Integration and Synthesis Summary for Plants, CONUS
Assessment Group 10: Dicots with biotic pollination vectors able to use self-fertilization and/or asexual reproduction at least partially to maintain populations over time

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 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 use biotic vectors to accomplish pollination, but can also rely on self-fertilization or asexual reproduction at least partially in order to 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	Number	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
Acanthomintha ilicifolia	San Diego thornmint	11	Threatened	Decline of 80-90% (NatureServe, 2015)	Not Available	55 (USFWS, 2009)	Only known from coastal San Diego County, California and adjacent Baja California Norte, Mexico (NatureServe, 2015).	150,000 - 170,000 (USFWS, 2009)	No Mention	No Mention	Medium
Aconitum noveboracense	Northern wild monkshood	36	Threatened	Variable (NatureServe, 2015)	Variable to declining (NatureServe, 2015	81 - 300 (NatureServe, 2015)	The species is considered a distinct species, but recent studies indicate that it may be conspecific with *Aconitum columbianum*. It is known only from three isolated geographic regions: the Catskill Mountains of New York, northeastern Ohio, and the Driftless Area (unglaciated portion) of northeast Iowa and southwest Wisconsin. The majority of the range of this species is in the Driftless area of Iowa (Mabry et al. 2009). (NatureServe, 2015)	2500 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Amphianthus pusillus	Little amphianthus	37	Threatened	Declining (USFWS, 2008)	Declining (USFWS, 2008)	21 - 80 (NatureServe, 2015)	Granite outcrop areas of Piedmont Alabama, Georgia, and South Carolina. (NatureServe, 2015)	10,000 to >1,000,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Arabis hoffmannii	Hoffmann's rock-cress	12	Endangered	Decline of 30-50% (NatureServe, 2015)	Increasing (USFWS, 2011)	10 (USFWS, 2011)	Currently, the species is known from Santa Cruz Island and Santa Rosa Island (NatureServe, 2015).	~244 (NatureServe, 2015)	No Mention	No Mention	Medium
Arabis macdonaldiana	McDonald's rock-cress	38	Endangered	Decline of 30-50% (NatureServe, 2015)	10 - 30% decline (NatureServe, 2015)	34 (NatureServe, 2015)	Recent genetic work indicates that *Arabis macdonaldiana* is confined to Red Mountain, Mendocino County, California (USFWS, 2013).	> 10,000 (USFWS, 2013); 17,500	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.

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								(NatureServe, 2015)			
Arenaria paludicola	Marsh Sandwort	55	Endangered	Declining (most populations extirpated) (USFWS, 2008)	Declining (USFWS, 2008)	1 (USFWS, 2008)	Since it was listed, *Arenaria paludicola* was rediscovered at Oso Flaco Lake in 1998 with this site now being the only known extant, wild population for this species (CNDDB 2007) (USFWS, 2008).	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Asclepias welshii	Welsh's milkweed	13	Threatened	Short-term trends suggest a decline of 10 to 30% (NatureServe, 2015)	Not Available	8 (USFWS, 2015)	Welsh's milkweed is endemic to active sand dunes of south central Utah (Kane County), northern Arizona (Coconino County) and the Navajo Indian Reservation in Arizona. (USFWS, 2015b)	~70,000 above-ground stems (NatureServe, 2015)	No Mention	No Mention	High
Astragalus applegatei	Applegate's milk-vetch	56	Endangered	Presumed extirpated until 1983 (USFWS, 2009); 10 - 70% decline (NatureServe, 2015)	Not Available	6 (USFWS, 2009)	Found only in Lower Klamath Basin, e.g., near the city of Klamath Falls, in Klamath County, Oregon. Perhaps in adjacent Siskiyou County, California ('to be sought', Barneby 1964) (NatureServe, 2015). Applegate's milk-vetch is currently known to be extant at three large occurrences, Ewauna Flats Preserve, Collins Tract, and the Klamath Falls Airport, and three smaller ones at Washburn Way-Railroad, Miller Island, and Worden (USFWS, 2009).	33,000 (USFWS, 2009)	No Mention	No Mention	High
Astragalus brauntonii	Braunton's milk-vetch	57	Endangered	Not Available	Not Available	20 (USFWS, 2009)	Inhabits the foothills bordering the Los Angeles plain, from the Santa Monica, Santa Ana and San Gabriel Mtns. Los Angeles, River- side, Ventura and Orange counties, California (NatureServe, 2015). Only occurs in five disjunct geographic areas in Ventura, Los Angeles, and Orange Counties, California (USFWS, 2009).	Variable; tens to thousands per population, depending on disturbance cycle (USFWS, 2009)	No Mention	No Mention	High
Astragalus phoenix	Ash meadows milk-vetch	14	Threatened	Not Available	Improving (USFWS, 2009)	6 (USFWS, 2009)	Occurs in a 7 x 3 mile area in Ash Meadows, Nye Co., Nevada (NatureServe, 2015). The range of the species encompasses the Ash Meadows National Wildlife Refuge and adjacent Bureau of Land Management and private lands (USFWS, 2009).	~11,643 (USFWS, 2009)	No Mention	No Mention	Medium
Astragalus tener var. titi	Coastal dunes milk-vetch	58	Endangered	Decline of 70 - 90% (NatureServe, 2015)	10 - 30% decline (NatureServe, 2015)	1 (NatureServe, 2015))	Today it is only verified at one area in Monterey County. The total known range in the 3 areas adds up to about 270 sq mi (NatureServe, 2015).	Variable; 100 - 7,000 depending on climatic	No Mention	No Mention	High

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								conditions (USFWS, 2009)			
Berberis pinnata ssp. insularis	Island Barberry	15	Endangered	Decline of 70-90% (NatureServe, 2015)	Not Available	5 (USFWS, 2013)	Occurs on Santa Cruz Island (Channel Islands, CA) (NatureServe, 2015).	5 (USFWS, 2013)	No Mention	No Mention	High
Bonamia grandiflora	Florida bonamia	39	Threatened	Declining (NatureServe, 2015)	Declining (USFWS, 2008)	110 (NatureServe, 2015)	*Bonamia grandiflora* is a Florida endemic restricted to the xeric, white sand scrub (or its edges) in the center of the peninsula. Florida Natural Area Inventory data reports it from Hardee, Highlands, Lake, Marion, Orange and Polk Counties and it was collected in Manatee (1916), Osceola (1938), Sarasota (1878) and Volusia (1900) Counties years ago (Myint, Ward, 1968). (NatureServe, 2015)	1000 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Campanula robinsiae	Brooksville bellflower	59	Endangered	Not Available	Decreasing (USFWS, 2010)	4 - 5 (USFWS, 2010)	Additional surveys in 1983 found this species at two additional sites in Hernando County, Burns Prairie and on private property known as the Young site both within the Chinsegut Hill area. In 2006, *C. robinsiae* was found outside the known historic range at two sites in Hillsborough River State Park in Hillsborough County. Another site was found at the State Park in 2009 (Peterson 2007; Gandy, FDEP, personal communication, 2009) (USFWS, 2010).	1 - 2500 (NatureServe, 2015)	No Mention	No Mention	High
Chionanthus pygmaeus	Pygmy fringe-tree	1	Endangered	Not Available	Not Available	Not Available	Pygmy fringe tree occurs in Seminole, Lake, northwestern Osceola, Polk, and Highlands Counties in central Florida. Wunderlin and Hansen (2004) have recently added the east side of Tampa Bay (Hillsborough, Manatee, and Sarasota Counties) to its distribution. Detailed information on localities and habitats is not yet available. In central Florida, pygmy fringe tree is known from west of Lake Apopka in Lake County, northwestern Osceola County, and the Lake Wales Ridge (LWR) in Polk and Highlands counties. It is no longer found in its historic habitat on the Mount Dora Ridge. One of the largest known populations is at the Carter Creek tract of LWR National Wildlife Refuge (NWR) in Highlands County, where it occurs with turkey oak (*Quercus laevis*) and scattered longleaf pine (*Pinus palustris*) with an understory with abundant scrub palmetto (*Sabal etonia*). Experimental prescribed fires and reintroductions of Florida ziziphus (*Ziziphus celata*) have been conducted	Not Available	No Mention	No Mention	High

