Integration and Synthesis Summary for Plants, CONUS
Flowering Plants Assessment Group 5 – Monocots reliant upon outcrossing with biotic pollination vector

The tables below contain summaries of the information and data we used to determine the ranking (high, medium, low) for vulnerability, risk and usage indicators. Information in most of the columns was used directly in the ranking determination (green fill). Where indicated, information in other columns was not used directly in the ranking calculation, but provided additional information about the species that fed into one of the ranking metrics or was used to make the draft determination when relevant. The summary for this assessment group also includes new conservation measures[1] that have been incorporated into the Action since the draft biological opinion was released. The measures and our related assumptions are incorporated into our analysis (immediately above Table 4), and also factor into the rationales for our conclusions for each species, as described below.

All species in this assessment groups are monocots, a class of angiosperm flowering plant defined by having only one cotyledon (embryonic seed leaves). There are a large variety of monocot species, though typical monocot plants include grasses, lilies and palms. The monocots in this assessment group utilize biotic vectors to accomplish pollination, such as insects, birds, and mammals. All plants in this group need to achieve outcrossing (pollen transfer between individuals), in order to reproduce successfully and maintain their populations over time. 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.

Table 1: Summarizing Data and Information for Vulnerability Ranking
Data Sources: Status of the Species (SOS) accounts updated as of November, 2019 (Appendix C); NA = Not Applicable

Scientific Name	Common Name	Status	Population Level Trends	Species Level Trends	Number of Populations	Distribution	Number of Individuals*	Pesticides Listed as a Threat	Pollinator Loss Listed as a Threat	Vulnerability Ranking
Platanthera leucophaea	Eastern prairie fringed orchid	Threatened	Decline	Decline	76	U.S. States: Illinois, Indiana, Iowa, Maine, Michigan, Missouri, Ohio, Oklahoma, Virginia, Wisconsin; Canada.	Not Available	No Mention	No Mention	Medium
Platanthera praeclara	Western prairie fringed Orchid	Threatened	> 60% decline (NatureServe, 2015)	Not Available	172 (NatureServe, 2015)	Inhabits the Red River Valley of northern Minnesota, south in the Great Plains through the eastern Dakotas, central Nebraska, eastern Kansas, and northeastern Oklahoma; eastward through southern Minnesota, Iowa, and northern Missouri and in Manitoba. The eastern limit roughly corresponds to the Mississippi River (Watson, 1989; Bowles and Duxbury, 1986) (NatureServe, 2015).	~15,000 (inferred from NatureServe, 2015)	No Mention	No Mention	Medium
Spiranthes diluvialis	Ute ladies'-tresses	Threatened	Not Available	Not Available	>50	When it was listed under the Act in 1992, Ute ladies'-tresses was known from 10 extant populations within portions of only two states (Colorado and Utah, USFWS 1992a). At that time, these 10 populations were estimated to encompass approximately 170 ac of occupied habitat. At listing, the species was presumed extirpated in Nevada. Since listing, Ute ladies'-tresses was rediscovered in Nevada, and new populations were discovered in southern Idaho, southwestern Montana, western Nebraska, central and northern Washington, and southeastern Wyoming (Fertig et al. 2005, Figure 1 of this Biological Opinion), and south central British Columbia (Bjork 2007). In 2005, 53 populations (encompassing 674-784 ac of habitat) were considered extant across the range of the species (Fertig et al. 2005); the British Columbia locations were discovered	~80,000	No Mention	No Mention	Medium

[1] Additional information on these new conservation measures can be found in the Description of the Action section of this biological opinion.

