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of *Kadua cookiana*.

References:

U.S. Fish and Wildlife Service. 2023. *Kadua cookiana* (‘awiwi) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 7 pp.

U.S. Fish and Wildlife Service. 2010. *Kadua cookiana* (‘awiwi) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 8 pp.

U.S. Fish and Wildlife Service. 1995. Recovery Plan for the Kaua‘i Plant Cluster. Portland, Oregon. 287 pp.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Nehe

Scientific Name:	Common Name:	Entity ID:
Lipochaeta lobata var. *leptophylla*	Nehe	756

Conclusion:

Lipochaeta lobata var. *leptophylla* is a short-lived perennial shrub in the Asteraceae (sunflower) family and is endemic to lowland mesic forests and dry cliff ecosystems on the island of O‘ahu. Currently there are between 100 and 200 individuals of the species in two populations in the Wai‘anae mountains. In 2019, one subpopulation at Mākaha was observed to have 34 mature and three immature individuals. Three the other subpopulations have not been observed or monitored for more than 10 years. Populations may consist of fewer distinct individuals than it appears because many “individuals” are connected underground by the roots and are probably clones.

The first known seed collections were made in 2019, but reintroduction efforts have not progressed beyond this stage (USFWS 2019). Feral goats are one of the main threats to the survival of the species as they dig up, disturb, and eat the plants (USFWS 2011).

While pollination vectors are unknown for this species, given the daisy-like flower structure, we assume insects are the main pollinators. Fruits are achenes (contain one seed and don’t open when mature) which measure 0.1 inch in length and possess small wings about 0.2 in long. Seeds with wings such as those described for this species are typically wind dispersed, thus we assume *Lipochaeta lobata* var. *leptophylla* is dispered by wind and the species will not experience adverse reproductive effects due to loss of seed dispersal vectors.

While the overlap of the species’ range with methomyl use sites is medium at 5.4%, prior reporting data indicate that annual treatment with all insecticides on the island of O‘ahu occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 2.4% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. In addition, the species can be found on cliffs, where we anticipate exposure is unlikely. Furthermore, the nehe has the ability to reproduce clonally, thus reducing its reliance on insect pollinators for reproduction. Combined, these factors and characteristics of the species, including its ability to disperse by wind, decrease the likelihood of appreciable adverse reproductive effects to the species.

Because of the factors and characteristics described above, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of *Lipochaeta lobata* var. *leptophylla.*

References:

U.S. Fish and Wildlife Service. 2019. *Lipochaeta lobata* var. *leptophylla* (nehe) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 8 pp.

U.S. Fish and Wildlife Service. 2011. *Lipochaeta lobata* var. *leptophylla* (nehe) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 16 pp.

Rationale for Species Conclusion: Poʻe

Scientific Name:	Common Name:	Entity ID:
Portulaca sclerocarpa	Poʻe	806

Conclusion:

The poʻe is a short-lived perennial herb endemic to the island of Hawai'i and historically found on an islet off the coast of Lanai, however this population is likely extirpated. Currently, 276 mature and 174 immature wild individuals remain at 15 locations on the island of Hawaiʻi, though surveys are ongoing, and some estimates of wild plants are as high as 3,000 individuals. All known locations are within the Hawai'i Volcanoes National Park in volcanic, geothermal areas, or on Department of Defense lands at the Pohakuloa Training Area (USFWS 2020). Both Hawai'i Volcanoes National Park and Department of Defense have instituted excellent programs to control threats to rare plant taxa, including fencing, ungulate control, weed management, and maintaining propagation and reintroduction programs (USFWS 2012).

More than 2,000 individuals were reintroduced as of 2020, and some populations have a greater than 60 percent survival rate over two years. Reintroduced populations are provided protection from feral ungulates by fencing and ungulate control at PTA and Hawai'i Volcanoes National Park, however, recruitment of seedlings has not been reported (USFWS 2020).

While little is known about pollination and seed dispersal vectors, many species of *Portulaca* are insect pollinated, and we have no reason to believe otherwise for *P. sclerocarpa*. The presence of juveniles in wild populations indicates that pollination, germination, and some seed dispersal is occurring. One study found that all *Portulaca* taxa in Hawai'i were self-fertilizing, at least under experimental conditions, since numerous viable seeds were produced from bagged flowers. The thick-walled, indehiscent capsule of *P. sclerocarpa* required about four weeks to mature, twice as long as most other Portulaca taxa. This modification might be related to the unusual volcanic fumarole habitat the species seemed to favor. Given a lack of information on seed dispersal for this species, we will assume at least some dispersal is undertaken by biotic vectors (USFWS 2012).