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							here by Archbold Biological Station in a project like the one underway at The Nature Conservancy's Tiger Creek Preserve. Pygmy fringe tree is represented at Tiger Creek Preserve by thirteen populations with few to numerous individuals, which have been mapped. Approximately 75 percent of the individuals occur in yellow sand scrub at the extreme northwestern edge of the preserve. The remaining individuals are scattered throughout xeric hammocks. Because of the stability of this plant's populations with and without fire, monitoring of this species consists only of mapping of individuals during complete surveys, which are conducted throughout the preserve every 5 years Bea Pace-Aldana of The Nature Conservancy (in litt., March 2005). Pygmy fringe tree is protected in Polk County at Horse Creek Scrub (South Florida Water Management District and Southwest Florida Water Management District), Snell Creek (LWR NWR), A. D. Broussard Catfish Creek State Park, Saddle Blanket Lakes and Tiger Creek Preserve (TNC), Arbuckle and Walk in Water tracts of LWR State Forest; in Highlands County at Flamingo Villas (LWR NWR) and Lake Apthorpe (LWR Wildlife and Environmental Area). It is maintained as part of the National Collection of Endangered Plant Species at Bok Tower Gardens. Information is being gathered on the effects of hurricane Charley in August 2004. The Lake Wales Ridge State Forest near Avon Park, Florida suffered only minor wind damage to the vegetation and facilities were undamaged. The Hickory Lake scrub and Saddle Blanket Lakes suffered minor wind damage, including fallen oak limbs and snapped sand pines. In general, the shrub layer was unaffected. Plants in cultivation at the Historic Bok Sanctuary survived, although nearby buildings were heavily damaged.				
Chorizanthe robusta var. robusta	Robust spineflower	40	Endangered	Not Available	Not Available	11 (USFWS, 2010)	Currently, there are 11 populations in Santa Cruz County over a range of approximately 21 miles (33.8 km). (USFWS, 2010)	Not Available	No Mention	No Mention	Medium
Cirsium vinaceum	Sacramento Mountains thistle	16	Threatened	Not Available	10 - 30% decline (NatureServe, 2015)	~20 (NatureServe, 2015)	The range occurs approximately 6 mi northeast to 17 mi south of Cloudcroft. Greater than 95% of the known thistle habitats occur on the Lincoln National Forest (USFWS, 2010).	100,000 - 1,000,000 individuals (NatureServe, 2015)	Pesticides (USFWS, 2010)	No Mention	High

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Clarkia franciscana	Presidio clarkia	60	Endangered	Declining	Declining	2	There are two extant subpopulations of *Presidio clarkia*: one at the San Francisco Presidio, and one experimental population that was introduced to the coastal bluffs at the Presidio in the fall of 2008. All of the subpopulations in the Presidio are currently protected on public land owned by the National Park Service. There are seven extant subpopulations of *Presidio clarkia* that occur within a half mile of each other at the wildland-urban interface, and in an adjacent residential area of the Oakland Hills. Only one of these subpopulations is protected on public land owned by the East Bay Regional Park District at Redwood Regional Park (USFWS 2010).	unknown	No Mention	Loss of pollinators (USFWS, 2010)	High
Clarkia imbricata	Vine Hill clarkia	61	Endangered	Increasing (USFWS, 2015)	Not Available	2 (USFWS, 2011)	Vine Hill Area, Sonoma County, California. (NatureServe, 2015)	5,000 (NatureServe, 2015)	No Mention	No Mention	High
Clematis socialis	Alabama leather flower	62	Endangered	Not Available	Stable (USFWS, 2010)	5 (USFWS, 2010)	St. Clair, Cherokee and Etowah Counties, northeastern Alabama. There are a few occurrences too from Floyd County, Georgia (Tom Patrick pers. comm.) (NatureServe, 2015).	Not Available	No Mention	No Mention	High
Clitoria fragrans	Pigeon wings	8	Threatened	Not Available	Not Available	21 - 80 (NatureServe, 2015); 77 (USFWS, 2016)	Fantz (1977) and Wunderlin et al. (1980) listed records from Lake, Osceola, Orange, Polk, and Highlands Counties. Populations in Osceola and Orange Counties have apparently been lost, thereby reducing the historic range of the species. Along with other central Florida scrub plants, *C. fragrans* has experienced major habitat loss to agriculture and residential development. Pigeon wings occurs in a range of xeric upland habitats on the Lake Wales, Winter Haven, and Bombing Range Ridges and on xeric upland sites west of Bombing Range Ridge within APAFR. On the southern third of theLWR (i.e., the part within Highlands County), it occurs primarily in sandhill and oak-hickory scrub (Menges et al. 2007b). On APAFR, it occurs primarily in sandhill and oak scrub (S. Orzell, APAFR, pers. comm. 2008). Pigeon wings is a soil generalist, occurring on a yellow, white, and gray sands (Menges et al. 2007b; S. Orzell, pers. comm. 2008).	1000 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Cordylanthus maritimus ssp. maritimus	Salt marsh bird's-beak	41	Endangered	Decline of >30% (NatureServe, 2015)	Not Available	37 (USFWS, 2009)	*Chloropyron maritimum* subsp. *maritimum* is currently known to persist in seven coastal salt marshes: San Diego County at Tijuana Estuary (separated into Border Field State Park and Tijuana Slough NWR), Naval Radar Receiving Facility (NRRF), and Sweetwater Marsh Unit	30,000 (highly variable) (NatureServe, 2015)	No Mention	No Mention	Medium

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							of San Diego Bay NWR; Orange County at Upper Newport Bay (State) Ecological Reserve; Ventura County at Naval Base Ventura County, Point Mugu; Santa Barbara County at Carpinteria Salt Marsh; San Luis Obispo County at Morro Bay. (USFWS, 2009)				
Coryphantha scheeri var. robustispina	Pima pineapple cactus	63	Endangered	Not adequately assesssed, but considered to have declined between 1997 and 2003 data.	Not adequately assessed, but considered to have declined between 1997 and 2003 data.	Not adequately assessed.	The precise geographic distribution of the three subspecies of *Coryphantha scheeri* is a matter of debate, but the subspecies *C. scheeri* var. *robustispina* (*C. robustispina ssp. robustispina*) is found in the following general areas: south-central Arizona (Pima and Santa Cruz counties) and northern Sonora, Mexico.	Not adequately assessed.	No Mention	No Mention	High
Coryphantha sneedii var. leei	Lee pincushion cactus	64	Threatened	Not Available	Not Available	6 (USFWS, 2015)	Occurs in the Guadalupe Mountains (Eddy County) of New Mexico (NatureServe, 2015). This subspecies includes individuals from six canyons scattered in populations of low abundance over approximately 22 kilometers (14 miles) of the Guadalupe Mountains including BLM lands (Carlsbad District) (USFWS, 2015).	1,000 - 2,000 (USFWS, 1986)	No Mention	No Mention	High
Coryphantha sneedii var. sneedii	Sneed pincushion cactus	65	Endangered	Not Available	Not Available	20 (USFWS, 1986)	It occurs in western Texas and nearby southern New Mexico (between El Paso and Las Cruces) (NatureServe, 2015). It possibly occurs in the Guadalupe Mountains (USFWS, 2015).	Possibly > 100,000 (USFWS, 1986)	No Mention	No Mention	High
Cycladenia humilis var. jonesii	Jones Cycladenia	17	Threatened	Unknown (NatureServe, 2015)	Not Available	26 (USFWS, 2008)	The five Jones cycladenia complexes include: Joe Hutch Creek, San Rafael, Moab, and Greater Circle Cliffs in Utah, and Pipe Springs in Arizona (USFWS, 2008).	1,100 (USFWS, 2008)	No Mention	No Mention	Medium
Dalea foliosa	Leafy prairie-clover	42	Endangered	> 45% decline (NatureServe, 2015)	Stable to declining (USFWS, 2015)	21 - 80 (NatureServe, 2015)	Mesic dolomite river-terrace prairies of northeastern Illinois, Middle Tennessee Limestone Glades, northern Alabama Limestone Glades. In Tennessee, occurs on only 13 USGS 7.5' quads in seven counties of the Central Basin. (NatureServe, 2015)	Unknown (NatureServe, 2015)	No Mention	No Mention	Medium
Dicerandra christmanii	Garrett's mint	2	Endangered	Declining (2009 5 year review)	Not Available	Four occurrences	Garrett's mint has an extremely small range – known from five populations, all in Highlands County, Florida. In the most recent FNAI (FL Natural Areas Inventory) Element Tracking Summary, Garrett's mint was known from 4 occurrences, 1 of which is on a managed area (Flamingo Villas Unit of the Lake Wales Ridge National Wildlife Refuge). The Service is aware of a thriving population on private land on a site known as Sebring East Railroad Scrub. The remaining occurrences were located on private land, and their status is uncertain but	3891	No Mention	No Mention	High

