Integration and Synthesis Summary for Plants, Pacific Islands
Flowering Plants Assessment Group 9 – Dicots reliant on outcrossing by biotic 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 exposure 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 dicots, a class of angiosperm flowering plant defined by having two cotyledons (embryonic seed leaves). Dicots are a hugely diverse class of flowering plants, with tens of thousands of species. Familiar dicots include plants such as daisies, roses and oak trees. All plants in this group need to achieve outcrossing (pollen transfer between individuals) in order to reproduce successfully and maintain their populations over time. They utilize biotic vectors to accomplish outcrossing and pollination, such as insects, birds or mammals. 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; HI=Hawaii; GU=Guam; CNMI=Commonwealth of Northern Marianas Islands

Scientific Name	Common Name	Number	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
Alsinidendron lychnoides	Kuawawaenohu	23	HI	Endangered	Not Available	Not Available	4 (USFWS, 2010)	Found in Kauai. (NatureServe, 2015)	50-100 individuals (USFWS, 2010)	No Mention	No Mention	High
Argyroxiphium kauense	Mauna Loa (=Ka'u) silversword	1	HI	Endangered	Not Available	Not Available	3 (USFWS, 2015)	The current range is restricted slopes of Mauna Loa, Island of Hawaii. (NatureServe, 2015)	626 individuals (USFWS, 2015)	No Mention	No Mention	High
Argyroxiphium sandwicense ssp. macrocephalum	`Ahinahina	2	HI	Threatened	Decreasing	Not Available	7	The Haleakala silversword is endemic to 2,500 acres between 6,900 and 9,800 feet elevation in the crater and outer slopes of Haleakala Volcano within the Park and The Nature Conservancy of Hawaii's Waikamoi Preserve, where it apparently occupies most of its historical range (Loope and Crivellone 1986). Near extinction in the 1920s due to human vandalism and browsing by goats and cattle, Haleakala silverswords have increased substantially due to protection and vigorous conservation efforts. The first reliable information on Haleakala silversword numbers is from the summer of 1935 when Ranger S. H. Lamb tallied 1,470 plants (88 of which were flowering) on a single cinder cone (Ka Moa o Pele) within Haleakala Crater (Lamb 1935). Since about 217 plants were flowering within the	approximately 50,000 individuals	No Mention	Yes	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	Number	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
								crater (Lamb 1935), a reasonable estimate of the total population at that time was about 4,000 individuals (Loope and Medeiros 1994). Information gathered illustrates the trend of the silversword population over a 70-year period of protection. Since plants occur on otherwise barren cinder, fairly accurate counts are possible. Plants have been counted by successive investigators on the cinder cone, Ka Moa o Pele, where the largest number of plants occurred in 1935. By 1979, the population on this volcanic cone had increased by 4.4 times, from 1,470 to 6,528 individuals (Kobayashi 1991). Elsewhere in Haleakala Crater, the silversword also increased in numbers and extent, with large local populations in areas where few plants occurred in 1935. A census of the entire Haleakala silversword population has been attempted four times since 1971, with the following results: 1971: 43,262 individuals (Kobayashi 1973); 1979-80: 35,000 total plants (Kobayashi 1991); 1982: 47,640 (Loope and Crivellone 1986); and 64,800 plants were counted in 1991 (Kobayashi 1993).				
Argyroxiphium sandwicense ssp. sandwicense	`Ahinahina	24	HI	Endangered	Not Available	Not Available	2 wild populations; number of outplanting populations uncertain (USFWS, 2012)	The Mauna Kea silversword is only found in Mauna Kea, Hawaii (USFWS, 2012)	Approx 27 individuals (wild); at least 10,000 invidiuals in several outplantings (USFWS, 2012)	No Mention	No Mention	High
Brighamia insignis	Olulu	16	HI	Endangered	Declining (USFWS, 2008)	Not Available	1 (USFWS, 2008)	Range includes Na Pali and Hapuu areas of Kauai, current reports on Niihau but no specimens collected. (NatureServe, 2015)	<100 individuals (NatureServe, 2015)	No Mention	Pollination (USFWS, 2008)	High
Brighamia rockii	Pua `ala	17	HI	Endangered	Not Available	Not Available	3 (USFWS, 2014)	It is currently only found on Molokai. (USFWS, 2014)	34 individuals (USFWS, 2014)	No Mention	No Mention	High
Chamaesyce skottsbergii var. skottsbergii	Ewa Plains `akoko	3	HI	Endangered	Not Available	Not Available	9 occurrences (NatureServe, 2015)	Its current range includes Ewa plains, Oahu & west Molokai. (NatureServe, 2015)	1,345 (USFWS, 2007)	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
Clermontia oblongifolia ssp. brevipes	`Oha wai	4	HI	Endangered	Not Available	Not Available	1 (USFWS, 2011)	Its current range is in Molokai. (NatureServe, 2015)	10 (USFWS, 2011)	No Mention	No Mention	High
Clermontia oblongifolia ssp. mauiensis	`Oha wai	5	HI	Endangered	Not Available	Not Available	1 (USFWS, 2011)	This subspecies is endemic to Maui and Lanai. (NatureServe, 2015)	4 (USFWS, 2011)	No Mention	No Mention	High
Cyanea grimesiana ssp. grimesiana	Haha	25	HI	Endangered	Not Available	Not Available	4 (NatureServe, 2015)	Known from Oahu and Molokai. The taxon was last observed on Molokai in 1991 (USFWS, 2012; NatureServe, 2015). On Oahu, *Cyanea grimesiana subsp. grimesiana* occurs in the Waianae Mountains (USFWS, 2011).	3 outplanted (USFWS, 2011); 5 - 6 (wild?) (NatureServe, 2015)	No Mention	Loss of pollinators (USFWS, 2016)	High
Cyanea grimesiana ssp. obatae	Haha	26	HI	Endangered	Significant increase since 1994 (USFWS, 2016)	Not Available	6 (USFWS, 2016)	Currently occurs in the Waianae Mountains of Oahu (NatureServe, 2015). Many of the occurrences that have been monitored over the last 15 to 20 years have either died out or have greatly declined in numbers; most of the known occurrences have been recently discovered. One naturally occurring plant was recently discovered at Makaha, which represents a new occurrence for this subspecies. A new, naturally occurring plant was also recently discovered in the Central Kaluaa population unit (USFWS, 2016).	254 (USFWS, 2016)	No Mention	Loss of pollinators (USFWS, 2016)	High
Cyanea superba	Haha	27	HI	Endangered	Extinct in the wild in 2002 (USFWS, 2016)	All occurrences are reintroductions from propagated stock (USFWS, 2016)	2 (USFWS, 2012)	Current range includes Waianae Mountains of Oahu (NatureServe, 2015). The Kahanahaiki and Pahole to Kapuna population units are current (U.S. Army Garrison 2005b). The Central and East Makaleha, and Makaha, population units are designated as future reintroduction sites for this subspecies (USFWS, 2016).	169 mature reintroduced (USFWS, 2012)	No Mention	Loss of pollinators (USFWS, 2016)	High
Delissea subcordata	Oha	20	HI	Endangered	Increase in individuals since 1996 (USFWS, 2016)	83% of individuals are from propagate stock (USFWS, 2016); increasing (USFWS, 2013)	7 (USFWS, 2016)	Current range includes Waianae Mountains, Oahu (NatureServe, 2015). This species is absent from several locations in the Waianae Mountains where it was found in the 1970s and 1980s, and it is no longer found in the Koolau Mountains (USFWS, 2016).	72 wild, 1,404 reintroduced (USFWS, 2013)	No Mention	Loss of pollinators (USFWS, 2016)	Medium

