Integration and Synthesis Summary for Plants, Islands
Pacific Islands Species: Assessment Group 4, monocots with abiotic pollination vectors

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 3), 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, typical monocot plants include grasses, lilies and palms. The monocots in this assessment group use abiotic vectors to accomplish pollination, such as wind and water. Seed dispersal for the species in this group is achieved by biotic (dispersal by animals) and 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; HI=Hawaii; GU=Guam; CNMI=Commonwealth of the Northern Marianas Islands

Scientific Name	Common Name	Location	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
Astelia waialealae	Pa`iniu	HI	Endangered	Short-term trends indicate a decline of 10-30% (NatureServe, 2015)	Not Available	4 occurrences (NatureServe, 2015)	Recorded only from the montane bogs of the central plateau of the island of Kauai, state of Hawaii. (NatureServe, 2015)	~26 plants (NatureServe, 2015)	No Mention	Loss of pollinators (USFWS, 2017)	High
Calamagrostis expansa	Maui reedgrass	HI	Endangered	Declining	Declining	13 populations on the islands of Maui (9) and Hawaii (4)	Currently, *Calamagrostis expansa* is found on the islands of Maui and Hawaii, in wet forest, open bogs, and bog margins (HBMP 2008).	~660 individuals	No Mention	No Mention	High
Calamagrostis hillebrandii	Hillegrand's reedgrass	HI	Endangered	Short-term trends indicate declines of 10-30%, whereas long-term trends are unknown (NatureServe, 2015)	Not Available	3 (NatureServe, 2015)	Endemic to the island of Maui in the Hawaiian Islands. It has been recorded only on the western mountain mass of the island, the West Maui Mountains. (NatureServe, 2015)	250 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	High
Cenchrus agrimonioides	Kamanomano	HI	Endangered	Increasing (USFWS, 2014)	Not Available	4 (USFWS, 2016)	Population units include: Kahanahaiki and Pahole, Central Ekahanui, Makaha and Waianae Kai, and South Huliwai (USFWS, 2016).	645 (USFWS, 2014)	No Mention	No Mention	High
Cyperus fauriei	No common name	HI	Endangered	Not Available	Not Available	3 (USFWS, 2012)	It currently occurs on Molokai and Hawaii Island. It was last seen on Lanai in 1929 (USFWS 1996; 2003a) (USFWS, 2012).	2,000 - 10,000 (USFWS, 2012)	No Mention	No Mention	High

[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	Location	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
Cyperus neokunthianus	No common name	HI	Endangered	Last observed in 1996 (USFWS, 2015)	Not Available	0 (USFWS, 2015)	Currently, there are no known individuals in the wild; however, Waihee Valley and Maui County lands have been suggested as potential habitat for further surveys (PEPP 2013, p. 32; PEPP 2014, p. 59) (USFWS, 2015).	Not Available	No Mention	No Mention	High
Cyperus pennatiformis	No common name	HI	Endangered	Not Available	Not Available	1 (inferred from USFWS, 2013)	It is still extant on Hawaii and Maui (USFWS, 2013).	~20 (USFWS, 2013)	No Mention	No Mention	High
Cyperus trachysanthos	Pu`uka`a	HI	Endangered	Not Available	Not Available	7 (USFWS, 2010)	It occurs on Oahu and Kauai (USFWS, 2013).	~700 (USFWS, 2010)	No Mention	No Mention	High
Eragrostis fosbergii	Fosberg's love grass	HI	Endangered	Not Available	Not Available	1 (USFWS, 2011)	Known only from Waianae Mountains of Oahu. (NatureServe, 2015)	<10 (USFWS, 2011)	No Mention	No Mention	High
Festuca hawaiiensis	No common name	HI	Endangered	Not Available	Not Available	4 (USFWS, 2014; USFWS, 2016)	Currently, *Festuca hawaiiensis* is known from Puu Anahulu State Game Management Area to Kipuka Alala in the Pohakuloa Training Area (PTA), on the island of Hawaii (Hawaii Biodiversity and Mapping Program (HBMP) 2008). We are unaware of additional surveys conducted to date (June 19, 2014).	~1500 individuals (USFWS, 2016)	No Mention	No Mention	High
Festuca molokaiensis	No common name	HI	Endangered	Not Available	Not Available	1 (NatureServe, 2015)	Known only from Kupaia Gulch, Molokai (USFWS 2012). Last observed in 2009 (USFWS 2012). (NatureServe, 2015)	Unknown (USFWS, 2016)	No Mention	No Mention	High
Ischaemum byrone	Hilo ischaemum	HI	Endangered	Declining (USFWS, 2015)	Not Available	6 (USFWS, 2015)	Currently known from Kauai, Molokai, east Maui, and Hawaii island (USFWS, 2016b).	1,000-3,000 (NatureServe, 2015)	No Mention	No Mention	High
Neraudia sericea	No common name	HI	Endangered	Not Available	Declining (USFWS, 2012)	9 (USFWS, 2012)	Currently occurs on Molokai, Lanai, and Maui (USFWS, 2012).	~27 (USFWS, 2012)	No Mention	No Mention	High
Panicum fauriei var. carteri	Carter's panicgrass	HI	Endangered	Not Available	Not Available	4 (USFWS, 2011)	Current range includes Oahu, Molokai, and Maui. (NatureServe, 2015)	<1,000 (NatureServe, 2015)	No Mention	No Mention	High
Panicum niihauense	Lau `ehu	HI	Endangered	Not Available	Not Available	1 (USFWS, 2008; see current range/distribution)	Currently only one population is known and it is located on the northwest comer of Kauai at Polihale State Park (USFWS, 2008).	~35 mature (USFWS, 2008)	No Mention	No Mention	High
Poa mannii	Mann's bluegrass	HI	Endangered	Not Available	Not Available	13 (USFWS, 2010)	The species currently occurs on State-owned land in the right and left branches of Kalalau Valley, Awaawapuhi Valley, Kuia Valley, and Kauhao Valley within the Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Waimea Canyon State Park (GDSI 2000; HINHP Database 2000; O'Connor 1999; K. Wood, in litt. 1999) (USFWS, 2003).	100+ (USFWS, 2010)	No Mention	No Mention	High