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

While the overlap of the species' range with methomyl use sites is medium at 5.7%, prior reporting data indicate that annual treatment with all insecticides on the island of Hawaiʻi occurs on up to 35% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 35% figure, we determine that 2.0% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators and seed dispersers of this species. Furthermore, the likelihood of methomyl agricultural use sites near individuals of the species is low. This is due to the fact that populations of the poʻe are only found within Hawai'i Volcanoes National Park and at Pohakuloa Training Area, where agricultural use of methomyl is not likely, and active management for the species is ongoing. In addition, poʻe is capable of self-fertilization and therefore is less dependent on insect pollinators for successful reproduction, and therefore reducing concern of reproductive effects to the species if there is a temporary reduction in pollinating insects in a portion of its range.

Because of the low exposure to methomyl and the species only occurs in areas where exposure from agricultural methomyl use is unlikely and is able to reproduce through self-pollination, thus lowering its dependence on insect pollinators, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of *Portulaca sclerocarpa.*

References:

U.S. Fish and Wildlife Service. 2020. *Portulaca sclerocarpa* (po'a) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 11 pp.

U.S. Fish and Wildlife Service. 2012. *Portulaca sclerocarpa* (po'a) 5-Year Review: Summary and Evaluation. Honolulu, Hawai'i. 28 pp.

Rationale for Species Conclusion: No common name

Scientific Name:	Common Name:	Entity ID:
Vigna o-wahuensis	No common name	862

Conclusion:

This short-lived perennial vine or twining herb in the *Vigna* (cowpea) genus is endemic to the islands of Hawaiʻi, Maui, Kahoʻolawe, and Molokaʻi, with historic occurrences on Lānaʻi, Oʻahu, and Niʻihau. Currently, between 180 and 500 wild individuals of *Vigna o-wahuensis* in one population occur within the Pohakuloa Training Area on the island of Hawaiʻi, owned by the

U.S. Army. Only 12 individuals remain on Moloka‘i in two small populations, approximately 10 individuals on Maui in two populations, and one individual remains on Kaho‘olawe. Viable seeds have been produced at populations on Hawai’i, Moloka‘i, and Maui. Two populations are provided protection from feral ungulates by fencing and ungulate control at PTA with some non-native plant management. Seed collections and germination trials are ongoing and of the over 600 reintroduced individuals planted, only five survive (USFWS 2020).

Due to their nature of broadcasting seeds (dehiscent) from the pod, species in the genus Vigna tend to be dispersed by gravity. As such, we do not anticipate adverse reproductive effects to the species from loss of seed dispersers.

Species in the genus Vigna are typically pollinated by insects, often bees or bumblebees, though the genus is also known for its ability to self-pollinate (Lazaridi et al. 2023). We will assume *V. o-wahuensis* is pollinated by insects as we have no reason to believe otherwise, but it is unknown whether the species can self-pollinate, and to be protective we will not attribute that ability to the species.

While the overlap of the species’ range with methomyl use sites is relatively low at 5.3%, prior reporting data indicate that annual treatment with all insecticides across the main islands in the State of Hawai’i occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 2.4% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, most individuals of this species occur on Pohakuloa Training Area, where agricultural use of methomyl is unlikely. Lastly, given that viable seeds have been produced at all three main populations (on Hawai’i, Moloka‘i, and Maui), this demonstrates that successful pollination is occurring and does not point to an existing deficit in the pollinator community within the range of the species. Most seed and seedling loss is likely due to predation and disturbance by non-native ungulates and other non-native species such as rats and slugs.

Because of the reasons outlined above we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure in a small portion of the range. 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 *Vigna o-wahuensis.*

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

References:

Lazaridi, E. et al. 2023. Investigation of Cowpea (*Vigna unguiculata*) - Insect Pollinator Interactions Aiming to Increase Cowpea Yield and Define New Breeding Tools. Ecologies 4(1): 124-140.

U.S. Fish and Wildlife Service. 2020. *Vigna o-wahuensis* (No Common Name) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 11 pp.

Rationale for Species Conclusion: Nehe

Scientific Name:	Common Name:	Entity ID:
Melanthera tenuifolia	Nehe	963

Conclusion:

Melanthera tenuifolia is a short-lived perennial woody herb endemic to the island of O‘ahu. The species occurs primarily on north-facing slopes, cliff faces and ledges, and steep rocky ridge sides. To a lesser extent, it occurs in forest openings vegetated with native shrubs, grasses, and sedges. Currently there are approximately 2,100 mature and immature individuals in five populations in the Wai‘anae mountains, four of which occur on the Makua Military Reservation run by the U.S. Army. In addition, there is one individual in Kahanahāiki (a valley, also within the Makua Military Reservation). Fencing and ungulate control protects most or portions of four populations, constructed and monitored by the Army Natural Resources Program. The Army also monitors all populations, both on and off their lands. Genetic storage collections have begun but are limited (USFWS 2011, USFWS 2019).