Scientific Name	Common Name	Number	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
Dubautia herbstobatae	Na`ena`e	28	HI	Endangered	Not Available	Stable (USFWS, 2013)	7 (USFWS, 2016)	*Dubautia herbstobatae* is endemic to the Hawaiian Islands and is known to occur on the leeward side of the northern Waianae Mountains on only two ridge systems. These ridge systems span a distance of approximately 6 km (4 mi). One system includes Ohikilolo Ridge and the ridges in and around Keaau Valley. The second ridge system includes Kamaileunu, encompassing the Kamaileunu and Waianae Kai population units (USFWS, 2016).	1,242 (USFWS, 2013)	No Mention	No Mention	High
Dubautia latifolia	Koholapehu	29	HI	Endangered	Not Available	Not Available	18 occurrences (NatureServe, 2015)	Current range is northwestern Kauai. (NatureServe, 2015)	100-200 (USFWS, 2010)	No Mention	No Mention	High
Euphorbia haeleeleana	`Akoko	30	HI	Endangered	Not Available	Not Available	15 (USFWS, 2016)	*Euphorbia haeleeleana* is known historically and currently from 15 populations (between 450 and 625 individuals) from northwestern Kauai and the Waianae Mountains of Oahu (Service 1995a, 1995b, 1999a) (USFWS, 2016).	445 (USFWS, 2010)	No Mention	No Mention	High
Euphorbia herbstii	`Akoko	31	HI	Endangered	Significant decline since 1996 (USFWS, 2016)	Not Available	7 (USFWS, 2016)	Currently, all known remaining individuals of *C. herbstii* occur on State and private lands in gulches of the Kapuna to Pahole population unit in the northern Waianae Mountains (U.S. Army Garrison 2006d; 68 FR 35950) (USFWS, 2016).	~87 (USFWS, 2016)	No Mention	No Mention	High
Flueggea neowawraea	Mehamehame	32	HI	Endangered	Decline since 1994 (USFWS, 2016)	Declining (USFWS, 2013)	28 (USFWS, 2016)	Currently, *F. neowawraea* still exists throughout its recorded range except on Molokai, where the single known tree died before 1939. Only two trees are known to persist on the southern flank of Haleakala, East Maui. Five to seven trees are known on the island of Hawaii. On Oahu, *F. neowawraea* grows in gulches of the northern Waianae Mountains (Makua Implementation Team 2003). In addition, there are 60 to 80 trees known on Kauai (Makua Implementation Team 2003) (USFWS, 2016).	76 (USFWS, 2013)	No Mention	No Mention	High
Gardenia brighamii	Hawaiian gardenia (=Na`u)	6	HI	Endangered	Not Available	Not Available	4 (USFWS, 2014)	Current populations from Oahu, Lanai and Molokai. (NatureServe, 2015)	13 wild, ~100 reintroduced (USFWS, 2014)	No Mention	No Mention	High
Geranium arboreum	Nohoanu	7	HI	Endangered	Not Available	Not Available	5 (USFWS, 2011)	Current range is in East Maui. (NatureServe, 2015)	~50 (USFWS, 2011)	No Mention	No Mention	High