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							likely extirpated due to habitat loss to development at these sites (2019 Lake Wales Ridge Plants Recovery Plan Amendment).				
Dudleya abramsii ssp. parva	Conejo dudleya	66	Threatened	Stable (inferred from USFWS, 2015)	Stable (inferred from USFWS, 2015)	14 (USFWS, 2015)	Known locations are in a narrow band of recorded occurrences along a 10-mile stretch of land from the western portion of the Simi Hills, through Mountclef Ridge, to the Conejo Grade in Ventura County, California (USFWS, 2015b).	~150,000 individuals (USFWS, 2015)	No Mention	No Mention	High
Dudleya stolonifera	Laguna Beach liveforever	67	Threatened	Not Available	Not Available	6 (USFWS, 2010)	*Dudleya stolonifera* was historically found only in Orange County, California. At listing, the species was found in six occurrences near Laguna Beach (USFWS 1998, p. 54939). Historical occurrences were restricted between Laguna Canyon to the north and Aliso Canyon to the south, an area of approximately 10 sq. km (3.9 sq. mi). Since listing, no new occurrences have been reported. All six of the historical occurrences are considered extant. (USFWS, 2010)	~30,000 (USFWS, 2010)	No Mention	No Mention	High
Echinacea laevigata	Smooth coneflower	43	Endangered	Decline of 30-70% (NatureServe, 2015)	Stable (USFWS, 2011)	68 (USFWS, 2011)	Current range: Georgia, South Carolina, North Carolina, Virginia. Reports from Alabama and Arkansas are believed to have been misidentifications (Gaddy 1991); also an apparent false report from Maryland (NatureServe, 2015).	2500 - 100,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Erigeron rhizomatus	Zuni fleabane	18	Threatened	Not Available	Not Available	39 (USFWS, 2007)	Occurs in the Datil and Sawtooth Mountains in northern New Mexico. McKinley and Catron counties in the Cibola National Forest, and some on Bureau of Land Management public land in Catron County. Also found in Arizona on the east side of the Chuska Mountains in June 1999 (Sue Schuetze pers. comm. to Eric Nielsen 6/2000) (NatureServe, 2015).	2500 - 100,000 individuals (NatureServe, 2015)	No Mention	No Mention	Low
Eriodictyon altissimum	Indian Knob mountain balm	68	Endangered	Stable (USFWS, 2009)	Not Available	Not Available	Known from the following locations in California: Broderson, Hazard Canyon, Morro Dunes, and Indian Knob. They are found within a few square miles of each other, from the south side of the community of Los Osos to the north end of Montai'ia de Oro State Park. A sixth stand is found 15 miles to the southeast on Indian Knob, between San Luis Obispo and Arroyo Grande (USFWS, 1998)	6 (USFWS, 1998)	No Mention	No Mention	High
Eriogonum gypsophilum	Gypsum wild-buckwheat	69	Threatened	Not Available	Stable (USFWS, 2007)	3 (USFWS, 2007)	Known only from Eddy County, New Mexico at Seven Rivers, Black River, and Ben Slaughter Draw. There is a false report from Hay Hollow (USFWS 2007; NatureServe, 2015).	37,730 - 49,098 (inferred from USFWS,	No Mention	No Mention	High

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								2007; NatureServe, 2015)			
Eriogonum kennedyi var. austromontanum	Southern mountain wild-buckwheat	70	Threatened	Not Available	Not Available	10 (USFWS, 2015)	*Eriogonum kennedyi var. austromontanum* is found in pebble plain habitat in the northeastern San Bernardino Mountains of southwest San Bernardino County. (USFWS, 2015)	Not Available	No Mention	No Mention	High
Eriogonum ovalifolium var. williamsiae	Steamboat buckwheat	71	Endangered	Long-term trends indicate a decline of >30% to an increase of 25%, whereas short-term trends indicate a decline of <30% to a relatively stable population (NatureServe, 2015)	Not Available	1 (NatureServe, 2015)	It is confined to about 127 acres in the vicinity of Steamboat Hot Springs, southern Washoe County, Nevada, U.S.A. (Reveal, 1981; USFWS, 1995; Archibald et al., 2001). (NatureServe, 2015)	200,000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Eriogonum pelinophilum	Clay-Loving wild buckwheat	3	Endangered	Unknown (NatureServe, 2015)	Relatively stable (NatureServe, 2015)	14 (USFWS, 2009)	Estimated range is 420 square kilometers. Imprecisely reported occurrences are not included (NatureServe, 2015). The plants extend from near Lazear, east of Delta on the northern end of the species' range, to the southeastern edge of Montrose in Delta and Montrose Counties, Colorado (USFWS, 2009).	~278,000 (USFWS, 2009)	Herbicide Use (USFWS, 2009)	No Mention	High
Eryngium cuneifolium	Snakeroot	4	Endangered	Not Available	Not Available	Not Available	The distribution of snakeroot is in southern Highlands County, Florida, near the town of Lake Placid. It occurs only on the southern Lake Wales Ridge. The northernmost sites were at several sites in and around the town of Sebring, Highlands County, especially on the sand dune along the south side of Lake Jackson (Wunderlin et al. 1981); this area was developed by about 1990. All other sites are in an area about 39 km long from the southern side of Josephine Creek to the southern tip of the Lake Wales Ridge. Christman (1988) reported only about 20 localities, but even this number is	Not Available	No Mention	No Mention	High

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							misleading since he divided several larger sites. A survey of properties under consideration for purchase by the State did not find any new localities (Schultz et al. 1999).				
Erysimum menziesii	Menzies' wallflower	72	Endangered	Unknown (USFWS, 2008)	30 - 50% decline (NatureServe, 2015)	16 (USFWS, 2008); 15 (NatureServe, 2015)	It is distributed predominately in the nearshore dune community of four disjunct dune systems in northern and central California: Humboldt Bay in Humboldt County, Ten Mile River in Mendocino County, the Marina Dunes at Monterey Bay, and the Monterey Peninsula in Monterey County (Price 1993) (USFWS, 2008).	Unknown (USFWS, 2008); 33,300 (NatureServe, 2015)	No Mention	No Mention	High
Fremontodendron mexicanum	Mexican flannelbush	44	Endangered	Not Available	Increasing (USFWS, 2009)	3 (inferred from USFWS, 2009)	Since listing, two additional occurrences have been discovered in the United States (both within 2 miles of the known occurrence), and one additional occurrence has been located in Mexico. It is now known to occur in three canyons in the United States and one canyon in Baja California (USFWS, 2009). Found in Imperial, Kern, Monterey, and San Diego Counties, California and Baja California, Mexico (Smith and Berg, 1988). According to the California Natural Diversity Database, *Fremontodendron mexicanum* is distributed from the border south to Arroyo Seco (North of San Quintin) in Mexico (NatureServe, 2015).	6,000 (USFWS, 2009)	No Mention	No Mention	Medium
Geum radiatum	Spreading avens	73	Endangered	Unknown (USFWS, 2013)	Stable (USFWS, 2013)	15 (USFWS, 2013)	The range of *G. radiatum* consists of populations distributed across Ashe, Avery, Buncombe, Mitchell, Transylvania, Watauga and Yancey counties, North Carolina and Carter and Sever counties, Tennessee (USFWS, 2013)	Unknown (NatureServe, 2015)	No Mention	No Mention	High
Gilia tenuiflora ssp. arenaria	Monterey gilia	9	Endangered	Not Available	3 populations extirpated since listing (USFWS, 2008)	24 (USFWS, 2008)	Restricted to isolated sites within two coastal dune scrub communities along Monterey Bay and the Monterey Peninsula (NatureServe, 2015). Occurrences are distributed in discontinuous populations from Spanish Bay on the Monterey Peninsula north to Moss Landing in Monterey County, CA (USFWS 2008).	Variable from year to year; 1,665 - 25,000 depending on location (USFWS, 2008)	No Mention	No Mention	Medium
Hedeoma todsenii	Todsen's pennyroyal	19	Endangered	Not Available	Not Available	32 (NatureServe, 2015)	Occurs in the San Andres Mountains and Sacramento Mountains of Southern New Mexico (USFWS 2011h; NatureServe, 2015). All 32 known populations occur on Federal lands: BLM has 7 populations; BLM and the LNF share 6 populations; and the LNF has 4 populations (M. Howard 2009, pers. comm.). White Sands Missile	Unknown (USFWS, 2011)	No Mention	No Mention	Medium