Melanthera tenuifolia flowers for much of the year, mostly in late winter and spring until onset of the summer dry season. The flowers are likely insect-pollinated, as many yellow-flowered members of the sunflower family are pollinated by insects. The species is also able to reproduce vegetatively, decreasing our concern of reproductive effects from loss of insect pollinators due to methomyl exposure, since this species can reproduce successfully in their temporary absence. The species likely disperses seeds via wind as do many species in the sunflower family, thus we do not anticipate adverse reproductive effects to the species from loss of seed dispersers (USFWS 2011).

While the overlap of the species’ range with methomyl use sites is 6.8%, prior reporting data indicate that annual treatment with all insecticides across the island in of O‘ahu occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 3.1% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, most individuals of this species occur on the Makua Military Reservation where agricultural use is unlikely and they also tend to occur on cliffs and ridges where exposure is also unlikely. Lastly, the species can reproduce using vegetative means, as mentioned above, thus decreasing our concern of appreciable reproductive effects due to a temporary loss of insect pollinators in a small portion of the range.

Because of the reasons outlined above we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure in a small portion of the range. 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 *Melanthera tenuifolia.*

References:

U.S. Fish and Wildlife Service. 2019. *Melanthera tenuifolia* (nehe) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 9 pp.

U.S. Fish and Wildlife Service. 2011. *Lipochaeta (=Melanthera) tenuifolia* (nehe) 5-Year Review: Summary and Review. Honolulu, Hawai‘i. 19 pp.

Rationale for Species Conclusion: ‘Ohai

Scientific Name:	Common Name:	Entity ID:
Sesbania tomentosa	‘Ohai	999

Conclusion:

Sesbania tomentosa is a long-lived perennial shrub or tree in the pea family (Fabaceae). It is known from Nihoa and Necker (Mokumanamana) islands, part of the Papahanaumokuakea Marine National Monument, and all the main Hawaiian Islands (USFWS 2015). There are estimated to be hundreds of plants on the uninhabited Northwestern Hawaiian Islands of Nihoa and Mokumanamana where the species was noted as the dominant vegetation throughout the island when last visited in June 2019. Individuals were observed to be healthy with all age classes represented (seedlings to reproductive plants). Fewer than 700 wild individuals are documented on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i. Recent outplanting efforts have been high (1,259 individuals reintroduced since 2015), but survivorship is low at several locations. Only three populations in the main Hawaiian Islands have been recruiting individuals (USFWS 2021).

The most important limiting factors identified for *S. tomentosa* are loss of seeds to rodent predation and low seedling recruitment, probably due to destruction and disturbance by non-native ungulates on the main islands. Other limiting factors include the loss of flowers to non-native insect predation and displaying very low fruit set caused by either a lack of effective pollination or self-compatibility problems. Pollination studies determined that six insect species were floral visitors, and native *Hylaeus* (yellow-faced bees) and *Apis mellifera* honeybees were found to be transporting pollen of the rare plant (USFWS 2015).

As a member of the pea family, seeds are found in large pods (3-9 inches long) that break open when mature. Seeds are likely dispersed by gravity or birds and mammals; therefore, we anticipate minimal adverse reproductive effects due to methomyl exposure of seed dispersers.

While the overlap of the species' range with methomyl use sites is 5.7%, we do not expect exposure to occur on the islands of Nihoa and Mokumanamana as they are not inhabited by humans and no agriculture exists. It is likely that at least half the individuals in existence occur on these uninhabited islands. For the remainder of the range occurring on the main islands, prior reporting data indicate that annual treatment with all insecticides across the islands in the State of Hawai'i occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 2.6% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species across the main Hawaiian Islands.

Because of the reasons outlined above we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure in a small portion of the range. 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 *Sesbania tomentosa.*

References:

U.S. Fish and Wildlife Service. 2021. Short Form Summary *Sesbania tomentosa* (‘ohai). Honolulu, Hawai‘i. 16 pp.

U.S. Fish and Wildlife Service. 2015. Short Form Summary *Sesbania tomentosa* (‘ohai). Honolulu, Hawai‘i. 16 pp

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: ‘Awiwi

Scientific Name:	**Common Name:**	**Entity ID:**
Schenkia sebaeoides	‘Awiwi	1093

Conclusion:

Schenkia sebaeoides is an annual, coastal herb prone to fluctuations in population size and the only native Hawaiian species in the gentian family (Gentianaceae). There were over 100 individuals observed over the last five years (prior to 2021) of the species which occurs on Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, and Maui, but thousands have been estimated. It is difficult to assess populations due to limited observations, dependency on rainfall, and annual life span. Declining hours of daylight trigger the plant to produce seeds and die. Such populations develop extensive, long-lived seed banks to survive poor years and successfully exploit favorable years, resulting in wide fluctuations in the population depending on rainfall. Seed collections and propagation are ongoing, however there are currently no outplanted individuals. Natural reproduction is occurring in at least 3 populations determined as necessary by the latest 5-year Status Review in 2021 (USFWS 2010, USFWS 2021).