Scientific Name	Common Name	Location	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
Poa sandvicensis	Hawaiian bluegrass	HI	Endangered	Not Available	Increasing (USFWS, 2010)	9 (USFWS, 2010)	Currently, *Poa sandvicensis* is known to be extant at Alealau, Keanapuka, Awaawapuhi Trail, Kumuwela Ridge, Maile Flat Trail, Mohihi Stream, Mohihi-Waialae Trail, Kawaiiki Valley, and Waialae Valley in the Alakai Wilderness Preserve, Hono o Na Pali NAR, Kokee State Park, Na Pali Coast State Park, and Na Pali-Kona Forest Reserve (GDSI 2000; HINHP Database 2000; 57 FR 20580; K. Wood, in litt. 1999) (USFWS, 2003).	~6,000 (USFWS, 2010)	No Mention	No Mention	Medium
Poa siphonoglossa	No common name	HI	Endangered	Not Available	Increasing (USFWS, 2010)	6 (USFWS, 2010)	It currently occurs on State-owned land at Kahuamaa Flats, Mohihi-Waialae Trail, Kuia Valley, Makaha Ridge, and Kaulaula Valley in the Alakai Wilderness Preserve, Kuia NAR, Na Pali Coast State Park, Na Pali-Kona Forest Reserve, and Puu Ka Pele Forest Reserve (GDSI 2000; HINHP Database 2000; K. Wood, in litt. 1999) (USFWS, 2003).	50 - 70 (USFWS, 2010)	No Mention	No Mention	Medium

*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); NA=Not Applicable; HI=Hawaii; GU=Guam; CNMI=Commonwealth of the Northern Marianas Islands

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.

The monocots in this assessment group do not rely on animal species for pollination, thus no effects are expected to these plants from loss in pollinator populations from malathion exposure across use sites within their ranges. Mortality is expected for insect seed dispersers exposed to malathion on use sites or via spray drift. Some bird 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 seed dispersers from malathion exposure either on use sites or from spray drift.

Scientific Name	Common Name	Location	Direct effects expected (yes or no, reduction in dry weight when exposed in use areas that may have effects)	Effects to Pollinators	Method of Reproduction (risk modifier)	Seed Dispersal Vector (risk modifier)	Obligate or Specific Pollinator (risk modifier)	Pollination Vector*	% Range Overlap with Federal Lands	Risk Ranking
Astelia waialealae	Pa`iniu	HI	No	Medium	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Unknown	0	Low
Calamagrostis expansa	Maui reedgrass	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	11.12	Low
Calamagrostis hillebrandii	Hillegrand's reedgrass	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0	Low
Cenchrus agrimonioides	Kamanomano	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	11.39	Low

Scientific Name	Common Name	Location	Direct effects expected (yes or no, reduction in dry weight when exposed in use areas that may have effects)	Effects to Pollinators	Method of Reproduction (risk modifier)	Seed Dispersal Vector (risk modifier)	Obligate or Specific Pollinator (risk modifier)	Pollination Vector*	% Range Overlap with Federal Lands	Risk Ranking
Cyperus fauriei	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	5.63	Low
Cyperus neokunthianus	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0	Low
Cyperus pennatiformis	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	3.40	Low
Cyperus trachysanthos	Pu`uka`a	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	7.07	Low
Eragrostis fosbergii	Fosberg's love grass	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	31.71	Low
Festuca hawaiiensis	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	27.34	Low
Festuca molokaiensis	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0.82	Low
Ischaemum byrone	Hilo ischaemum	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	5.63	Low
Neraudia sericea	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0.57	Low
Panicum fauriei var. carteri	Carter's panicgrass	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0.11	Low
Panicum niihauense	Lau `ehu	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	3.63	Low
Poa mannii	Mann's bluegrass	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0	Low
Poa sandvicensis	Hawaiian bluegrass	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0	Low
Poa siphonoglossa	No common name	HI	No	Low	Abiotic - Pollinating Agent	Abiotic, Biotic	NA	Abiotic	0	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:

Additional information on these new conservation measures can be found in the *Description of the Action* section and Appendix A-2 of this biological opinion, and further information on the anticipated impacts of each measure in the *Effects of the Action* section.