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							Range has 15 populations (N. Sikula 2009, pers. comm.) (USFWS, 2011).				
Hedyotis purpurea var. montana	Roan Mountain bluet	74	Endangered	Not Available	Not Available	8 (NatureServe, 2015)	Limited to metamorphic rock outcrops above 1350 m, from Big Bald (Yancey County, North Carolina) to Bluff Mountain (Ashe County, North Carolina). Recently found on Colt's Cliff in Tennessee per Andrea Shea, 12/96 (NatureServe, 2015).	Unknown (NatureServe, 2015)	No Mention	No Mention	High
Helianthus schweinitzii	Schweinitz's sunflower	45	Endangered	Not Available	Not Available	~86 (USFWS, 2010)	The species' distribution includes 13 NC counties (the original five plus Anson, Davidson, Gaston, Montgomery, Randolph, Richmond, Stokes, Surry) and two SC counties (Lancaster and York) (USFWS, 2010).	5,000 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Hoffmannseggia tenella	Slender rush-pea	5	Endangered	Not Available	Not Available	5-6 (NatureServe, 2015)	The known range of SRP, as delineated by known population locations (Table 1), extends from Robstown, Nueces County, on the most northeastern extent of the range to east-central Kleberg County, then west to a point near Kingsville, and north to the vicinity of the Nueces/Jim Wells County line, encompassing approximately 221,000 acres. (USFWS, 2008)	>10,000 (NatureServe, 2015)	No Mention	No Mention	High
Hudsonia montana	Mountain golden heather	76	Threatened	Stable (USFWS, 2012)	Not Available	1 - 20 (NatureServe, 2015)	Very narrow endemic, known from only two adjacent North Carolina counties; east rim of Linville Gorge, within 8 km. of Table Rock Mountain, and 2 pops. about 20 miles distant from Linville Gorge. (NatureServe, 2015)	1000 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Iliamna corei	Peter's Mountain mallow	20	Endangered	Declining (USFWS, 2008)	Declining (USFWS, 2008)	1 (NatureServe, 2015)	Only site known is Giles County in Ridge and Valley Province of Virginia. (NatureServe, 2015)	1 - 250 individuals (NatureServe, 2015)	No Mention	Lack of recruitment (USFWS, 1990)	High
Leavenworthia texana	Texas golden Gladecress	77	Endangered	Long-term trends indicate a decline of 30-70%, whereas short-term trends suggest a decline of 30-50% (NatureServe, 2015)	Not Available	3 (NatureServe, 2015)	Endemic to San Augustine and Sabine Counties in eastern Texas, on a particular geologic formation (the Weches Formation). (NatureServe, 2015)	250 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
Lespedeza leptostachya	Prairie bush-clover	21	Threatened	Not Available	Not Available	~32 (NatureServe, 2015)	It is presently known in 24 counties in northern Illinois, southern and western Wisconsin, southern Minnesota, and Iowa (USFWS, 1988).	24,530 (USFWS, 1998)	No Mention	No Mention	Low
Lilaeopsis schaffneriana var. recurva	Huachuca water-umbel	22	Endangered	Declining	Stable or declining across range	30 naturally-occurring locations in the U.S. and 21 in Sonora, Mexico.	U.S.: Cochise, Pima, and Santa Cruz counties, Arizona; Mexico: Sonora.	Not Available	No Mention	No Mention	Medium
Limnanthes floccosa ssp. californica	Butte County meadowfoam	78	Endangered	Unknown (USFWS, 2008)	Not Available	20 (USFWS, 2008)	At least eight new occurrences of *Limnanthes floccosa* ssp. *californica* have been discovered since 1988 (USFWS, 2005).	Not Available	No Mention	No Mention	High
Malacothrix squalida	Island malacothrix	23	Endangered	Unknown (USFWS, 2010)	Not Available	2 (USFWS, 2010)	There has been no significant change in the geographic range for *Malacothrix squalida* since listing in 1997; however, several of the known populations appear to have expanded in areal extent in the last few years. There are currently two known extant populations of *Malacothrix squalida*.	Under 50 (USFWS, 2010)	No Mention	No Mention	High
Mimulus michiganensis	Michigan monkey-flower	79	Endangered	Not Available	Not Available	19	There are 19 element occurrences, including two historical occurrences (MNFI 2012) of MMF, ranging from Benzie and Leelanau counties to Mackinac County (Figure 3 and Appendix A). However, the majority of occurrences are clustered within the Mackinac Straits region. The newest colony was discovered in 2008 (MNFI 2012). Overall, the entire population is stable, although MMF colonies at a few sites are in decline (MNFI 2012). However, this information was obtained from records in which most have not been updated in more than 10 years (MNFI 2012). A systematic survey would provide a more accurate description of MMF abundance and population trends.	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Monardella viminea	Willowy monardella	80	Endangered	Declining (USFWS, 2008)	Not Available	8 (USFWS, 2008)	Occurs in coastal sage scrub and riparian scrub in sandy bottoms and on banks of ephemeral washes in canyons where surface water flows for usually less than 48 hours after a rain event (Scheid 1985, p. 3; Elvin and Sanders 2003, p. 430; Kelly and Burrascano 2006, p. 51). Monardella viminea is a geographically narrow endemic species restricted to three watersheds north of Kearny Mesa in San Diego County, California 2012 5-year Review for *Monardella viminea* (Elvin and Sanders 2003, p. 431). Within these watersheds, M. viminea occurs on land owned by the Department of Defense at	Up to 6,000 total individuals, as many as six populations of fewer than 15 individuals (USFWS, 2008)	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
							Marine Corps Air Station (MCAS) Miramar, the City of San Diego, the County of San Diego, and private parties. (USFWS, 2012)				
Navarretia fossalis	Spreading navarretia	24	Threatened	Long-term trends suggest a decline of >90%, while short-term trends indicate a decline of 50-70% (NatureServe, 2015)	Not Available	48 occurrences (USFWS, 2010)	Known from southern California and adjacent Mexico, from northwestern Los Angeles County and western Riverside County south through coastal San Diego County to San Quentin in northwestern Baja California (USFWS 1998, 2005). A population was reported from San Luis Obispo County, California, but the identification of that population is believed to be in error (Spencer 2004 cited in USFWS 2005). (NatureServe, 2015).	Not Available	No Mention	No Mention	Low
Nitrophila mohavensis	Amargosa niterwort	25	Endangered	Decreasing (USFWS, 2007)	Not Available	1 - 5 (NatureServe, 2015)	Known only from the Amargosa River drainage in extreme southeastern Inyo County, California (Reveal, 1989) and from Nye county in bordering Nevada. (NatureServe, 2015)	1000 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	High
Oxypolis canbyi	Canby's dropwort	46	Endangered	Decreasing (NatureServe, 2015)	Not Available	21 - 80 (NatureServe, 2015)	Native to the coastal plain, from southwestern Georgia through South Carolina to southeastern North Carolina (mostly in the middle and inner Coastal Plain), and from eastern MD to (historically) Delaware (Weakley 2008). (NatureServe, 2015)	10,000 - 100,000 total individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Packera franciscana	San Francisco Peaks ragwort	26	Threatened	Stable (USFWS, 2010)	Stable (USFWS, 2010)	1 - 5 (NatureServe, 2015)	Endemic to the San Francisco Peaks, a high altitude mountain range in Coconino County, northern Arizona; range about 4.44 sq km. (NatureServe, 2015)	At least 100,000 clones (USFWS, 2010)	No Mention	No Mention	High
Pedicularis furbishiae	Furbish lousewort	81	Endangered	Long-term trends suggest declines of 30 to 50%, whereas short-term trends indicate declines of 10 to 30% (NatureServe, 2015)	Declining (NatureServe, 2015)		Endemic to the Saint John River Valley of northern Maine and adjacent New Brunswick. The entire range of *Pedicularis furbishiae* covers 225 km of the St. John River, extending from a point 1.5 miles upriver of the confluence with the Big Black River in Aroostook County, Maine to the town of Andover, New Brunswick in Canada. (NatureServe, 2015)	2500 - 10,000 individuals (NatureServe, 2015)	Increased runoff (USFWS, 1991)	No Mention	High