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Gouania hillebrandii	No common name	8	HI	Endangered	Not Available	Not Available	6 (NatureServe, 2015)	Current populations from Maui and Molokai. (NatureServe, 2015)	2,000-3,000 (NatureServe, 2015)	No Mention	No Mention	High
Gouania meyenii	No common name	9	HI	Endangered	Not Available	Not Available	7 (USFWS, 2010)	*Gouania meyenii* is found in Northern Waianae Mountains, Oahu and Kalalau Valley, Kauai. (NatureServe, 2015)	~100 (USFWS, 2010)	No Mention	No Mention	High
Hesperomannia arbuscula	No common name	33	HI	Endangered	Unknown (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	*Hesperomannia arbuscula* is endemic to the Waianae Mountains of Oahu and to West Maui (USFWS, 2016). Current range: Waianae Mountains of Oahu and West Maui. Historically, no additional range.	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Hesperomannia lydgatei	No common name	18	HI	Endangered	Not Available	Not Available	1 (USFWS< 2010)	Current range includes Wahiawa Mts. of Kauai. (NatureServe, 2015)	<100 (USFWS, 2010)	No Mention	No Mention	High
Hibiscadelphus distans	Kauai hau kuahiwi	10	HI	Endangered	Not Available	Not Available	1 natural and 3 re-introduced (USFWS, 2017)	*Hibiscadelphus distans* is currently found in Koaie Canyon, Kauai. (NatureServe, 2015)	>300 (10-20 wild) (USFWS, 2017)	No Mention	No Mention	High
Kadua haupuensis	No common name	34	HI	Endangered	Not Available	No wild individuals currently known (USFWS, 2015); 7 individuals observed in 2010 (USFWS, 2014)	0 (USFWS, 2015)	Currently, there are no known extant individuals of *K. haupuensis* in the wild (USFWS, 2015).	0 wild, 11 propagated (USFWS, 2015)	No Mention	No Mention	High
Kokia cookei	Cooke's koki`o	35	HI	Endangered	Short-term trends suggest declines of greater than 30%. (NatureServe, 2015)	Not Available	1 (0 wild) (USFWS, 2014)	Species is extirpated from its natural range. There are several individuals in cultivation in managed collections on Molokai (USFWS, 2014).	<10 (0 wild) (USFWS, 2014)	No Mention	Loss of pollinators (USFWS, 1998)	High
Labordia cyrtandrae	Kamakahala	11	HI	Endangered	Not Available	Not Available	1 - 5 (NatureServe, 2015)	Currently, there are 19 known *L. cyrtandrae* individuals remaining in six occurrences: Kaalaea (2 individuals), east Makalaea (4), north Mohiakea (1), north Haleauau (3), south Haleauau (3), and Mount Kaala (6). However, there is a great deal of under-surveyed potential	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High

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								habitat for this taxon on the upper slopes of Mt. Kaala. Occurrences of this plant are declining, and those that remain are small and widely dispersed, which puts the species at risk of extinction from naturally occurring events and/or lack of reproductive vigor (Service 1998a; U.S. Army 2003a; K. Kawelo, U.S. Army, pers. comm. 2003; J. Lau, HINHP, pers. comm. 2003).				
Labordia pumila	Kamakahala	12	HI	Endangered	Unknown (NatureServe, 2015)	Stable (NatureServe, 2015)	3 (USFWS, 2010a)	It occurs on the Alakai plateau, at the summit of Waialeale, along the Wainiha rim, and at Namolakama (Kauai) (USFWS, 2010b).	500 (USFWS, 2010a)	No Mention	No Mention	High
Labordia tinifolia var. lanaiensis	Kamakahala	36	HI	Endangered	Not Available	Not Available	1 - 3 (USFWS, 2012)	In recent times, the population has become more restricted to the southeastern end of the summit ridge of Lanaihale, which is privately owned land (USFWS, 2012).	300 - 800 (USFWS, 2012)	No Mention	No Mention	High
Melicope makahae	Alani	37	HI	Endangered	This species has declined precipitously and is extremely threatened (NatureServe, 2015)	Decline of 10 - 30 % (NatureServe, 2015)	4 (USFWS, 2012)	Currently north and west of the summit area of the Waianae Mountains on Oahu (USFWS, 2012).	< 200 individuals (USFWS, 2012)	No Mention	Lack of regeneration (USFWS, 2012)	High
Phyllostegia hispida	No common name	38	HI	Endangered	Presumed extinct in the wild until rediscovery in 1998 and 2005 (USFWS, 2016)	Not Available	4 (USFWS, 2016)	*Phyllostegia hispida* currently occurs entirely on public lands or lands that are managed by the State of Hawai‘i’s Department of Land and Natural Resources, Division of Forestry and Wildlife, Natural Area Reserve System in Pu‘u Ali‘i, and The Nature Conservancy’s Kamakou and Pelekunu Preserves (USFWS, 2013).	25 (USFWS, 2016)	No Mention	No Mention	High
Platydesma cornuta decurrens	No common name	39	HI	Endangered	Unknown (NatureServe, 2015)	Decline of 10 - 30% (NatureServe, 2015)	15 (USFWS, 2012)	On the island of Oahu in the state of Hawaii, scattered from Pahole to Palawai Gulch in the Waianae Mountains (USFWS, 2012).	259 - 309 individuals (USFWS, 2012)	No Mention	No Mention	High
Polyscias racemosa	No common name	21	HI	Endangered	Not Available	Increasing (USFWS, 2010)	17 (USFWS, 2010)	Occurrences are now known from Waiahuakua, Pohakuao, the left and right branches of Kalalau Valley, Nakeikionaiwi Valley, Awaawapuhi Valley spring, Honopu Valley, Nualolo Valley, Poomau Valley, Kawaiiki Valley, Koaie Canyon, Nonou, Haupu, and Keopaweo (USFWS, 2003).	114 wild, > 400 outplanted (USFWS, 2010)	No Mention	No Mention	Medium
Remya kauaiensis	No common name	40	HI	Endangered	Rediscovered in 1983	Not Available	17 (USFWS, 2010)	As of 2003, the species was located in Hipalau Valley, Awini Valley, Koaie Canyon, Mohihi Stream, the left branch of Kalalau Valley,	106 - 114 wild, 2,500 propagated	No Mention	No Mention	High