The major threats to *Schenkia sebaeoides* on all islands are competition with and overtopping by salt-tolerant, invasive introduced woody plant species, trampling and erosion of habitat by ungulates, and damage caused by off-road vehicles (USFWS 2010).

Flowers are stalkless and are arranged along the stems near their ends. The white or pale pink petals are fused into a short tube. The small, cylindrical seed capsules contain numerous tiny brown seeds. Many species in the gentian family are pollinated by insects (often bees and bumblebees) and their seeds are dispersed by wind or water. We have no evidence to suggest *Schenkia sebaeoides* differs from this pattern (USFWS 1999).

While the overlap of the species’ range with methomyl use sites is 8.8%, prior reporting data indicate that annual treatment with all insecticides across all islands in the State of Hawai’i occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 3.9% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, the species has a relatively wide distribution for a Hawaiian plant and a relatively large number of individuals, thus decreasing our concern of appreciable reproductive effects due to a temporary loss of insect pollinators in a small portion of the range.

Because of the reasons outlined above we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure in a small portion of the range. 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 *Schenkia sebaeoides.*

References:

U.S. Fish and Wildlife Service. 2021. *Schenkia sebaeoides* (awiwi) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 9 pp.

U.S. Fish and Wildlife Service. 2010. *Schenkia sebaeoides* (awiwi) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 11 pp.

U.S. Fish and Wildlife Service. 1999. *Recovery Plan for the Multi-Island Plants*. Portland, Oregon. 305 pp.

Rationale for Species Conclusion: Nioi

Scientific Name:	Common Name:	Entity ID:
Eugenia koolauensis	Nioi	1116

Preliminary Conclusion:

Eugenia koolauensis is a long-lived perennial shrub or small tree that is found in mesic forests, usually on gulch slopes. The species occurs on the island of Oʻahu and historically was found on Molokaʻi (USFWS 2013). Currently there approximately 70 to 200 individuals in 10 populations of *Eugenia koolauensis* in the Koʻolau and Waiʻanae mountains; however, the number of healthy individuals is declining rapidly due to infestation with the *Austropuccinia psidii* rust. This is less than half the number of mature individuals reported previously. Over 200 plants survive in two living collections. There are three fenced areas managed by the U.S. Army and one fenced area managed by the State. Fewer than 100 seeds are in storage as storage protocols have yet to be developed for this recalcitrant species (USFWS 2019).

This species has been observed in flower from February to December in various years. No other information exists on pollinators, seed dispersal mechanisms, or reproductive methods (USFWS 1998). However, we assume that the nioi uses insects for pollination and birds for seed dispersal based on similar species in the genus.

All the plant species in this appendix, including the nioi, require biotic pollination vectors to reproduce successfully. The nioi is likely to require insect pollinators for successful reproduction, though it is unknown whether the species utilizes a generalist or specialist pollination system. Seeds of the species are likely dispersed by birds, who eat the fleshy, orange fruits; thus, we expect minimal adverse effects to reproduction from loss of seed dispersers as discussed in the Effects of the Action section, above.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

While the overlap of the species' range with methomyl use sites is medium at 11.2%, prior reporting data indicate that annual treatment with all insecticides across the island of O'ahu occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 5.0% of the range is likely to be treated with methomyl, leading us to conclude there will be a low to moderate extent of exposure to the pollinators of this species. Furthermore, in discussions with the Pacific Islands Fish and Wildlife Office, it is likely that pollinators of this species may be attracted on field while certain methomyl crops are blooming. Given the high vulnerability of this species, pollinator loss from on field exposure is likely to meaningfully add to the overall exposure for the pollinators of the species.

Because the species' relies on insect pollinators for successful reproduction and the species is highly vulnerable to additional threats in its environment (factors that increase the species' vulnerability include: the small number of individuals that is declining rapidly due to rust infestation and few of the populations are fully protected from threats), we anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure that will be expected to occur in a small to moderate portion of the range over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

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

References:

U.S. Fish and Wildlife Service. 1998. Recovery Plan for the O‘ahu Plants. Portland, Oregon. 362 pp.

U.S. Fish and Wildlife Service. 2013. *Eugenia koolauensis* (nioi) 5-Year Review: Short Form Summary. Honolulu, Hawai’i. 7 pp.