Scientific Name	Common Name	Number	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
Penstemon debilis	Parachute beardtongue	27	Threatened	Unknown (NatureServe, 2015)	10 - 30% decline (NatureServe, 2015)	4 (USFWS, 2016)	All of the currently known occurrences occupy about 91.8 ac (37.2 ha) on the Green River geologic formation in Garfield County, Colorado (USFWS, 2016).	< 7,600 (inferred from NatureServe, 2015 and USFWS, 2013)	No Mention	No Mention	High
Penstemon penlandii	Penland beardtongue	82	Endangered	Not Available	Stable (NatureServe, 2015)	1 (USFWS, 2016)	Kremmling beardtongue is known from only one site 16 kilometers (10 miles) east of Kremmling, Colorado (USFWS, 2016).	~1.4 million (NatureServe, 2015)	No Mention	No Mention	High
Pilosocereus robinii	Key tree cactus	28	Endangered	Decreasing	Not Available	Seven	Monroe County, Florida on Upper and Lower Matecumbe Keys, Key Largo, Plantation Key, Long Key, Umbrella Key, Key West. Cuba near Havana and Matanzas. (NatureServe, 2015). The Key tree-cactus grows in the coastal hammocks of the Keys (Avery 1982, Benson 1982, Britton and Rose, 1937 Small 1917, 1921) and in the coastal thickets of the Matanzas and Habana provinces in Cuba (Benson 1982, Britton and Rose 1937). The historical distribution of this species on the Florida Keys, which included populations that are now extinct on Key West, Boca Chica, and Windley Keys, has been substantially diminished by the destruction of populations occurring in the Lower Keys, particularly Key West (Avery 1982, Britton and Rose 1937, Small 1917, 1921). Construction and development activity has been directly responsible for the destruction of several major Key tree-cactus populations over the past seven decades (Austin 1980, Avery [no date], Britton and Rose 1937, Small 1921, 1924).	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Pinguicula ionantha	Godfrey's butterwort	29	Threatened	Decreasing (NatureServe, 2015)	Not Available	21 - 80 (NatureServe, 2015)	Restricted to the central panhandle region of Florida with known occurrences in Bay, Calhoun, Franklin, Gulf, Liberty, and Walton counties (Wunderlin and Hansen 2008; USFWS 2009) (NatureServe, 2015).	2500 - 100,000 individuals (NatureServe, 2015)	No Mention	No Mention	Low
Pityopsis ruthii	Ruth's golden aster	30	Endangered	Decreasing (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Known only to occur along short reaches of the Ocoee and Hiwassee River, Polk County, Tennessee. (NatureServe, 2015)	1000 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Pogogyne nudiuscula	Otay mesa-mint	83	Endangered	Decreasing (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	San Diego County, California; adjacent Baja California, Mexico. The range extent covers approximately 370 sq mi. (NatureServe, 2015)	1000 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
Polygala lewtonii	Lewton's polygala	10	Endangered	Not Available	Not Available	49	Lewton's polygala occurs in sandhill (high pine) vegetation and Florida scrub of the Lake Wales and Mount Dora ridges in Highlands, Polk, Osceola, Orange, Lake, and Marion Counties of central Florida.	Not Available	No Mention	No Mention	Medium
Primula maguirei	Maguire primrose	84	Threatened	Unknown	Not Available	6 - 20 (NatureServe, 2015)	Limited area of Logan Canyon in Cache county, Utah (Tilley et al. 2011).	250 - 2500 individuals (NatureServe, 2015); 4000 - 20000 (USFWS, 2011)	No Mention	No Mention	High
Ptilimnium nodosum	Harperella	47	Endangered	Long-term trends suggest a decline of 30 to 70%, whereas short-term trends indicate a decline of >50% (NatureServe, 2015)	Declining (NatureServe, 2015)	24 (NatureServe, 2015)	Currently known from scattered sites in western Maryland, eastern West Virginia, northeastern Virginia, north-central North Carolina, central South Carolina, central Georgia, northeastern Alabama, and west-central Arkansas. (NatureServe, 2015)	~500,000 (NatureServe, 2015)	No Mention	No Mention	Medium
Rhodiola integrifolia ssp. leedyi	Leedy's roseroot	85	Threatened	Unable to assess (NatureServe, 2015)	Not Available	6 (USFWS, 2015)	Leedy's roseroot is found today in only six locations in two widely separated states. Four populations of several thousand plants each are found in Fillmore and Olmsted Counties, Minnesota. The other two are in upstate New York, a large population on the shores of Seneca Lake and a single plant at Watkins Glen. (USFWS, 2015)	2500 - 10,000 individuals (NatureServe, 2015)	Agricultural pesticides (USFWS, 1992)	No Mention	High
Rhododendron chapmanii	Chapman rhododendron	86	Endangered	Not Available	Not Available	6 - 20 (NatureServe, 2015)	According to surveys in 1984 and 1985 (Hardin et al., 1985) *Rhododendron chapmanii* is known from only three areas in Florida: coastal Gulf County in the vicinity of Port St. Joe; Liberty and Gadsden counties in the vicinity of Hosford; and Clay County on Camp Blanding Military Reservation. According to surveys in the mid-1980's, there were a total of 610 plants known from 11 sites in Gulf county (Hardin et al., 1985); ca 2320 plants from 18 sites in Gadsden and Liberty counties (Cooper et al., 1984), and 32 plants from 1 site in Clay County, giving a total of 2962 plants. New sites in the same areas of Gulf and Gadsden /Liberty counties have been	1000 - 2500 total individuals (NatureServe, 2015)	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
							sporadically reported since the 1985 survey. A complete survey of known sites in spring of 1997 showed 2158 plants from 22 sites in Gadsden/Liberty counties (Hosford area) and 484 plants from 16 sites in Gulf County (Port St Joe area) (Schltz and Johnson, 1997). (NatureServe, 2015)				
Rhus michauxii	Michaux's sumac	48	Endangered	Short-term Trend: Decline of <30% to relatively stable. Long-term Trend: Decline of 30-50% (NatureServe, 2015)	Not Available	21 - 80 (NatureServe, 2015)	Extant occurrences are currently known to exist in North Carolina, Virginia, and Georgia. In NC, 44 occurrences (number of occurrences for each county follows in parentheses) are currently known from Cumberland (1), Davie (1), Franklin (1), Hoke (5), Moore (4), Richmond (18), Robeson (1), Scotland (8), and Wake (3) counties (NCNHP 2005). The range of this species in North Carolina is approximately 290 km^2. In 1993, the Virginia Department of Conservation and Recreation's Division of Natural Heritage discovered a large population of Michaux's sumac on Fort Pickett Military Reservation in Dinwiddie and Nottoway counties, Virginia (Fleming 1993). By the end of inventory work in 1993, 32 subpopulations containing an estimated total of 20,000+ plants had been documented within approximately 10,000 acres (Fleming 1993). The largest of these more-or-less continuous subpopulations contained an estimated 10,000+ plants, and several others contained an estimated 1,000+ plants (Fleming 1993). It should be noted that at the time of the 1993 survey, plants were seen that were presumed to be a hybrid but by 1995, due to genetic research on Fort Pickett colonies (Burke and Hamrick 1995), it was decided that these plants with little to no stem pubescence but pubescent leaflets should be included under *R. michauxii*. Therefore, the 1993 stem count total underestimates the true total. By 1995, an additional 65 subpopulations with at least 7500 stems were found within the occurrence area (Van Alstine and Smith 1995). Other populations recognized as separate occurrences were found on Fort Pickett by either DCR-DNH staff or Fort Pickett personnel adding 5 other occurrences totaling at least 250-300 stems and expanding the known occurrences south into Brunswick County. In 2003, consultants surveying an abandoned railroad track right-of-way for a proposed high speed rail line found the first occurrence in Virginia located outside	2500 - 100,000 total individuals (NatureServe, 2015)	Herbicides (USFWS, 2014)	No Mention	Medium

Scientific Name	Common Name	Number	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
							of Fort Pickett. This population of 230 stems in Brunswick County occurs in a fairly ruderal habitat next to a railroad grade with trash and weeds. Three years of surveys (2003-2005) in areas surrounding Fort Pickett including public roadside utility line rights-of-way and roadsides and clearcuts on private lands have been unsuccessful in finding any more occurrences (Van Alstine and Belden 2005, N. Van Alstine 2006). The current range extent in Virginia occupies ca. 87 km^2. In Georgia both extant and historical populations of *R. michauxii* occur on mafic/sub-mafic substrates and derivatives. This type of habitat in GA is extremely limited (NatureServe, 2015).				
Ribes echinellum	Miccosukee gooseberry	87	Threatened	Not Available	Not Available	1 - 5 (NatureServe, 2015)	Occurs in three locations: along the shores of Lake Miccosukee in Jefferson County, Florida, and along Stevens Creek and a site on the Sumter National Forest, Edgefield Ranger District in McCormick County, South Carolina. (NatureServe, 2015)	Florida ~ 5,000 plants, South Carolina ~ 9,870 plants (USFWS, 2015)	No Mention	No Mention	High
Rorippa gambellii	Gambel's watercress	88	Endangered	Decreasing (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Currently known from a few populations in California within 4 aerial miles of each other in San Luis Obispo County (Rutherford 1991), and a few sites in Santa Barbara County (Smith 1998). The total California range extent, as defined by 4 discreet areas, is about 160 sq mi. (NatureServe, 2015)	250 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	High
Sarracenia oreophila	Green pitcher-plant	49	Endangered	Decreasing (NatureServe, 2015)	Not Available	21 - 80 (NatureServe, 2015)	Restricted to areas of the Cumberland Plateau and the Ridge and Valley province in these four regions: Coosa Valley, Lake Chatuge, Lookout Mountain, and Sand Mountain (USFWS 2013). Extent of occurrence was calculated during the 2015 conservation status review to be approximately 9,000 sq. km. (NatureServe, 2015)	1000 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Sarracenia rubra ssp. jonesii	Mountain sweet pitcher-plant	89	Endangered	Short term trend: Decline of 10-30% (NatureServe, 2015)	Not Available	Twelve (USFWS, 2013)	Endemic to a few mountain bogs and waterslides in southwest North Carolina and northwest South Carolina on both sides of the Blue Ridge divide (U.S. Fish and Wildlife Service 1990). Four populations are in the French Broad River drainage in Henderson and Transylvania Counties, North Carolina, five are in the Saluda River drainage in Greenville County, South Carolina, and one population is in the Enoree River drainage also in Greenville County, South Carolina (U.S. Fish and Wildlife Service 1990). (NatureServe, 2015)	Not Available	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
Schwalbea americana	American chaffseed	50	Endangered	Long-term trends indicate population declines from 50 to 90%, whereas short-term trends suggest declines of 10 to 30% (NatureServe, 2015)	Declining (NatureServe, 2015)	174 (USFWS, 2010)	Historically known from Massachusetts and New York south along the East Coast to Florida and west along the Gulf Coast states to Texas. Currently not found north of the Carolinas except in New Jersey. Historic or extirpated in several southern states as well. (NatureServe, 2015)	2500 - 10,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Sibara filifolia	Santa Cruz Island rockcress	90	Endangered	Decreasing (NatureServe, 2015)	Not Available	Not Available	California endemic, currently known only from San Clemente Island (possibly still be extant on Santa Catalina Island, although not seen there since 1973); formerly collected on distant Santa Cruz Island, so thought to have been more widespread in the past (USFWS 1997). (NatureServe, 2015)	Not Available	No Mention	No Mention	High
Sidalcea nelsoniana	Nelson's checker-mallow	51	Threatened	Unknown (USFWS, 2016)	Not Available	~90 (USFWS, 2016)	Nelson's checkermallow primarily occurs in Oregon's Willamette Valley, but is also found at several sites in Oregon's Coast Range and at two sites in the Puget Trough of southwestern Washington. The plant's range extends from southern Benton County, Oregon, north to Cowlitz County, Washington, and from central Linn County, Oregon, west to the crest of the Coast Range. In the late 1990s, the species was known to occur in 65 occurrences within five relict population centers in Oregon and Washington and occupy approximately 273 acres (USFWS 1998) (USFWS, 2016).	10,000 - 100,000 individuals (NatureServe, 2015)	No Mention	No Mention	Medium
Sidalcea pedata	Pedate checker-mallow	31	Endangered	Decreasing (NatureServe, 2015)	Not Available	6 - 20 (NatureServe, 2015)	California endemic, occurs in the Big Bear Basin of San Bernardino County, California. (NatureServe, 2015)	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Silene polypetala	Fringed campion	52	Endangered	Stable short term population trend (NatureServe, 2015)	Not Available	21 - 80 (NatureServe, 2015)	This species has a very narrow range, from the Florida panhandle near the Apalachicola River (Chafin 2000) and in west-central Georgia in the Flint and Ocmulgee River drainages (Patrick et al. 1995). It is known in Bibb, Crawford, Decatur, Talbot, Taylor and Upson counties in Georgia, and Gadsden and Jackson counties in Florida (USFWS 1996).	1000 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	Medium