Scientific Name	Common Name	Status	Population Level Trends	Species Level Trends	Number of Populations	Distribution	Number of Individuals*	Pesticides Listed as a Threat	Pollinator Loss Listed as a Threat	Vulnerability Ranking
						the following year (Bjork 2007). Utah had the most populations (23), the largest amount of occupied habitat (234-308) ac, and the highest number of reported plants (47,859 individuals) of any state (Fertig et al. 2005). The Spanish Fork watershed in Utah was assessed as having the highest recorded population estimate (28,825 plants), whereas the Upper Green-Flaming Gorge Reservoir population (which spans the Colorado-Utah border) spanned the most extensive area (117-126 ac). The majority of known populations (66 percent) occupied between 0.1 and 10 ac, whereas relatively few (4.9 percent) occupied more than 50 ac.				
Trillium persistens	Persistent trillium	Endangered	Decreasing (NatureServe, 2015)	Not Available	1-20 (NatureServe, 2015)	Known only from an approximately four square mile area at the head of Tallulah Gorge in Georgia and South Carolina (Flora of North America Editorial Committee 2002) (NatureServe, 2015).	2,500 - 20,000 individuals (NatureServe , 2015)	No Mention	No Mention	High
Xyris tennesseensis	Tennessee yellow-eyed grass	Endangered	Decline of 50-70% (NatureServe, 2015)	Stable (USFWS, 2014)	23 (USFWS, 2014)	The known current and historic distribution of *Xyris tennesseensis* is restricted to the states of Alabama, Georgia, and Tennessee almost exclusively within the Interior Plateau and Ridge and Valley ecoregions (USFWS, 2014).	Not Available	No Mention	No Mention	High

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Table 2: Summarizing Data and Information for Risk Ranking
Data Sources: SOS accounts (Appendix C); R Plot Appendices; NA=Not Applicable

Risk to Individuals and Pollinators if exposed: The individual plants in this assessment group are not expected to experience effects to growth or survival from exposure to malathion.
Mortality is expected for insect pollinators and seed dispersers exposed to malathion on use sites, via spray drift, and from mosquito control applications. Because terrestrial invertebrates exhibit a range of sensitivities to malathion, insect abundance is expected to be reduced where exposure occurs, but not completely eliminated. However, some species are likely to incur greater levels of mortality than others based on their sensitivity. As plants often have unknown or specific pollinators and seed dispersers for which toxicity data is unavailable, we assume insects that pollinate or disperse the seeds of listed plants are sensitive to malathion, and that exposure will cause mortality. In field studies, reductions of common insect species following pesticide exposure are often temporary with recovery over a short period of time. However, since listed plants may be reliant on insect pollinators or seed dispersers that are limited in range or abundance, these insect species may be less likely to recover following pesticide exposure. Some bird pollinators and seed dispersers exposed to malathion on use sites may experience mortality or sublethal effects, depending on the site of exposure and size of the bird. Smaller birds exposed on use sites with higher allowable use rates (e.g., developed, open space developed, orchards and vineyards) have a greater chance of being affected. Exposure to spray drift is not expected to result in effects to bird seed dispersers. No mortality or sublethal effects are expected for mammalian pollinators or seed dispersers from malathion exposure either on use sites or from spray drift.

Scientific Name	Common Name	Direct Effects to Mortality or Growth Expected (yes or no; reduction in dry weight when exposed in use areas that may have effects)	Effects to Pollinators, % insect pollinator mortality (% bird pollinator mortality)	Method of Reproduction (risk modifier)	Seed Dispersal Vector (risk modifier)	Obligate or Specific Pollinator (risk modifier)	Pollination Vector*	Risk Ranking
Platanthera leucophaea	Eastern prairie fringed orchid	No	129.32	Biotic - Outcrosser	Abiotic	No Mention	Insect	Medium
Platanthera praeclara	Western prairie fringed Orchid	No	92.71	Biotic - Outcrosser	Abiotic	No Mention	Insect	Medium
Spiranthes diluvialis	Ute ladies'-tresses	No	66.12	Biotic - Outcrosser	Abiotic	No Mention	Insect	Medium
Trillium persistens	Persistent trillium	No	22.05	Biotic - Outcrosser	Biotic	No Mention	Insect	Medium
Xyris tennesseensis	Tennessee yellow-eyed grass	No	72.11	Biotic - Outcrosser	Abiotic, Bird, Mammal	No Mention	Insect	Medium

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Volatilization: We do not expect transport from volatilization to be an appreciable source of exposure for most or all species in this assessment group. For species that occur at high elevations, we expect additional exposure to malathion that may vaporize from application sites. However, the magnitude of increased exposure is uncertain due to the unpredictability of weather events, along with variability of the geographical features across the landscapes that influence transport and deposition, though the information available does not allow us to conclude that concentrations from this route alone will rise to the level where effects are expected.