U.S. Fish and Wildlife Service. 2019. *Eugenia koolauensis* (nioi) 5-Year Review: Short Form Summary. Honolulu, Hawai’i. 10 pp.

Rationale for Species Conclusion: Hala pepe

Scientific Name:	Common Name:	Entity ID:
Pleomele hawaiiensis (= Chrysodracon hawaiiensis)	Hala pepe	1141

Conclusion:

Pleomele hawaiiensis is a long-lived perennial tree species endemic to the island of Hawai’i where it grows in forests on old lava flows. Approximately 350-400 wild individuals remain at 10 locations on the island (USFWS 2020). Recent estimates of the population size suggest a gradual but sustained downward trend in the total number of wild individuals (USFWS 2012). Seed and cuttings collections from wild and reintroduced individuals, propagation, and reintroduction are ongoing. Approximately 1,000 individuals were reintroduced as of 2020 and have a greater than 80% survival rate over two years. Reintroduced populations are provided protection from feral ungulates by fencing and ungulate control at Pu‘uwa‘awa‘a and Hawai’i Volcanoes National Park, and recruitment of seedlings is observed at two populations (USFWS 2020).

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Life-history information is mostly absent for the species. The numerous, pale yellow flowers appear on a large drooping panicle (a loose, diversely branching flower cluster) and are perfect (both male and female on the same flower) and appear in multiples of three. Once pollinated, a reddish berry will form containing anywhere between one and three tan seeds (USFWS 2012). Given the flowers' structure, pollination vectors may be insects, birds, or even bats. Birds may play a role in seed dispersal, but no definitive information exists.

All the plant species in this appendix, including the hala pepe, require biotic pollination vectors to reproduce successfully. The hala pepe may require insects, birds, and/or mammal pollinators for successful reproduction, and it is unknown whether the species utilizes a generalist or specialist pollination system.

While the overlap of the species' range with methomyl use sites is medium at 10.3%, prior reporting data indicate that annual treatment with all insecticides on the island of Hawaiʻi occurs on up to 35% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 35% figure, we determine that 3.6% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators and seed dispersers of this species. In addition, a large number of individuals have been successfully reintroduced into areas where methomyl use is unlikely (Hawai'i Volcanoes National Park) and seedling recruitment has been observed at two of these populations, confirming successful pollination.

Seeds of the species are likely dispersed by birds; thus, we expect minimal adverse effects to reproduction from loss of seed dispersers as discussed in the Effects of the Action section above.

Because of the low exposure to methomyl and the successful reintroduction and recruitment of individuals, demonstrating successful pollination, and ability to rely on birds for seed dispersal, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure that will be expected to occur in a substantial portion of the range over the duration of the proposed 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 *Pleomele hawaiiensis.*

References:

U.S. Fish and Wildlife Service. 2020. *Pleomele hawaiiensis* (hala pepe) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 12 pp.

U.S. Fish and Wildlife Service. 2012. *Pleomele hawaiiensis* (hala pepe) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 20 pp.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: Lo'ulu

Scientific Name:	Common Name:	Entity ID:
Pritchardia maideniana	Lo'ulu	1142

Preliminary Conclusion:

This long-lived perennial tree in the Arecaceae (palm) family is endangered and is endemic to the island of Hawai'i. Currently, nine mature and approximately 80 immature wild individuals of *Pritchardia maideniana* occur at seven locations. Seed and cuttings collections from wild and reintroduced individuals, propagation, and reintroduction are ongoing. Approximately 180 individuals have been reintroduced since the last 5-Year Review (2012) with variable or unknown success. Recruitment of seedlings has been reported at one location (USFWS 2020).

At the time of listing (1994) and thereafter, most individuals of *P. maideniana* were found in areas of human habitation or development. Because all native vegetation in the known geographical range of *P. maideniana* has been cleared, it is uncertain what the original associated native plant species were. There are populations scattered in urban areas along the western coast and within Hawai'i Volcanoes National Park (USFWS 2012).

It has been suggested that the pollinators of this species are insects and that the presumed dispersal mechanism for transport to the Hawaiian Islands was internally via birds and possibly by oceanic drift, as the tree produces fleshy fruits. According to field biologists, pollination rates appear to be low for this species, and the absence of seedlings and juveniles at most known locations suggests that regeneration is not readily occurring, which they believe to be caused, in part, by beetle, rat, and pig predation on the fruits, seeds, and seedlings. Evidence also suggests that beetles constitute the most important group of pollinators in palms, followed by bees and flies (Barford et al. 2011), thus we will assume this species uses insects for successful pollination and birds for seed dispersal.

As seeds of the species may be dispersed by birds, we expect minimal adverse effects to reproduction from loss of seed dispersers, as discussed in the Effects of the Action, above.