Scientific Name	Common Name	Number	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
Solidago spithamaea	Blue Ridge goldenrod	32	Threatened	Three historical populations were extirpated by extensive recreational and residential development (NatureServe, 2015).	Not Available	1 - 5 (NatureServe, 2015)	Endemic to three mountains, Grandfather Mountain and Hanging Rock Mountain in North Carolina, and Roan Mountain on the North Carolina-Tennessee border (Weakley 2008) (NatureServe, 2015).	over 1,800 total 'clumps' (NatureServe, 2015)	No Mention	No Mention	High
Spiraea virginiana	Virginia spiraea	53	Threatened	Short-term trends indicate a decline of 10 to 30% (NatureServe, 2015)	Not Available	31 (NatureServe, 2015)	Pennsylvania and Ohio south to Georgia and Tennessee. Records for Pennsylvania are historic. It occurs on streams that drain into the Ohio River and primarily within the Appalachian (Cumberland) Plateau and Blue Ridge physiographic regions, with at least one outlier in the Bluegrass Region of Kentucky. (NatureServe, 2015)	Not Available	No Mention	No Mention	Medium
Stephanomeria malheurensis	Malheur wire-lettuce	33	Endangered	Decreasing (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Endemic to central Harney Co., Oregon, U.S.A., in an area called the Narrows, near Malheur and Harney lakes.	250 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Streptanthus niger	Tiburon jewelflower	91	Endangered	Decreasing (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Two populations are known from the southern end of the peninsula where they occur within 3 kilometers (2 miles) of one another (CNDDB, 2009). One is at the tip of the peninsula at Old St. Hilary's Church Preserve (Preserve), and the other is along the Middle Ridge of the peninsula. No historical occurrences are known outside of the Tiburon Peninsula, and it is likely S. niger never occurred elsewhere (Morey and Hunter 1989). (USFWS, 2010)	250 - 2500 individuals (NatureServe, 2015)	No Mention	No Mention	High
Thysanocarpus conchuliferus	Santa Cruz Island fringepod	34	Endangered	Not Available	Not Available	Not Available	Species is endemic to Santa Cruz Island. Junak et al. (1995) reported that it occurs from the north slopes of the island between Lady's and Prisoner's Harbors, the Central Valley near Lagunitas Secas in Cañada de la Portezuela, and on the south side of the island on Sierra Blanca Ridge (USFWS, 2009).	Not Available	No Mention	No Mention	High
Trifolium amoenum	Showy Indian clover	92	Endangered	Decreasing (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	Currently believed extant only in Marin (native) and Sonoma (reintroduced) counties (NatureServe, 2015).	1 - 1000 individuals (NatureServe, 2015)	No Mention	No Mention	High

Scientific Name	Common Name	Number	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
Verbesina dissita	Big-leaved crownbeard	93	Threatened	Decreasing (USFWS, 2010)	Not Available	Two (USFWS, 2010)	*Verbesina dissita* is found on rugged hillsides in dense maritime chaparral from Laguna Beach in Orange County south to the San Telmo area east of Cabo Colonet in Baja California, Mexico. In California it is known from two population centers less than 3.2 km (2 mi) apart (USFWS, 1996).	Not Available	No Mention	No Mention	High
Warea carteri	Carter's mustard	6	Endangered	Populations fluctuate widely from year to year (2019 RP Amendment)	Not Available	29 Element Occurrences (2021 5-year Review)	Carter's mustard is an annual herb found in scrubby flatwood and yellow sand scrub on the Lake Wales Ridge in Lake, Polk, and Highlands counties. Populations are not well distributed across the known range (2021 5-year Review).	Not Available	No Mention	No Mention	High
Yermo xanthocephalus	Desert yellowhead	35	Threatened	Unknown (NatureServe, 2015)	Not Available	1 - 5 (NatureServe, 2015)	State endemic restricted to the Beaver Rim area in the Sweetwater River Plateau in Fremont County, Wyoming.	2500 - 100,000 individuals (NatureServe, 2015)	No Mention	No Mention	High
Ziziphus celata	Florida ziziphus	7	Endangered	Not Available	Not Available	14	Florida ziziphus is a thorny clonal shrub found only on yellow sand xeric habitats that historically supported longleaf pine/wiregrass sand hills and similar vegetative communities. Today, Florida ziziphus is known only from a few sites on the Lake Wales Ridge in southern Polk and northern Highlands counties. Only four of the 14 known populations occur in publicly protected sites. Most populations are self-sterile due to limited genetic diversity and the isolation of populations. (2019 Lake Wales Ridge Plants Recovery Plan Amendment).	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, Pollinators, and Seed dispersers 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 effects (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	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
Acanthomintha ilicifolia	San Diego thornmint	11	Yes (12%)	9.76	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	Low
Aconitum noveboracense	Northern wild monkshood	36	Yes (12%)	103.99	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Amphianthus pusillus	Little amphianthus	37	Yes (12%)	48.96	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Selfing	High
Arabis hoffmannii	Hoffmann's rock-cress	12	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Low
Arabis macdonaldiana	McDonald's rock-cress	38	Yes (12%)	7.51	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Medium
Arenaria paludicola	Marsh Sandwort	55	Yes (12%)	94.68	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Asclepias welshii	Welsh's milkweed	13	Yes (12%)	43.98	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Insect	Low
Astragalus applegatei	Applegate's milk-vetch	56	Yes (12%)	25.48	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Yes	Insect	High
Astragalus brauntonii	Braunton's milk-vetch	57	Yes (12%)	91.38	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Astragalus phoenix	Ash meadows milk-vetch	14	Yes (12%)	0.37	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Low
Astragalus tener var. titi	Coastal dunes milk-vetch	58	Yes (12%)	123.98	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Berberis pinnata ssp. insularis	Island Barberry	15	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Bird, Mammal	No	Insect	Low
Bonamia grandiflora	Florida bonamia	39	Yes (12%)	122.16	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Campanula robinsiae	Brooksville bellflower	59	Yes (12%)	146.67 (30.60)	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Insect, Bird	High

Scientific Name	Common Name	Number	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
Chionanthus pygmaeus	Pygmy fringe-tree	1	Yes (12%)	129.65	Biotic - Asexual, Self-pollinating	Biotic	Unknown	Insect	High
Chorizanthe robusta var. robusta	Robust spineflower	40	Yes (12%)	154.92	Biotic - Asexual, Self-pollinating	Bird, Mammal	Unknown	Selfing, Insect	High
Cirsium vinaceum	Sacramento Mountains thistle	16	Yes (12%)	1.57 (0.39)	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect, Bird	Low
Clarkia franciscana	Presidio clarkia	60	Yes (12%)	**	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Clarkia imbricata	Vine Hill clarkia	61	Yes (12%)	214.26 (53.97)	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect, Bird	Medium
Clematis socialis	Alabama leather flower	62	Yes (12%)	88.22	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Clitoria fragrans	Pigeon wings	8	Yes (12%)	124.89	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Cordylanthus maritimus ssp. maritimus	Salt marsh bird's-beak	41	Yes (12%)	117.76	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect	Medium
Coryphantha scheeri var. robustispina	Pima pineapple cactus	63	Yes (12%)	13.06	Biotic - Asexual, Self-pollinating	Insect, Bird, Mammal	Yes	Insect	High
Coryphantha sneedii var. leei	Lee pincushion cactus	64	Yes (12%)	55.24	Biotic - Asexual, Self-pollinating	Abiotic, Insect, Bird, Mammal	Unknown	Insect	Medium
Coryphantha sneedii var. sneedii	Sneed pincushion cactus	65	Yes (12%)	63.00	Biotic - Asexual, Self-pollinating	Insect, Bird, Mammal	Unknown	Insect	Medium
Cycladenia humilis var. jonesii	Jones Cycladenia	17	Yes (12%)	38.67 (0.39)	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect, Bird	Low
Dalea foliosa	Leafy prairie-clover	42	Yes (12%)	113.51	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Yes	Insect	High
Dicerandra christmanii	Garrett's mint	2	Yes (12%)	45.06	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Yes	Insect	High
Dudleya abramsii ssp. parva	Conejo dudleya	66	Yes (12%)	149.22	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Dudleya stolonifera	Laguna Beach liveforever	67	Yes (12%)	161.10	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Echinacea laevigata	Smooth coneflower	43	Yes (12%)	83.94	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Erigeron rhizomatus	Zuni fleabane	18	Yes (12%)	45.45	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Low
Eriodictyon altissimum	Indian Knob mountain balm	68	Yes (12%)	78.18	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High