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					(USFWS, 2010)			Kalalau Valley Rim, Awaawapuhi and Nualolo Valleys, Kuia and Kawaiula Valleys, Makaha Valley and Makaha Ridge, Poopooiki Valley, Kauhao Valley, Waialae Valley, and Kaulaula Valley (Kauai) (USFWS 2003; 2010).	(USFWS, 2010)			
Remya mauiensis	Maui remya	22	HI	Endangered	Presumed extinct until rediscovery in 1971 (USFWS, 1997)	Increasing (USFWS, 2014)	6 (USFWS, 2014)	Current range includes West Maui (NatureServe, 2015). It occurs in Kauaula, Puehuehunui, Ukumehame, Papalaua, Pohakea, and Manawainui (USFWS 2012; 2014).	500 (USFWS, 2014)	No Mention	No Mention	Medium
Remya montgomeryi	No common name	41	HI	Endangered	Not Available	Declining (USFWS, 2010)	6 (USFWS, 2010)	It currently occurs in the left and right branches of Kalalau Valley, Koaie Canyon, and Kuia Valley within the Alakai Wilderness Preserve and Na Pali Coast State Park (GDSI 2000; HINHP Database 2000; Herbst 1988; K. Wood, in litt. 1999) (USFWS, 2003).	18 (USFWS, 2010)	No Mention	No Mention	High
Schiedea adamantis	Diamond Head schiedea	19	HI	Endangered	Decreasing (USFWS, 2013)	Not Available	1 - 5 (NatureServe, 2015)	Restricted to Diamond Head Crater, Oahu. (NatureServe, 2015)	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Schiedea apokremnos	Ma`oli`oli	42	HI	Endangered	Not Available	Extirpated at 3 locations, increase in known number of individuals (USFWS, 2010)	9 (USFWS, 2010)	It is currently known to occur at Nakeikianaiiwi, Pohakuao, Nualolo Valley, Haeleele Valley, and Kawaiiki Valley within the Na Pali Coast State Park and Puu Ka Pele Forest Reserve; Alealau and Polihale Ridge (Kauai) (USFWS, 2010).	750 - 850 (USFWS, 2010)	No Mention	No Mention	High
Schiedea diffusa ssp. macraei	No common name	43	HI	Endangered	Unknown	Not Available	Not Available	As of 2012, known only from the Kohala Mountains on the island of Hawai`i (USFWS 2012). (NatureServe, 2015)	Not Available	No Mention	No Mention	High
Schiedea haleakalensis	No common name	44	HI	Endangered	Unknown	Not Available	1 - 5 (NatureServe, 2015)	Endemic to crater of Haleakala, East Maui. (NatureServe, 2015)	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Schiedea hookeri	No common name	45	HI	Endangered	Unknown	Not Available	18 (USFWS, 2016)	Currently, this species occurs only in the Waianae Mountains (USFWS, 2016).	~420 individuals (USFWS, 2016)	No Mention	Lack of pollinators (USFWS, 2016)	High
Schiedea kaalae	No common name	46	HI	Endangered	Not Available	Not Available	10	*Schiedea* is a genus endemic to the Hawaiian Islands. Historic data indicate *Schiedea kaalae* was known from the north-central and south-	235	No Mention	No Mention	High

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								central Waianae Mountains and the northern Koolau Mountains of Oahu. When listed in 1991, there were five occurrences in the Waianae Mountains and two occurrences in the Koolau Mountains that together totaled less than 100 individuals (56 FR 55770). In 2003, eight population units totaling 24 to 25 individuals indicated a steady decline for this species (Makua Implementation Team 2003). The latest information available indicates an increasing in detection due to more diligent survey effort and augmentation, with 10 population units totaling 235 individuals located on Federal, State, and private lands (68 FR 35950) (Table SB 34). Of these, 62 individuals are naturally occurring and 173 are augmentations from greenhouse-propagated stock. A new population unit was recently discovered at Kahana, and additional individuals were discovered at the Makua population unit (U.S. Army Garrison 2005b). None of the population units have reached the numeric targets for stabilization (defined as 50 mature individuals for short-lived perennials).				
Schiedea lydgatei	No common name	13	HI	Endangered	Decreasing (USFWS, 2011)	Not Available	4 (USFWS, 2016)	Current range includes Eastern Molokai. (NatureServe, 2015)	> 200 (USFWS, 2016)	No Mention	No Mention	High
Schiedea membranacea	No common name	47	HI	Endangered	Decreasing (USFWS, 2010)	Not Available	1 - 5 (NatureServe, 2015)	Endemic to northwest Kauai. (NatureServe, 2015)	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Schiedea pubescens	Ma`oli`oli	48	HI	Endangered	Not Available	Not Available	Molokai: 1; Maui: 7 (USFWS, 2016)	This species, which is declining and extremely threatened, is known from 13 populations on Maui, Molokai, and Hawaii (Wood, in litt. 2001; Oppenheimer, in litt. 2006; HBMP 2008; Bakutis, in litt. 2010; Oppenheimer, in litt. 2010; Perlman, in litt. 2010).	Molokai: < 30 (USFWS, 2016)	No Mention	No Mention	High
Schiedea spergulina var. leiopoda	No common name	49	HI	Endangered	Unknown (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Current range includes southern Kauai. (NatureServe, 2015)	1 - 1000 individuals (NatureServe, 2015)	Pesticides (USFWS, 1995)	No Mention	High
Schiedea spergulina var. spergulina	No common name	50	HI	Threatened	Unknown (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Current range includes Waimea Canyon area of Kauai. (NatureServe, 2015)	2500 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	High

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Serianthes nelsonii	Hayun Iagu (=(Guam), Tronkon guafi (Rota))	51	GU, CNMI	Endangered	Not Available	Not Available	Not Available	*Serianthes nelsonii* is endemic to the islands of Guam and Rota (USFWS 1987, p. 4907). Recorded specimens on Guam were mostly from northern limestone forests, but a few trees were recorded in southern clay soils (USFWS 1994, p. 8).	50	No Mention	No Mention	High
Tinospora homosepala	No common name	52	GU	Endangered	Not Available	Not Available	3 (USFWS, 2015)	Known only on Guam (USFWS, 2015).	30 (USFWS, 2015)	No Mention	Lack of female plants (USFWS, 2015)	High
Vicia menziesii	Hawaiian vetch	14	HI	Endangered	Presumed extinct until rediscovery in 1974 (USFWS, 2012)	Declining (USFWS, 2012)	6 (USFWS, 2012)	During the past 150 years it had been known only from the northeastern slope of Mauna Kea (Warshauer and Jacobi 1982) (USFWS, 2012).	37 (USFWS, 2012)	No Mention	No Mention	High
Viola helenae	No common name	15	HI	Endangered	Unknown	Not Available	1 - 5 (NatureServe, 2015)	Current range: Wahiawa Mountains of Kauai; historically no additional range.	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Wilkesia hobdyi	Dwarf iliau	53	HI	Endangered	Unknown (USFWS, 2010)	Not Available	6 - 20 (NatureServe, 2015)	Endemic to west coast of Kauai.	1 - 1000 individuals (NatureServe, 2015)	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); NA=Not Applicable; HI=Hawaii; GU=Guam; CNMI=Commonwealth of Northern Marianas Islands