While the overlap of the species' range with methomyl use sites is high at 15.3%, prior reporting data indicate that annual treatment with all insecticides across the island of Hawai'i occurs on up to 35% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 35% figure, we determine that 5.4% of the range is likely to be treated with methomyl, leading us to conclude there will be a low to moderate extent of exposure to the pollinators and seed dispersers of this species. Furthermore, , it is likely that pollinators of this species may be attracted on field while certain methomyl crops are blooming. Given the high vulnerability of this species, pollinator loss from on field exposure is likely to meaningfully add to the overall exposure for the pollinators of the species.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Even a small or moderate decrease in the insect pollinator community in the range of this species is likely to exacerbate its pre-existing reproductive decline, as evidenced by low numbers and isolation of mature trees, low pollinations rates, and absence of juveniles and seedlings. This leads us to conclude that there will be moderate adverse reproductive effects from methomyl exposure in a small to moderate portion of the range.

Because of the factors and characteristics described above, we anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure that will be expected to occur in a small to moderate portion of the range over the duration of the action.

Final Conclusion (with Species-Specific Conservation Measures):

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

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

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

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

References:

Barford, A.S. et al. 2011. Twenty-five years of progress in understanding pollination mechanisms in palms (Arecaceae). Ann Bot.; 108(8): 1503–1516.

U.S. Fish and Wildlife Service. 2020. *Pritchardia maideniana* (loʻulu) 5-Year Review: Short Form Summary. Honolulu, Hawaiʻi. 11 pp.

U.S. Fish and Wildlife Service. 2012. *Pritchardia maideniana* (loʻulu) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 19 pp.

Rationale for Species Conclusion: No common name

Scientific Name:	Common Name:	Entity ID:
Spermolepis hawaiiensis	No common name	1154

Conclusion:

Spermolepis hawaiiensis is a short lived annual herb in the Apiaceae (parsley) family and is endemic to the islands of Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi. It is an ephemeral species, and although it is an annual, it may not always be present throughout its entire range unless environmental conditions are favorable. It grows in open areas, and sometimes in cultivated fields (USFWS 2010, USFWS 2021).

Currently there are approximately 5,895-8,095 wild individuals (including several hundred recruits) across all islands where it occurs, with the most individuals occurring on Maui. There are presently no outplanted individuals, though thousands of seeds are in storage (USFWS 2021). One of three recovery criteria has been met, namely that a minimum of three populations should be documented on islands where they now occur or occurred historically, and each of these populations must be naturally reproducing and increasing in number, with a minimum of 100 mature individuals per population (USFWS 2010).

In terms of pollination systems, plants of the parsley or carrot family, Apiaceae, are regarded as pollinator generalists, since their flowers are visited by a wide range of insects representing several taxonomic orders (Zych et al. 2019).

The morphology of the small seeds, including small, hooked bristles across the surface, suggest dispersal by attachment to the fur or feathers of mammals or birds, respectively. As such, we anticipate minimal loss of reproductive function of the species from loss of seed dispersers from methomyl exposure as discussed in the Effects of the Action Section, above.

While the overlap of the species' range with methomyl use sites is low to moderate at 5.5%, prior reporting data indicate that annual treatment with all insecticides across the islands of the State of Hawai'i occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 2.5% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, there is no evidence to suggest this species has a pre-existing pollinator deficit as evidenced by recruitment at a number of populations and production of seed. The species can also rely on a variety of pollinator species, allowing successful pollination even if there is a temporary loss of a small portion of the pollinator community within a small area of the range.

Because of the factors and characteristics described above, we do not anticipate adverse, species-level effects from the minimal loss of reproductive success from pollinator mortality due to methomyl exposure that will be expected to occur in a small portion of the range 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 *Spermolepis hawaiiensis*.

References:

U.S. Fish and Wildlife Service. 2021. *Spermolepis hawaiiensis* (No Common Name) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 10 pp.

U.S. Fish and Wildlife Service. 2010. *Spermolepis hawaiiensis* (No Common Name) 5-Year Review: Summary and Evaluation. Honolulu, Hawai‘i. 21 pp.

Zych, M. et al. 2019. *Spatiotemporal variation in the pollination systems of a supergeneralist plant: is Angelica sylvestris (Apiaceae) locally adapted to its most effective pollinators?.* Ann Bot.; 123(2): 415–428.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

Rationale for Species Conclusion: ‘Awikiwiki

Scientific Name:	Common Name:	Entity ID:
Canavalia napaliensis	‘Awikiwiki	2118

Conclusion:

Canavalia napaliensis is a long-lived perennial vine in the Fabaceae (pea) family and is known only from the island of Kaua‘i. There are approximately 8 populations containing 900 wild individuals of the species along a small section of the Na Pali coast of Kaua‘i, however no population estimates have been made since 2017. No new propagation, outplanting or other management actions are reported, and no individuals have been outplanted (USFWS 2022).