Scientific Name	Common Name	Number	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
Eriogonum gypsophilum	Gypsum wild-buckwheat	69	Yes (12%)	55.24	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Medium
Eriogonum kennedyi var. austromontanum	Southern mountain wild-buckwheat	70	Yes (12%)	1.65	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	Medium
Eriogonum ovalifolium var. williamsiae	Steamboat buckwheat	71	Yes (12%)	59.13	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect	High
Eriogonum pelinophilum	Clay-Loving wild buckwheat	3	Yes (12%)	161.41	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Eryngium cuneifolium	Snakeroot	4	Yes (12%)	45.06	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect	High
Erysimum menziesii	Menzies' wallflower	72	Yes (12%)	131.65	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Yes	Insect	High
Fremontodendron mexicanum	Mexican flannelbush	44	Yes (12%)	113.33	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Medium
Geum radiatum	Spreading avens	73	Yes (12%)	29.54	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Gilia tenuiflora ssp. arenaria	Monterey gilia	9	Yes (12%)	197.73	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Insect	High
Hedeoma todsenii	Todsen's pennyroyal	19	Yes (12%)	17.29 (0.46)	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect, Bird	Low
Hedyotis purpurea var. montana	Roan Mountain bluet	74	Yes (12%)	28.24	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Helianthus schweinitzii	Schweinitz's sunflower	45	Yes (12%)	108.85	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	unknown	Insect	High
Hoffmannseggia tenella	Slender rush-pea	5	Yes (12%)	170.76	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Hudsonia montana	Mountain golden heather	76	Yes (12%)	37.68	Biotic - Asexual, Self-pollinating	Abiotic, Insect, Bird	Unknown	Insect	High
Iliamna corei	Peter's Mountain mallow	20	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	Low
Leavenworthia texana	Texas golden Gladecress	77	Yes (12%)	5.71	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Selfing, Insect	Medium
Lespedeza leptostachya	Prairie bush-clover	21	Yes (12%)	106.30	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Lilaeopsis schaffneriana var. recurva	Huachuca water-umbel	22	Yes (12%)	6.14	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect	Low
Limnanthes floccosa ssp. californica	Butte County meadowfoam	78	Yes (12%)	174.94	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Selfing, Insect	High

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Malacothrix squalida	Island malacothrix	23	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	Low
Mimulus michiganensis	Michigan monkey-flower	79	Yes (12%)	22.06	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Monardella viminea	Willowy monardella	80	Yes (12%)	152.84	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Navarretia fossalis	Spreading navarretia	24	Yes (12%)	106.49	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	Unknown	Insect	High
Nitrophila mohavensis	Amargosa niterwort	25	Yes (12%)	0.09	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Abiotic, Insect	Low
Oxypolis canbyi	Canby's dropwort	46	Yes (12%)	161.74	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect	High
Packera franciscana	San Francisco Peaks ragwort	26	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Low
Pedicularis furbishiae	Furbish lousewort	81	Yes (12%)	59.54	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Penstemon debilis	Parachute beardtongue	27	Yes (12%)	11.46	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect	Low
Penstemon penlandii	Penland beardtongue	82	Yes (12%)	10.17	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Yes	Insect	High
Pilosocereus robinii	Key tree cactus	28	Yes (12%)	12.38	Biotic - Asexual, Self-pollinating	Insect, Bird, Mammal	Unknown	Insect	Low
Pinguicula ionantha	Godfrey's butterwort	29	Yes (12%)	87.33	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Pityopsis ruthii	Ruth's golden aster	30	Yes (12%)	11.02	Biotic - Asexual, Self-pollinating	Abiotic	No	Abiotic, Insect	Low
Pogogyne nudiuscula	Otay mesa-mint	83	Yes (12%)	157.25	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Polygala lewtonii	Lewton's polygala	10	Yes (12%)	113.88	Biotic - Asexual, Self-pollinating	Insect	No	Insect	High
Primula maguirei	Maguire primrose	84	Yes (12%)	10.00	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Insect	Medium
Ptilimnium nodosum	Harperella	47	Yes (12%)	52.66	Biotic - Asexual, Self-pollinating	Abiotic	unknown	Insect	High
Rhodiola integrifolia ssp. leedyi	Leedy's roseroot	85	Yes (12%)	***	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect	High
Rhododendron chapmanii	Chapman rhododendron	86	Yes (12%)	110.77	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Insect	High

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Rhus michauxii	Michaux's sumac	48	Yes (12%)	123.28	Biotic - Asexual, Self-pollinating	Bird, Mammal	unknown	Insect	High
Ribes echinellum	Miccosukee gooseberry	87	Yes (12%)	24.47	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Rorippa gambellii	Gambel's watercress	88	Yes (12%)	111.43	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Sarracenia oreophila	Green pitcher-plant	49	Yes (12%)	64.39	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	No	Insect	High
Sarracenia rubra ssp. jonesii	Mountain sweet pitcher-plant	89	Yes (12%)	91.78	Biotic - Asexual, Self-pollinating	Abiotic, Bird, Mammal	unknown	Insect	High
Schwalbea americana	American chaffseed	50	Yes (12%)	***	Biotic - Asexual, Self-pollinating	Abiotic	Unknown	Insect	High
Sibara filifolia	Santa Cruz Island rockcress	90	Yes (12%)	55.43	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Medium
Sidalcea nelsoniana	Nelson's checker-mallow	51	Yes (12%)	91.11	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect	High
Sidalcea pedata	Pedate checker-mallow	31	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	Low
Silene polypetala	Fringed campion	52	Yes (12%)	167.50	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Solidago spithamaea	Blue Ridge goldenrod	32	Yes (12%)	35.24	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High
Spiraea virginiana	Virginia spiraea	53	Yes (12%)	34.13	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect	High
Stephanomeria malheurensis	Malheur wire-lettuce	33	Yes (12%)	2.43	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Low
Streptanthus niger	Tiburon jewelflower	91	Yes (12%)	206.57	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	unknown	Insect	High
Thysanocarpus conchuliferus	Santa Cruz Island fringepod	34	Yes (12%)	0	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	Low
Trifolium amoenum	Showy Indian clover	92	Yes (12%)	43.56	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Verbesina dissita	Big-leaved crownbeard	93	Yes (12%)	183.57	Biotic - Asexual, Self-pollinating	Bird, Mammal	Unknown	Unknown	High
Warea carteri	Carter's mustard	6	Yes (12%)	103.22	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	Unknown	Insect	High
Yermo xanthocephalus	Desert yellowhead	35	Yes (12%)	20.09	Biotic - Asexual, Self-pollinating	Abiotic	No	Insect	Low

Scientific Name	Common Name	Number	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
Ziziphus celata	Florida ziziphus	7	Yes (12%)	111.25	Biotic - Asexual, Self-pollinating	Abiotic, Biotic	No	Insect	High

* 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; California (CA); NA=Not Applicable

Scientific Name	Common Name	Number	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential 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
Acanthomintha ilicifolia	San Diego thornmint	11	427711.30	14.13	100		2.90	5.72	0.16	0.159	CalPUR	Low
Aconitum noveboracense	Northern wild monkshood	36	5832188.03	4.71	0		30.01	13.00	2.57		Standard	Low
Amphianthus pusillus	Little amphianthus	37	2982242.28	0.81	0		10.78	10.27	0.91		Standard	Low
Arabis hoffmannii	Hoffmann's rock-cress	12	32699.02	100.00	100	Only occurs on Federal Lands	0	0	0		CalPUR	Low
Arabis macdonaldiana	McDonald's rock-cress	38	3521692.98	43.95	99	Other portion of range in OR	3.33	0.02	0.35	0.157	CalPUR	Low
Arenaria paludicola	Marsh Sandwort	55	9881656.78	31.85	89	Other portion of range in WA	19.37	48.20	2.12	1.749	CalPUR	Low
Asclepias welshii	Welsh's milkweed	13	1343034.69	23.29	0		0.67	42.06	0.04		Standard	Low
Astragalus applegatei	Applegate's milk-vetch	56	3927599.51	65.65	0		4.68	9.41	1.65		Standard	Low
Astragalus brauntonii	Braunton's milk-vetch	57	724969.26	50.07	100		31.19	50.27	1.63	1.638	CalPUR	Low
Astragalus phoenix	Ash meadows milk-vetch	14	1434546.70	97.53	0		0.13	0	0.01		Standard	Low
Astragalus tener var. titi	Coastal dunes milk-vetch	58	107819.74	29.20	100		50.09	55.71	2.67	2.496	CalPUR	Low
Berberis pinnata ssp. insularis	Island Barberry	15	62136.33	100.00	100	Only occurs on Federal Lands	0	0	0	No usage overlap	CalPUR	Low
Bonamia grandiflora	Florida bonamia	39	7089080.83	7.53	0		23.23	74.88	4.62		Standard	Low
Campanula robinsiae	Brooksville bellflower	59	1187509.30	1.08	0		30.62	84.09	3.86**		Standard	Low
Chionanthus pygmaeus	Pygmy fringe-tree	1	6174796.78	3.43	0		24.13	81.93	5.06		Standard	Medium