Several additional conservation measures have been recently provided by EPA and will be implemented as part of the Action. 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). All measures are anticipated to limit the exposure of 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.

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. Although these species have no biotic pollinators, this measure is anticipated to limit the exposure of 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 where seed dispersers are active prior to the completion of petal fall for the crop.

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 seed dispersers, thus decreasing the risk of impacts to the reproduction of these plants.

Residential use label changes: New restrictions to the method and frequency of application for residential use of malathion are anticipated to significantly 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. While these species have no biotic pollinators, we anticipate this measure will further reduce exposure to biotic seed dispersers, thus decreasing the risk of impacts to the reproduction of these plants.

Table 3: Summary of Conclusions

Scientific Name	Common Name	Vulnerability ranking	Risk Ranking	Potential Exposure ranking	Species Conclusion (J, NJ)
Astelia waialealae	Pa`iniu	High	Low	Not determined*	NJ
Calamagrostis expansa	Maui reedgrass	High	Low	Not determined*	NJ
Calamagrostis hillebrandii	Hillegrand's reedgrass	High	Low	Not determined*	NJ
Cenchrus agrimonioides	Kamanomano	High	Low	Not determined*	NJ
Cyperus fauriei	No common name	High	Low	Not determined*	NJ
Cyperus neokunthianus	No common name	High	Low	Not determined*	NJ
Cyperus pennatiformis	No common name	High	Low	Not determined*	NJ
Cyperus trachysanthos	Pu`uka`a	High	Low	Not determined*	NJ
Eragrostis fosbergii	Fosberg's love grass	High	Low	Not determined*	NJ
Festuca hawaiiensis	No common name	High	Low	Not determined*	NJ
Festuca molokaiensis	No common name	High	Low	Not determined*	NJ
Ischaemum byrone	Hilo ischaemum	High	Low	Not determined*	NJ
Neraudia sericea	No common name	High	Low	Not determined*	NJ
Panicum fauriei var. carteri	Carter's panicgrass	High	Low	Not determined*	NJ
Panicum niihauense	Lau `ehu	High	Low	Not determined*	NJ
Poa mannii	Mann's bluegrass	High	Low	Not determined*	NJ
Poa sandvicensis	Hawaiian bluegrass	Medium	Low	Not determined*	NJ
Poa siphonoglossa	No common name	Medium	Low	Not determined*	NJ

NJ = No Jeopardy; J = Jeopardy

*A Potential Exposure ranking was not undertaken for species in this Assessment Group as the magnitude of exposure for these species should not affect the analysis given they do not use biotic vectors in their life cycle.

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 species in this assessment group have either high or medium vulnerabilities based on their status, distribution, and trends and the risk to all species in this group posed by labeled uses across the range is anticipated to be low, as shown above. As described in the Approach to the Analysis for Pacific and Caribbean Island Species, we considered available usage data broadly and determined the relative likelihood of exposure of island species

based on their preferred habitat. However, for monocots using abiotic pollination vectors, we did not undertake a Potential Exposure ranking as the magnitude of exposure for these species should not affect the outcome of the analysis, given they do not rely on biotic pollination vectors. As such, we were able to draw conclusions for these species based on their vulnerability and risk ranking.

Pollinating animals do not play a role in the life cycle of this group of monocot plants, instead they use wind or water to transport pollen between individuals and populations; thus, no effects to pollinators are expected. Furthermore, the individual plants in this assessment group are not expected to experience sub-lethal effects from exposure to malathion, as discussed in the General Effects – Plants section of this Opinion. . However, these monocot species do rely on animals to disperse a portion of their seeds. We do not know the specific seed dispersal species they rely on, but assume it is a mixture of abiotic vectors and a variety of biotic vectors such as insects, birds, and mammals. No mortality or sublethal effects are expected for mammalian seed dispersers, however bird and insect seed dispersal species are expected to experience losses due to malathion exposure, although we anticipate that the additional conservation measures described above will substantially reduce the risk of exposure to seed dispersers in the portion of the range where we anticipate malathion to be applied. For example, exposure of biotic seed dispersers such as ants and birds to malathion will be reduced in areas of residential use as applications in these areas can only be made as spot treatments (no broadcast use), and the number of treatments per year has been reduced to two from “repeat as necessary.” Given that these species can rely on a variety of seed dispersal vectors, including abiotic vectors, and in light of the additional conservation measures, we do not anticipate effects to insect or bird seed dispersers for these species to result in species-level reproductive effects.

Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the species in the wild.