While the pollinators and seed dispersers of *Canavalia napaliensis* are unknown, many members of the Fabaceae (pea) family use bees and other insects for pollination and dehiscence for seed dispersal (pods forcibly expel seeds when dry). We assume the same for *C. napaliensis*. However, in addition to using insects for sexual reproduction, *C. napaliensis* can use vegetative reproduction, thus decreasing its reliance on insect pollinators (USFWS 2017).

While the overlap of the species’ range with methomyl use sites is moderate at 6.5%, prior reporting data indicate that annual treatment with all insecticides across the island of Kaua‘i occurs on up to 7.7% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 7.7% figure, we determine that 0.5% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. Furthermore, the species can reproduce vegetatively, decreasing its reliance on insect pollinators, and lastly, we do not expect adverse reproductive effects from loss of seed dispersers as dispersal occurs by dehiscence and does not involve biotic vectors.

Because of the factors and characteristics described above, we do not anticipate adverse, species-level effects from the minimal loss of reproductive success from pollinator mortality due to methomyl exposure that will be expected to occur in a very small portion of the range 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 *Canavalia napaliensis*.

References:

U.S. Fish and Wildlife Service. 2022. *Canavalia napaliensis* (‘awikiwiki) 5-Year Review: Short Form Summary. Honolulu, Hawai‘i. 6 pp.

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

U.S. Fish and Wildlife Service. 2017. *Canavalia napaliensis* (ʻawikiwiki) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 20 pp.

Rationale for Species Conclusion: Haiwale

Scientific Name:	Common Name:	Entity ID:
Cyrtandra nanawaleensis	Haiwale	10480

Conclusion:

Cyrtandra nanawaleensis is a short-lived perennial shrub or small tree in the African violet family. There are fewer than 37 wild individuals in six small populations in five areas on the island of Hawaiʻi, all south of Hilo. One population at the Keauʻohana Forest Reserve, two populations at Malama Kī Forest Reserve, one population within the Nānāwale Forest Reserve (Halepuaʻa section), one population at Kaniahiku section (adjacent to Lava Tree State Park), and one population in Leilani Estates. The population in the Halepuaʻa section of Nānāwale FR has declined since the 2000's from 159 individuals to only two individuals.

Collection, storage, propagation, and reintroduction are ongoing, with 106 individuals reintroduced, though only one reintroduced population totals more than 50 individuals. Natural recruitment has been observed at two reintroduction sites. Feral ungulate and non-native plant control (two of the biggest threats to the species) are ongoing at fenced and managed areas at Leilani Estates and the Halepuaʻa section of Nānāwale Forest Reserve, but threats are not being sufficiently managed throughout the range of the species.

The presumed pollinators for Hawaiian species in the genus Cyrtandra are insects, suggesting that some degree of outcrossing is maintained in the presence of effective pollinators. The fruits of Cyrtandra are fleshy and birds are the presumed mechanism for dispersal to and colonization of the islands of Hawaiʻi, and we assume birds continue to disperse the seeds of the species (USFWS 2020).

While the overlap of the species' range with methomyl use sites is high at 11.6%, prior reporting data indicate that annual treatment with all insecticides across the island of Hawai'i occurs on up to 35% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 35% figure, we determine that 4.1% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators of this species. In addition, five of the six extant populations exist on Forest Reserves where we anticipate low methomyl exposure. Many of these Forest Reserves on Hawai'i (including Keauʻohana Forest Reserve) are actively managed to restore the rainforest habitat for the benefit of rare and listed species, including the hiawale. Furthermore, recruitment is occurring at two reintroduction sites and some outcrossing via effective pollination is reported as maintained, thus decreasing our concern that a temporary loss of insect pollinators in a small portion of the species range will result in appreciable adverse reproductive effects.

Seed dispersers are likely birds; therefore, we anticipate minimal reproductive effects to the species from the effects of methomyl exposure to seed dispersers as described in the Effects of the Action section, above.

Because of the low exposure to methomyl, the fact that most populations of the species occur in areas where methomyl use is unlikely, the species can disperse using birds, recruitment is evident at some reintroduction sites, and some outcrossing continues, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator mortality due to methomyl exposure in a small portion of the range. 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 *Cyrtandra nanawaleensis.*

References:

U.S. Fish and Wildlife Service. 2020. *Cyrtandra nanawaleensis* (hiawale) 5-Year Review: Summary and Evaluation. Honolulu, Hawai'i. 27 pp.