Table 3: Summarizing Data and Information for Usage Ranking
Data Sources: R Plot Appendices for individual plant species; Federal lands overlap analysis; California (CA); NA=Not Applicable Federal lands overlap analysis; California data analysis

Scientific Name	Common Name	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total overlap % (All Uses)*	Total Overlap % (Mosquito Adulticide)*	Anticipated Usage within Range (agricultural data based on SUUM): total % of range for all uses	Anticipated Usage within Range (agricultural data based on CalPUR): total % of range for all uses	Ranking: Confidence Level	Usage Ranking
Platanthera leucophaea	Eastern prairie fringed orchid	47,431,067.31	1.20	0	NA	38.94	38.52	1.20	NA	Standard	Low
Platanthera praeclara	Western prairie fringed Orchid	118,703,452.70	8.49	0	NA	30.15	23.58	0.90	NA	Standard	Low

Scientific Name	Common Name	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total overlap % (All Uses)*	Total Overlap % (Mosquito Adulticide)*	Anticipated Usage within Range (agricultural data based on SUUM): total % of range for all uses	Anticipated Usage within Range (agricultural data based on CalPUR): total % of range for all uses	Ranking: Confidence Level	Usage Ranking
Spiranthes diluvialis	Ute ladies'-tresses	57,116,808.35	47.81	0	NA	9.29	39.94	1.26	NA	Standard	Low
Trillium persistens	Persistent trillium	439,726.07	33.65	0	NA	8.79	0.38	0.60	NA	Standard	Low
Xyris tennesseensis	Tennessee yellow-eyed grass	2,783,604.09	9.43	0	NA	14.06	33.96	1.18	NA	Standard	Low

*Information in this column was used to inform the ranking metrics or the draft determination when relevant.

Cumulative Effects and Environmental Baseline: Please refer to the Status of the Species accounts (Appendix C) and overarching Environmental Baseline and Cumulative Effects sections of this Opinion.

Additional Conservation Measures:

General Conservation Measures
Several additional conservation measures have recently been provided by EPA and will be implemented as part of the Action (see *Description of the Action* section of the biological opinion and Appendix A-2 for further details on these measures). These measures will apply to all species in this assessment group with corresponding use type overlap and usage (i.e., mosquito adulticide, agricultural and residential uses, see Table 3). All measures are anticipated to limit the exposure of pollinators and seed dispersers to malathion in the described use area where it occurs in or around the range of the species, thus further reducing the risk of reproductive effects to the species. We summarize the new measures and our related assumptions below.

Mosquito adulticide timing restrictions: Conservation measures for mosquito adulticide use will prohibit application during most daylight hours (from two hours after dawn until two hours before sunset). This period is when many diurnal insect pollinators and seed dispersers are most active and would mostly likely be exposed to malathion applications. This measure is anticipated to limit the exposure of insect pollinators/seed dispersers present in and around the range of the species to malathion when used as a mosquito adulticide.

Bloom restrictions: New restrictions on orchards and vineyards, pasture, and other crops UDLs will prohibit application of malathion within three days prior to bloom, during bloom, and until petal fall is complete on certain crops. This measure is anticipated to limit the exposure of pollinators/seed dispersers to malathion in this use area where it occurs in or around the range of the species, reducing the risk of impacts to reproduction.

