Integration and Synthesis Summary for Plants, Non-lower 48

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

Assessment Groups 6 & 10

This Integration and Synthesis Summary includes our jeopardy analysis for any species that we or EPA determined will "likely be adversely affected" by the proposed action. Our jeopardy analysis of the proposed action's impacts to listed species is split into three major factors: vulnerability, exposure, and toxicity. The tables below contain summaries of our rankings (high, medium, low) for vulnerability, exposure, and toxicity. Data and information used to determine individual species' rankings and a template worksheet to show how rankings were assessed and combined are in Appendix E. While all plants in this appendix (plant assessment groups 6 & 10) rely on biotic pollination vectors, they are also capable of using reproductive methods that do not involve biotic pollinators, such as self-fertilization and/or vegetative reproduction, and can use these methods to reproduce successfully and maintain their populations over time. As such, their toxicity rankings and anticipated reproductive effects are generally lower than plant species in the outcrossing groups (groups 5 and 9). All species in these assessment groups are found outside the conterminous United States, including the State of Hawai'i and Pacific and Caribbean Island U.S. Territories.

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

Exposure

We anticipate plants and their pollinators will be exposed to methomyl primarily through direct contact, either as the result of exposure to pesticide applications on-field or from pesticide 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, 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 on 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.

C-B6. NL48 Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

Toxicity

We characterize the expected toxic effect to species based on the anticipated level of direct and indirect[1] adverse effects to individuals. Our analysis of toxicity assumes individuals are exposed to 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 (i.e., 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

---

[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

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

Summary of Conclusions for Plants in Assessment Groups 6&10, 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.

C-B6. NL48 Flowering Plants: Biotic Pollination vectors with ability to reproduce asexually and/or by self-fertilization (Groups 6&10)

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

We group species together that have low or medium vulnerability, and low overlap with agricultural sites where methomyl is registered for use. For NL48 plant assessment groups 6&10, only Wheeler's peperomia meets the criteria for this group (Table 1). While we present some specific information about the species in Table 1 below, we provide additional information on vulnerability (including environmental baseline and cumulative effects), exposure, and toxicity in Appendix E. The status of the species accounts can be found in Appendix B.

Table 1. Plant species in groups 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) with medium vulnerability, medium 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
Peperomia wheeleri	Wheeler's peperomia	Medium	Low	Medium	3.6	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the vulnerability of the Wheeler's peperomia is medium. Our evaluation of the effects of the proposed action on this species indicates a low extent of exposure due to the low overlap of the action area within the range of the species. Toxicity is expected to be medium as this species' uses an abiotic pollination vector (wind) in addition to insects and can also reproduce, when needed, through vegetative reproduction, thus reducing the species' dependence on biotic pollinators.

While toxicity is medium for Wheeler's peperomia, given that exposure is anticipated to be low, the risk of indirect adverse reproductive effects to the species from loss of pollinators and/or seed dispersers is low. Furthermore, a species with medium vulnerability is more likely to be able to withstand additional stressors in its environment, including temporary declines in pollinator and seed disperser populations in very small portions of its range from methomyl exposure. Therefore, we anticipate a minimal level of adverse reproductive effects for the Wheeler's peperomia.

As a result, we anticipate minimal adverse effects to Wheeler's peperomia 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 minimal adverse effects will cause species-level effects due to low expected exposure of pollinators and seed dispersers, the species' ability to withstand temporary declines in pollinator and seed dispersers in very small portions of its range, and reliance on wind in addition to insect pollinators for successful reproduction. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce the survival and recovery of the species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Wheeler's peperomia.

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

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

Table 2. Plant species in groups 6 and 10 (i.e., biotic pollination vectors with self-fertilization and/or asexual reproduction) with high vulnerability, medium 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
Bulbophyllum guamense	Cebello halumtano	High	Low	Medium	2.1	No Jeopardy
Dendrobium guamense	No common name	High	Low	Medium	2.8	No Jeopardy
Harrisia portoricensis	Higo Chumbo	High	Low	Medium	0.0	No Jeopardy
Tetramolopium arenarium	No common name	High	Low	Medium	3.5	No Jeopardy
Tetramolopium filiforme	No common name	High	Low	Medium	0.2	No Jeopardy
Tetramolopium remyi	No common name	High	Low	Medium	3.0	No Jeopardy
Trichilia triacantha	Bariaco	High	Low	Medium	3.8	No Jeopardy

In our review of the current status of the species, and the environmental baseline and cumulative effects for the action area, the Service determined that the vulnerability of the species in Table 2 are high. Our evaluation of the effects of the proposed action on these species indicates a low extent of exposure due to the low overlap of the action area within the range of these species. Toxicity is expected to be medium for the plant species in this group, mainly due to their reliance on insect pollinators for successful reproduction. However, all plants in this appendix can rely, at least in part, on either self-fertilization and/or vegetative reproduction to reproduce successfully, thus decreasing their reliance on biotic pollination vectors, and decreasing the adverse effects on their reproduction due to exposure of their pollinators to methomyl. In addition, all the plants in Table 2 use abiotic vectors for some or all seed dispersal and all plants in Table 2 are likely to use a variety of insect species for pollination and seed dispersal (i.e., pollinator generalists) and are therefore likely to recover more quickly from temporary losses of insect pollinators in a small portion of their range.

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. The total overlap metric the Service uses is highly conservative as it does not fully account for redundancy between agricultural use sites and assumes exposure is occurring in all possible areas at the same time at the maximum application rates and frequencies, which is not reasonably expected to occur given recommended pesticide application practices. 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 to these species 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, partial ability to reproduce successfully without using pollinators, reliance on a variety of pollinator species for successful reproduction, and use of abiotic vectors for some or all seed dispersal. After adding the effects of the action and cumulative effects to the environmental baseline, and in light of the status of the species, we have determined the proposed action is not expected to appreciably reduce survival and recovery of these species in the wild. Thus, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the species in Table 2.