Risk to Individuals and Pollinators if exposed: The individual plants in this assessment group are estimated to experience up to a 12% decrease in dry weight if exposed to malathion on the following use sites, based on labeled application rates: orchards and vineyards, developed, nurseries, open space developed and Christmas trees. No effects are expected on other use sites.
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 pollinators or 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	Number	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
Alsinidendron lychnoides	Kuawawaenohu	23	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.00	High
Argyroxiphium kauense	Mauna Loa (=Ka'u) silversword	1	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No	Insect	29.52	High
Argyroxiphium sandwicense ssp. macrocephalum	`Ahinahina	2	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No	Insect	16.09	High
Argyroxiphium sandwicense ssp. sandwicense	`Ahinahina	24	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	12.42	Medium
Brighamia insignis	Olulu	16	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	Unknown	Insect, Bird	0.03	Medium
Brighamia rockii	Pua `ala	17	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	Unknown	Insect, Bird	8.25	Medium
Chamaesyce skottsbergii var. skottsbergii	Ewa Plains `akoko	3	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No	Insect	4.87	High
Clermontia oblongifolia ssp. brevipes	`Oha wai	4	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	No Mention	Insect, Bird	9.74	High
Clermontia oblongifolia ssp. mauiensis	`Oha wai	5	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	No Mention	Insect, Bird	5.48	High
Cyanea grimesiana ssp. grimesiana	Haha	25	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	Unknown	Insect, Bird	11.97	High
Cyanea grimesiana ssp. obatae	Haha	26	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	No Mention	Insect, Bird	8.56	High
Cyanea superba	Haha	27	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	No	Insect, Bird	26.99	High
Delissea subcordata	Oha	20	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Bird, Mammal	Unknown	Insect, Bird	17.55	High
Dubautia herbstobatae	Na`ena`e	28	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	27.33	High
Dubautia latifolia	Koholapehu	29	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	Unknown	Insect	0.00	High
Euphorbia haeleeleana	`Akoko	30	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	Unknown	Insect	11.56	High
Euphorbia herbstii	`Akoko	31	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	33.17	HIgh
Flueggea neowawraea	Mehamehame	32	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	6.09	High
Gardenia brighamii	Hawaiian gardenia (=Na`u)	6	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	3.13	High

Scientific Name	Common Name	Number	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
Geranium arboreum	Nohoanu	7	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect, Bird	17.05	High
Gouania hillebrandii	No common name	8	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.60	High
Gouania meyenii	No common name	9	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	9.11	High
Hesperomannia arbuscula	No common name	33	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Bird	13.55	High
Hesperomannia lydgatei	No common name	18	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	0.00	Medium
Hibiscadelphus distans	Kauai hau kuahiwi	10	HI	Yes (12%)	Medium	Biotic - Outcrosser	Unknown	No Mention	Bird	0.00	High
Kadua haupuensis	No common name	34	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.86	High
Kokia cookei	Cooke's koki`o	35	HI	Yes (12%)	Medium	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect, Bird	0.00	High
Labordia cyrtandrae	Kamakahala	11	HI	Yes (12%)	Medium	Biotic - Outcrosser	Biotic	No Mention	Insect, Bird	18.22	High
Labordia pumila	Kamakahala	12	HI	Yes (12%)	Medium	Biotic - Outcrosser	Biotic	No Mention	Insect, Bird	0.00	High
Labordia tinifolia var. lanaiensis	Kamakahala	36	HI	Yes (12%)	Medium	Biotic - Outcrosser	Biotic	No Mention	Unknown	0.00	High
Melicope makahae	Alani	37	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	32.98	HIgh
Phyllostegia hispida	No common name	38	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	11.41	High
Platydesma cornuta decurrens	No common name	39	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	20.39	High
Polyscias racemosa	No common name	21	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Selfing, Insect	0.39	High
Remya kauaiensis	No common name	40	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	0.00	Medium
Remya mauiensis	Maui remya	22	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	0.00	Medium
Remya montgomeryi	No common name	41	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	0.00	Medium
Schiedea adamantis	Diamond Head schiedea	19	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	0.00	Medium
Schiedea apokremnos	Ma`oli`oli	42	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.00	High
Schiedea diffusa ssp. macraei	No common name	43	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	7.99	High
Schiedea haleakalensis	No common name	44	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic	No Mention	Insect	32.88	Medium
Schiedea hookeri	No common name	45	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	Unknown	Insect	12.13	High
Schiedea kaalae	No common name	46	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	15.11	High
Schiedea lydgatei	No common name	13	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	1.66	High

Scientific Name	Common Name	Number	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
Schiedea membranacea	No common name	47	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	Unknown	Insect	0.00	High
Schiedea pubescens	Ma`oli`oli	48	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	5.32	High
Schiedea spergulina var. leiopoda	No common name	49	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.10	High
Schiedea spergulina var. spergulina	No common name	50	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.39	High
Serianthes nelsonii	Hayun Iagu (=(Guam), Tronkon guafi (Rota))	51	GU, CNMI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.00	High
Tinospora homosepala	No common name	52	GU	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	0.00	High
Vicia menziesii	Hawaiian vetch	14	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Biotic	No Mention	Insect	20.59	High
Viola helenae	No common name	15	HI	Yes (12%)	High	Biotic - Outcrosser	Abiotic, Insect	No Mention	Insect	0.00	High
Wilkesia hobdyi	Dwarf iliau	53	HI	Yes (12%)	High	Biotic - Outcrosser	Birds	No Mention	Insect	0.11	High

*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.

General Conservation Measures

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 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.