Rationale for Species Conclusion: No common name

Scientific Name:	Common Name:	Entity ID:
Tetramolopium rockii	No common name	850

Conclusion:

Tetramolopium rockii is a short-lived perennial climbing shrub in the Asteraceae (sunflower) family that is endemic to the island of Moloka‘i. Currently, there are approximately 7,000-10,000 individuals of *Tetramolopium rockii var. rockii,* and 1,000-2,000 of *Tetramolopium rockii var. calcisabulorum* along the northwest coast of Moloka‘i, a slight decline from the previous estimates in 2018 (USFWS 2023). Individuals are present in four occurrences across State Lands, National Park Service lands, and private lands (USFWS 2018). There are approximately two known founder lines represented in ex situ storage and propagation collections, as well as additional founders of unknown origins from Moloka‘i. These collections include seeds in seed banks. However, a majority of the seeds have been in storage for over 30 years, and the viability of the seeds is unknown (USFWS 2023). Ongoing threats include habitat destruction and degradation by feral ungulates, ecosystem-altering invasive plant species, predation and herbivory by feral ungulates and rats (USFWS 2023).

Little is known about the life history of this species. Its flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, and limiting factors are unknown (USFWS 2018).

C-B7. NL48 Flowering Plants: Biotic pollination vector; other reproductive mechanisms unknown (Groups 7&11)

All the plant species in this appendix, including *Tetramolopium rockii*, require biotic vectors to reproduce successfully. The pollination and seed dispersal vectors for this species are unknown but we assume they include some insects. While the overlap of the species with methomyl use site is medium at 5.5%, prior reporting data indicate that annual treatment with all insecticides across the islands of the State of Hawai'i occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 2.5% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators and seed dispersers of this species.

Because the temporary loss of insect pollinators and seed dispersers will only occur within a small portion of the range of the species, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator and seed disperser mortality. 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 *Tetramolopium rockii.*

References:

U.S. Fish and Wildlife Service. 2018. *Tetramolopium rockii* (No Common Name) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 9 pp.

U.S. Fish and Wildlife Service. 2023. *Tetramolopium rockii* (No Common Name) 5-Year Review: Summary and Evaluation. Honolulu, Hawaiʻi. 7 pp.

Rationale for Species Conclusion: Hala pepe

Scientific Name:	Common Name:	Entity ID:
Pleomele forbesii	Hala pepe	3737

Conclusion:

Pleomele forbesii is a short-lived perennial tree in the asparagus family, endemic to the island of Oʻahu in the lowland dry, lowland mesic, and dry cliff ecosystems of the Waiʻanae and Koʻolau mountains at elevations generally between 800 and 2,920 ft. Currently, the Army Natural Resources Program tracks populations while conducting management actions for other listed species in the Waiʻanae mountains where there are at least 11 occurrences totaling fewer than 150 individuals. Some Waiʻanae occurrences have not been monitored since the early 2000s and their current status is unknown. The population in the southern Koʻolau mountains at Kului gulch likely persists since its last observation in 2005. The species' flowering cycles, pollination vectors, seed dispersal agents, specific environmental requirements, and limiting factors are largely unknown. Lacking more specific information, we assume that the species relies on insect pollinators and seed dispersers for successful reproduction.

Very small plant populations, such as those of the hala pepe, may experience reduced reproductive vigor due to ineffective pollination or inbreeding depression. Lack of regeneration is noted as a cause of loss of reproductive vigor of the species in the southern Ko‘olau mountains.

All the plant species in this appendix, potentially including *Pleomele forbesii*, require biotic vectors to reproduce successfully. The pollination and seed dispersal vectors for this species are unknown but we assume they include some insects (USFWS 2019). While the overlap of the species with methomyl use site is medium at 8.6%, prior reporting data indicate that annual treatment with all insecticides on the island of O‘ahu occurs on up to 45% of crops. As this percentage reflects usage of all insecticides, and not just methomyl, we consider it an upper bound for methomyl usage. Using the 45% figure, we determine that 3.8% of the range is likely to be treated with methomyl, leading us to conclude there will be a low extent of exposure to the pollinators and seed dispersers of this species. A decrease in the insect pollinator and seed disperser community in a small portion of the range of this species is unlikely to exacerbate the pre-existing reproductive decline of this species.

Because the temporary loss of insect pollinators and seed dispersers will only occur within a small portion of the range of the species, we do not anticipate adverse, species-level effects from the loss of reproductive success from pollinator and seed disperser mortality. 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 *Pleomele forbesii.*

References:

U.S. Fish and Wildlife Service. 2019. *Pleomele forbesii* (hala pepe) 5-Year Review: Summary and Evaluation. Honolulu, Hawai‘i. 19 pp.