Reduced application number and rate: New restrictions on corn, cotton, orchards and vineyards, pasture, other crops, and vegetables and groundfruit lower the maximum allowable number of applications (previously ranging from 3-13 applications per year, depending on the specific crop) to 2-4 per year, as described in the Description of the Action of this Opinion. This is anticipated to reduce the amount of malathion used and decrease exposure to the species and its pollinators/seed dispersers, thus decreasing the risk of impacts to reproduction and direct impacts to the plant itself.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are anticipated to substantially reduce exposure to species and their pollinators/seed dispersers that overlap with developed and open space developed areas. Label changes will ensure that residential use is limited to spot treatments only (rendering spray drift offsite unlikely) and reducing the extent of area which can be treated in the developed and open space developed areas by as much as 75% or more from modeled values. In addition, we expect the frequency of exposure to decrease as the number of allowable applications is reduced from “repeat as necessary” to a maximum of 2–4 applications per year (depending on the specific residential use). Retreatment intervals of 7-10 days between any repeated applications are expected to reduce environmental concentrations by allowing initial residues to degrade prior to the next application. We anticipate this measure will further reduce exposure to biotic pollinators and seed dispersers, thus decreasing the risk of impacts to reproduction and sub-lethal impacts to the plant itself.

Table 4: Summary of Conclusions

Number	Scientific Name	Common Name	Vulnerability Ranking	Risk Ranking	Usage Ranking	Species Conclusion (J, NJ)*
1	*Platanthera leucophaea*	Eastern prairie fringed orchid	Medium	Medium	Low	NJ
2	*Platanthera praeclara*	Western prairie fringed Orchid	Medium	Medium	Low	NJ
3	*Spiranthes diluvialis*	Ute ladies'-tresses	Medium	Medium	Low	NJ
4	*Trillium persistens*	Persistent trillium	High	Medium	Low	NJ
5	*Xyris tennesseensis*	Tennessee yellow-eyed grass	High	Medium	Low	NJ

*NJ = No Jeopardy; J = Jeopardy

Rationale for Species Conclusions

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

The individual plants in this assessment group are not expected to experience mortality or sub-lethal effects from direct exposure to malathion (on use sites or as spray drift), as discussed in the General Effects section of this Opinion.

The species in this assessment group have either high or medium vulnerabilities based on their status, distribution, and trends, as described above. We anticipate medium risk to all species posed by labeled uses across the range, and low estimated usage within their ranges. As a result, we anticipate malathion application on a very small portion of the ranges of these species, resulting in a low level of pollinator and seed disperser mortality. Additionally, there is no mention of threats from pesticide use or pollinator loss in the recovery plans or 5-year reviews of these species. Some threats to these species include habitat destruction and modification, competition from non-native invasive plants, and drought and climate change. While the lack of identification of pesticides in these species' documents does not mean the application of malathion would not result in adverse effects should exposure occur, based on our analysis of the vulnerability, risk, and usage, we anticipate only low levels of adverse effects via mortality and sublethal impacts to other animals these species rely upon for pollination or seed dispersal. In addition, we anticipate the conservation measures described above will further reduce the risk of exposure of both pollinators and seed dispersers and the resultant reproductive effects to the plant species in the very small portion of the range where we anticipate malathion to be applied. For example, the conservation measure limiting mosquito adulticide applications during most daytime hours is anticipated to substantially reduce exposure and therefore mortality of diurnal pollinators and seed dispersers, which are important for the reproductive success of the listed plants.

All species in this assessment group except persistent trillium rely on abiotic means for all or a portion of their seed dispersal, giving these species the capability to reproduce successfully even in the absence of a portion of their biotic seed dispersal vectors. For example, Tennessee yellow-eyed grass, being an obligate wetland species, relies mainly on water for seed dispersal. We do not anticipate impacts from malathion applications to seed dispersal for species with abiotic seed dispersal mechanisms. Although the persistent trillium distribution is geographically limited, most of its abundance (90%) occurs on U.S. Forest Service or Georgia Department of Natural Resources lands. Both agencies have habitat management protection plans in place for the trillium (USFWS 5- year review, 2011). As a result, we do not anticipate malathion usage occurring within the range of this species that would result in decreases to the species' pollinator population to an extent to cause species-level effects, and the conservation measures described above are expected to further reduce the likelihood of exposure and effects to these species.

We do not anticipate that the use of this pesticide is likely to have species-level effects for these species. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of these species in the wild.