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 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. 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 3: Summary of Conclusions

Number	Scientific Name	Common Name	Location	Vulnerability Ranking	Risk Ranking	Exposure Ranking	Species Conclusion (J, NJ)*
1	*Argyroxiphium kauense*	Mauna Loa (=Ka'u) silversword	HI	High	High	Medium	NJ
2	*Argyroxiphium sandwicense ssp. macrocephalum*	`Ahinahina	HI	High	High	Medium	NJ
3	*Chamaesyce skottsbergii var. skottsbergii*	Ewa Plains `akoko	HI	High	High	Medium	NJ
4	*Clermontia oblongifolia ssp. brevipes*	`Oha wai	HI	High	High	Medium	NJ
5	*Clermontia oblongifolia ssp. mauiensis*	`Oha wai	HI	High	High	Medium	NJ
6	*Gardenia brighamii*	Hawaiian gardenia (=Na`u)	HI	High	High	Medium	NJ
7	*Geranium arboreum*	Nohoanu	HI	High	High	Medium	NJ
8	*Gouania hillebrandii*	No common name	HI	High	High	Medium	NJ
9	*Gouania meyenii*	No common name	HI	High	High	Medium	NJ
10	*Hibiscadelphus distans*	Kauai hau kuahiwi	HI	High	High	Medium	NJ
11	*Labordia cyrtandrae*	Kamakahala	HI	High	High	Medium	NJ
12	*Labordia pumila*	Kamakahala	HI	High	High	Medium	NJ
13	*Schiedea lydgatei*	No common name	HI	High	High	Medium	NJ
14	Vicia menziesii	Hawaiian vetch	HI	High	High	Medium	NJ
15	*Viola helenae*	No common name	HI	High	High	Medium	NJ
16	*Brighamia insignis*	Olulu	HI	High	Medium	Low	NJ
17	*Brighamia rockii*	Pua `ala	HI	High	Medium	Low	NJ
18	*Hesperomannia lydgatei*	No common name	HI	High	Medium	Low	NJ
19	*Schiedea adamantis*	Diamond Head schiedea	HI	High	Medium	Medium	NJ
20	*Delissea subcordata*	Oha	HI	Medium	High	Low	NJ
21	*Polyscias racemosa*	No common name	HI	Medium	High	Low	NJ
22	*Remya mauiensis*	Maui remya	HI	Medium	Medium	Low	NJ
23	*Alsinidendron lychnoides*	Kuawawaenohu	HI	High	High	Low	NJ
24	*Argyroxiphium sandwicense ssp. sandwicense*	`Ahinahina	HI	High	Medium	Low	NJ
25	*Cyanea grimesiana ssp. grimesiana*	Haha	HI	High	High	Low	NJ
26	*Cyanea grimesiana ssp. obatae*	Haha	HI	High	High	Low	NJ
27	*Cyanea superba*	Haha	HI	High	High	Low	NJ
28	*Dubautia herbstobatae*	Na`ena`e	HI	High	High	Low	NJ
29	*Dubautia latifolia*	Koholapehu	HI	High	High	Low	NJ

Number	Scientific Name	Common Name	Location	Vulnerability Ranking	Risk Ranking	Exposure Ranking	Species Conclusion (J, NJ)*
30	*Euphorbia haeleeleana*	`Akoko	HI	High	High	Low	NJ
31	*Euphorbia herbstii*	`Akoko	HI	High	High	Low	NJ
32	*Flueggea neowawraea*	Mehamehame	HI	High	High	Low	NJ
33	*Hesperomannia arbuscula*	No common name	HI	High	High	Low	NJ
34	*Kadua haupuensis*	No common name	HI	High	High	Low	NJ
35	*Kokia cookei*	Cooke's koki`o	HI	High	High	Low	NJ
36	*Labordia tinifolia var. lanaiensis*	Kamakahala	HI	High	High	Low	NJ
37	*Melicope makahae*	Alani	HI	High	High	Low	NJ
38	*Phyllostegia hispida*	No common name	HI	High	High	Low	NJ
39	*Platydesma cornuta decurrens*	No common name	HI	High	High	Low	NJ
40	*Remya kauaiensis*	No common name	HI	High	Medium	Low	NJ
41	*Remya montgomeryi*	No common name	HI	High	Medium	Low	NJ
42	*Schiedea apokremnos*	Ma`oli`oli	HI	High	High	Low	NJ
43	*Schiedea diffusa ssp. macraei*	No common name	HI	High	High	Low	NJ
44	*Schiedea haleakalensis*	No common name	HI	High	Medium	Low	NJ
45	*Schiedea hookeri*	No common name	HI	High	High	Low	NJ
46	*Schiedea kaalae*	No common name	HI	High	High	Low	NJ
47	*Schiedea membranacea*	No common name	HI	High	High	Low	NJ
48	*Schiedea pubescens*	Ma`oli`oli	HI	High	High	Low	NJ
49	*Schiedea spergulina var. leiopoda*	No common name	HI	High	High	Low	NJ
50	*Schiedea spergulina var. spergulina*	No common name	HI	High	High	Low	NJ
51	*Serianthes nelsonii*	Hayun Iagu (=(Guam), Tronkon guafi (Rota))	GU, CNMI	High	High	Low	NJ
52	*Tinospora homosepala*	No common name	GU	High	High	Low	NJ
53	*Wilkesia hobdyi*	Dwarf iliau	HI	High	High	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. While we expect some individual plants in this assessment group will experience reduced growth due to direct exposure to malathion, we do not anticipate this reduction in growth would have species-level effects.

For these species, we anticipate their high vulnerabilities and medium to high levels of risk to individuals or species is offset by low levels of usage of malathion, in most cases, as described below. For species with a portion of their range on Federal lands, we did not quantitatively evaluate use or usage on in these areas, but we assume only low levels of usage, per the rationale described in the Biological Opinion. For the non-Federal lands portion of the species ranges, we have limited information on past malathion usage in the Pacific Islands, and thus our estimation of usage and exposure on non-Federal lands contains a large degree of uncertainty. Briefly, we anticipate that usage in non-agricultural areas will be low (up to 5% of overlap in any given area). We anticipate that the available agricultural usage data, which is from a single year and does not distinguish between use categories, likely provides an upper bound of malathion usage for our analysis, particularly as it includes all insecticides. For the Pacific Islands as a whole, this usage is also anticipated to be low (~5% of agricultural lands treated across the islands as an upper bound for malathion), though we cannot predict the degree of usage in proximity to particular species' ranges. However, given that 95% of agricultural fields are not anticipated to be treated with insecticides, we assume a low probability that any individual plant will be in proximity to agricultural usage of malathion. We further discuss our assumptions and analysis of usage data on Federal lands and in

the Pacific Islands in the Usage section of this Opinion. (Due to the large number of species in this assessment group, we use the numbers assigned for the purpose of this analysis in the preceding table in our Assessment Group discussions below)

Species numbered 1-9, 11-15, and 19: These species are highly vulnerable based on their status, distribution and trends, high or medium risk posed by labeled uses across their ranges, and all have medium anticipated exposure to malathion within their ranges as described above, based on habitat type, even though overall anticipated usage is anticipated to be low.

Generally, the species in this sub-group have fewer than 10 populations, with a total estimated number of individuals ranging from less than 20 to approximately 29,000. Some are known from a single location, while others may occur on multiple islands. Species 2 is noted to be threatened by a loss in pollinator species caused by predation by non-native insects.

We anticipate high risk to individuals if exposed to malathion across the non-Federal portion of the species ranges, except for species number 19 which has a medium level of risk. Risk is related to reproduction through effects to pollinators and/or seed dispersers. The species in this assessment group rely on insect pollinators, and some species (4, 5, 7, and 10-12) also rely on bird pollinators. Insect pollinators are expected to experience high or medium levels of mortality across the non-Federal portions of the species range from exposure to malathion, while bird pollinators are also anticipated to experience medium levels of mortality from malathion exposure as indicated in Table 2 (Effects to Pollinators column). Most of the species rely on both abiotic (e.g., wind and water) and biotic (e.g., insect, bird, mammal) vectors for seed dispersal, giving these species the capability to reproduce successfully even in the absence of a portion of its biotic seed dispersal vectors. The exceptions are species 11 and 12, which rely only on biotic seed dispersal vectors, and species 19, which relies only on abiotic vectors. Thus, we anticipate adverse effects to individuals of the species in this assessment group related mainly to the loss of a portion of their pollinators, and also to the loss of seed dispersers, where applicable; we expect these losses would result in reduced reproductive success of the affected individual plants.

Due to the lack of robust use and usage data for the Pacific Islands, we further refine our analysis by considering the habitats the species are known or assumed to occupy. We are able more easily estimate exposure for species that occur within habitat types that place them either at a lower likelihood of exposure (e.g., within forested areas where malathion is not approved for usage and where drift from any adjacent application areas is less likely to enter) or at a higher likelihood of exposure (e.g., within or adjacent to pastures or agricultural land); however, the medium category is more difficult to discern. A medium ranking was assigned to species found in shrubland or grassland and to those species without precise habitat descriptors that provided indication of either low or high anticipated exposure. A medium level of anticipated exposure indicates that it is likely that individuals of these species, and most importantly their pollinators and biotic seed dispersal vectors, will be exposed to malathion within some non-Federal portion of their ranges. However, we anticipate usage to be low (e.g., <5%, as noted above), further reducing the likelihood of exposure of individuals to the effects described above. However, we anticipate implementation of the label restrictions described in the conservation measures listed above will reduce the risk of exposure to both pollinators and seed dispersers and the resultant reproductive effects to the plant species. For example, new restrictions prohibit application on crops in certain UDLs three days prior to bloom, during bloom, and until petal fall is complete. Given that most pollinating insects are likely to be attracted to crops in bloom and thus more likely to be present in agricultural areas during these times, avoiding application during bloom is anticipated to reduce exposure and resultant mortality of pollinators important for these plants.

While we anticipate that the proposed action will result in adverse reproductive effects to small numbers of individuals over the duration of the proposed action, we do not anticipate species-level effects due to the low anticipated levels of exposure. Implementation of the conservation measures will further reduce the likelihood of exposure and effects of the species, their pollinators, and seed dispersers. We therefore do not anticipate that the proposed action would appreciably reduce survival and recovery of these species in the wild.

Species numbered 20-22: These species have medium vulnerabilities based on their status, distribution and trends; medium or high risk posed by labeled uses across their ranges; and all have low anticipated exposure to malathion within their ranges as described above.

All three of these species occur in moist forested habitat, and on steep slopes within forested habitat. Each is restricted to a single island, with numbers of populations between 6 and 17 and total numbers of individuals in the wild ranging from 72 to 500. These species all rely on biotic pollination, and all three are pollinated by insects. Species number 20 is also pollinated by birds, and species number 21 also self-pollinates. Loss of pollinators is described as a specific concern for species number 20, *Delissea subcordata*.

We anticipate medium or high risk to individuals if exposed to malathion across the non-Federal portion of the species ranges. Risk is related to reproduction through effects to pollinators and/or seed dispersers. Insect pollinators are expected to experience medium or high levels of mortality across the non-Federal portions of the ranges of these species from exposure to malathion. Bird pollinators are also anticipated to experience medium or high mortality from malathion exposure as indicated in Table 2 (Effects to Pollinators column). Species 21 can rely on self-fertilization for reproduction, thus decreasing its reliance on pollinators for reproduction and survival. The species in this sub-group 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. Thus, we anticipate adverse effects to individuals of the species in this assessment group related mainly to the loss of a portion of their pollinators, and also to the loss of seed dispersers, where applicable, both of which we anticipate would result in reduced reproductive success of the affected individual plants.

While we anticipate some adverse effects to individuals of these species caused mainly by a reduction in insect and bird pollinators and also by a reduction in biotic seed dispersers, malathion is not registered for use in forests where these species are found. We assume there would also be low levels of spray drift within a forest given its physical structure and ability to block drift. As a result, we anticipate a low exposure to malathion within the non-Federal portions of their ranges for these species, based on the species' habitat. Furthermore, we anticipate usage to be low (e.g., <5%, as noted above), further reducing the likelihood of exposure individuals to the effects described above. We anticipate the label restrictions per the conservation measures described above will further reduce the risk of exposure to both pollinators and seed dispersers and the resultant reproductive effects to the plant species. For example, residential uses of malathion are now limited to two applications per year (reduced from as many as necessary) and to spot treatments only, reducing the application footprint and likelihood of spray drift within developed and open space developed areas.

While we anticipate that the proposed action will result in adverse reproductive effects to small numbers of individuals over the duration of the proposed action, we do not anticipate species-level effects due to the low level of anticipated exposure and the conservation measures that will be implemented. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the species in this sub-group in the wild.

Species numbered 16-18 and 23-53: These species all have high vulnerabilities based on their status, distribution and trends; high or medium risk posed by labeled uses across their ranges; and low anticipated exposure to malathion within the non-Federal portion of their ranges as described above.

All of the species in this assessment group occur in either in forested habitat, or on steep slopes or cliff faces. The majority of species within this group have fewer than ten populations, and the remainder have no more than 28 populations, with a range in numbers of individuals from no known individuals in the wild, to up to 10,000. Most of the species within this group currently occur on one island, but some are found on multiple islands. These species all rely on biotic pollination, and are pollinated by insects with the exception of species numbered 25-27 and 35, which are also pollinated by birds, species number 33, which is pollinated only by birds, and species number 36, for which we do not have sufficient information to determine the pollination vector. Loss of pollinators has been described as a specific concern for species numbered 25-27, 35, and 45.

We anticipate medium or high risk to individuals if exposed to malathion across the non-Federal portion of the species ranges. Risk is related to reproduction through effects to pollinators and/or seed dispersers. Insect pollinators are expected to experience medium or high levels of mortality across the non-Federal portions of the ranges of these species from exposure to malathion. Bird pollinators are also anticipated to experience medium or high mortality from malathion exposure as indicated in Table 2 (Effects to Pollinators column). The species in this assessment group 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. The exceptions are species numbered 36 and 53, which rely on biotic vectors and birds, respectively.

While we anticipate some adverse effects to these species caused mainly by a reduction in insect and bird pollinators and also by a reduction in biotic seed dispersers, malathion is not registered for use in forests and we anticipate low exposure to individuals from spray drift within a forest given its physical structure and ability to block drift. Cliffs, sand dunes and bogs on the islands tend to be isolated physically from other land use areas, thus we anticipate low exposure to individuals of species from direct malathion use and spray drift within the non-Federal portions of their range, based on species habitats. Furthermore, we anticipate usage to be low (e.g., <5%, as noted above), further reducing the likelihood of exposure individuals to the effects described above. Moreover, we anticipate the conservation measures described above will further reduce the risk of exposure to both pollinators and seed dispersers and the resultant reproductive effects to the plant species. For example, new restrictions prohibit application on crops in certain UDLs three days prior to bloom, during bloom, and until petal fall is complete. Given that most pollinating insects are likely to be attracted to crops in bloom and thus more likely to be present in agricultural areas during these times, avoiding application during bloom is anticipated to reduce exposure and resultant mortality of pollinators important for these plants.

Thus, we do not anticipate that pollinator and seed disperser mortality would cause species-level reproductive effects due to low anticipated levels of exposure, and the conservation measures that will be implemented will further reduce the likelihood of exposure and effects to these species, their pollinators, and seed dispersers. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of these species in the wild.

Species number 10, Kauai hau kuahiwi

The Kauai hau kuahiwi is a long-lived perennial shrub or small tree endemic to Koaie Canyon on the island of Kauai. Koaie Canyon is on State land within the Na Pali Kona Forest Reserve. Given its endemism and low number of populations, this species has a high vulnerability ranking. The species is critically endangered, with only a single wild population consisting of 10 to 20 individuals remaining. This wild population occurs on a cliff that is only accessible by rappelling (2017 5-year Status Review). However, propagation and outplanting efforts have been quite successful and there are now three re-introduced populations of over 300 individuals located on lands managed for the protection of this species . Major threats include feral goat browsing, erosion, stochastic events such as fires and hurricanes, competition with invasive introduced plant species, and reduced reproductive vigor due to the small number of founder individuals (USFWS 2017 5-year Status Review).

The species has a high level of risk posed by labeled uses of malathion across its range (no portion of its range occurs on Federal lands) due mainly to the fact it is likely an obligate outcrosser and requires pollen transport between individual plants in order to reproduce successfully (2019 Draft Kauai Islandwide Recovery Plan). The Kauai hau kuahiwi possesses narrow, tubular, curved flowers that are likely pollinated by the native bird family of honey-eaters and the sub-family of honeycreepers. Insect pollinators for this species have not been documented (2019 Draft Kauai Islandwide Recovery Plan). Bird pollinators are anticipated to experience medium levels of mortality from malathion exposure as indicated in Table 2 (Effects to Pollinators column). The species may rely on both abiotic and biotic vectors for seed dispersal and may therefore be able to reproduce successfully even in the absence of a portion of its biotic seed dispersal vectors. We anticipate adverse effects to the species related mainly to the loss of a portion of its avian pollinators, and also to the loss of a portion of seed dispersal species, both affecting reproductive success.

We anticipate a medium level of exposure to individual plants and their pollinators within the non-Federal portion of the species range, based on this species' habitat (Table 2). The medium ranking was assigned to species found in shrubland or grassland and those species without habitat descriptors that provided indication of either low or high anticipated exposure. However, given this species occurs entirely within protected areas and the only natural population occurs on an inaccessible cliff, we anticipate a low level of exposure to malathion for this species. We also anticipate usage to be low (e.g., <5%, as noted above), reducing the likelihood of exposure of individuals and avian pollinators to the effects described above. Furthermore, we anticipate the conservation measures described above will further reduce the risk of exposure to both pollinators and seed dispersers and the resultant reproductive effects to the plant species. Thus, we do not anticipate species level effects to the Kauai hua kuahiwi, and do not anticipate that the proposed action would appreciably reduce survival and recovery of the Kauai hau kuahiwi in the wild.