Scientific Name	Common Name	Number	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential 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
Chorizanthe robusta var. robusta	Robust spineflower	40	305177.43	12.97	99	100% range is in CA.	56.04	82.34	3.09	2.784	CalPUR	Low
Cirsium vinaceum	Sacramento Mountains thistle	16	4241623.73	71.45	0		0.41	0.01	0.04		Standard	Low
Clarkia franciscana	Presidio clarkia	60	14576176.42	***	100		***	***		***	CalPUR	Low
Clarkia imbricata	Vine Hill clarkia	61	37424.97	100.00	100		54.37	100.66	28.29	1.539	CalPUR	Low
Clematis socialis	Alabama leather flower	62	938851.42	3.35	0		14.74	34.01	2.15		Standard	Low
Clitoria fragrans	Pigeon wings	8	4341443.09	4.75	0		22.63	80.32	6.75**		Standard	Medium
Cordylanthus maritimus ssp. maritimus	Salt marsh bird's-beak	41	1535261.33	32.86	100		23.66	67.12	3.37	3.190	CalPUR	Low
Coryphantha scheeri var. robustispina	Pima pineapple cactus	63	1570440.69	19.32	0		6.96	0	0.59		Standard	Low
Coryphantha sneedii var. leei	Lee pincushion cactus	64	2686418.67	58.73	0		3.72	41.83	0.75		Standard	Low
Coryphantha sneedii var. sneedii	Sneed pincushion cactus	65	5776817.44	57.43	0		6.99	43.01	1.37**		Standard	Low
Cycladenia humilis var. jonesii	Jones Cycladenia	17	532335.59	61.74	0		0.44	36.98	0.10**		Standard	Low
Dalea foliosa	Leafy prairie-clover	42	5331306.32	1.37	0		34.22	53.96	2.02		Standard	Low
Dicerandra christmanii	Garrett's mint	2	708004.47	7.99	0		23.71	0.27	15.55		Standard	High
Dudleya abramsii ssp. parva	Conejo dudleya	66	118418.46	10.57	100		39.59	89.79	2.04	2.502	CalPUR	Low
Dudleya stolonifera	Laguna Beach liveforever	67	24354.86	0.02	100		41.95	100.82	2.29	2.087	CalPUR	Low
Echinacea laevigata	Smooth coneflower	43	6087911.50	12.85	0		17.26	21.56	1.10		Standard	Low
Erigeron rhizomatus	Zuni fleabane	18	11678202.89	35.42	0		0.29	44.10	0.02		Standard	Low

Scientific Name	Common Name	Number	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential 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
Eriodictyon altissimum	Indian Knob mountain balm	68	392173.60	48.22	99	100% range is in CA.	8.42	51.59	2.28	0.331	CalPUR	Low
Eriogonum gypsophilum	Gypsum wild-buckwheat	69	2686418.67	58.73	0		3.72	41.83	0.75		Standard	Low
Eriogonum kennedyi var. austromontanum	Southern mountain wild-buckwheat	70	354708.69	98.66	100		0.10	1.37	0.01	0.005	CalPUR	Low
Eriogonum ovalifolium var. williamsiae	Steamboat buckwheat	71	73811.72	43.36	0		16.31	35.33	0.96		Standard	Low
Eriogonum pelinophilum	Clay-Loving wild buckwheat	3	331111.31	19.80	0		30.24	45.66	11.13		Standard	High
Eryngium cuneifolium	Snakeroot	4	708004.47	7.99	0		23.71	0.27	15.55		Standard	High
Erysimum menziesii	Menzies' wallflower	72	36971429.79	32.18	100		27.67	60.04	1.73	0.677	CalPUR	Low
Fremontodendron mexicanum	Mexican flannelbush	44	50244.46	6.16	100		10.83	94.62	0.54	0.539	CalPUR	Low
Geum radiatum	Spreading avens	73	2356815.34	41.23	0		8.56	0.03	0.76		Standard	Low
Gilia tenuiflora ssp. arenaria	Monterey gilia	9	205432.30	4.57	100		39.45	74.72	6.58	9.247	CalPUR	Medium
Hedeoma todsenii	Todsen's pennyroyal	19	6952999.78	67.69	0		0.51	15.05	0.10		Standard	Low
Hedyotis purpurea var. montana	Roan Mountain bluet	74	1786334.35	40.09	0		6.41	0	0.70		Standard	Low
Helianthus schweinitzii	Schweinitz's sunflower	45	5781906.18	4.06	0		21.86	27.56	1.35		Standard	Low
Hoffmannseggia tenella	Slender rush-pea	5	1445054.26	3.12	0		37.03	76.65	16.63		Standard	High
Hudsonia montana	Mountain golden heather	76	614910.08	32.74	0		10.83	0	1.05		Standard	Low
Iliamna corei	Peter's Mountain mallow	20	131.52	25.91	0		0	0	0		Standard	Low
Leavenworthia texana	Texas golden Gladecress	77	748082.53	57.67	0		2.38	0	0.12		Standard	Low

Scientific Name	Common Name	Number	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential 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
Lespedeza leptostachya	Prairie bush-clover	21	50076980.55	0.49	0		46.19	10.94	0.91		Standard	Low
Lilaeopsis schaffneriana var. recurva	Huachuca water-umbel	22	1096936.52	41.86	0		1.84	0	0.12	No usage overlap	Standard	Low
Limnanthes floccosa ssp. californica	Butte County meadowfoam	78	220552.05	1.43	100		42.42	86.39	26.06	0.673	CalPUR	Low
Malacothrix squalida	Island malacothrix	23	18663.89	100.00	100	Only occurs on Federal Lands	0	0	0	No usage overlap	CalPUR	Low
Mimulus michiganensis	Michigan monkey-flower	79	5536465.18	4.85	0		3.92	0	0.81		Standard	Low
Monardella viminea	Willowy monardella	80	478178.01	9.83	100		44.79	90.39	2.37	2.234	CalPUR	Low
Navarretia fossalis	Spreading navarretia	24	4322907.17	34.94	100		16.90	65.04	2.68	1.329	CalPUR	Low
Nitrophila mohavensis	Amargosa niterwort	25	99988.12	98.59	<100	No pesticide usage overlap in CA. Species also occurs in NV.	0.024604	0	0.00123	0.001	CalPUR	Low
Oxypolis canbyi	Canby's dropwort	46	10587971.32	6.70	0		20.74	56.10	1.19		Standard	Low
Packera franciscana	San Francisco Peaks ragwort	26	155719.69	100.00	0		0	0	0		Standard	Low
Pedicularis furbishiae	Furbish lousewort	81	29564.47	0.00	0		12.33	0	3.68		Standard	Low
Penstemon debilis	Parachute beardtongue	27	365975.99	40.42	0		0.20	10.21	0.13		Standard	Low
Penstemon penlandii	Penland beardtongue	82	124391.47	34.68	0		2.22	0	0.39		Standard	Low
Pilosocereus robinii	Key tree cactus	28	2395485.05	49.92	0		0.88	10.88	0.05		Standard	Low
Pinguicula ionantha	Godfrey's butterwort	29	3179544.86	19.38	0		5.40	62.25	0.54		Standard	Low
Pityopsis ruthii	Ruth's golden aster	30	283139.06	76.99	0		3.54	0.01	0.97		Standard	Low
Pogogyne nudiuscula	Otay mesa-mint	83	35841.68	2.26	100		43.93	98.19	2.27	2.188	CalPUR	Low
Polygala lewtonii	Lewton's polygala	10	5759395.79	11.81	0		18.49	74.06	5.26		Standard	Medium

Scientific Name	Common Name	Number	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential 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
Primula maguirei	Maguire primrose	84	45946.21	96.06	0		2.44	4.11	1.18		Standard	Low
Ptilimnium nodosum	Harperella	47	9417106.44	25.33	0		9.88	6.60	1.42		Standard	Low
Rhodiola integrifolia ssp. leedyi	Leedy's roseroot	85	2554845.73	***	0		***	***	***		Standard	Low
Rhododendron chapmanii	Chapman rhododendron	86	1766147.67	20.21	0		8.82	73.63	1.54**		Standard	Low
Rhus michauxii	Michaux's sumac	48	8344289.83	4.41	0		22.83	30.01	1.27		Standard	Low
Ribes echinellum	Miccosukee gooseberry	87	614671.12	49.63	0		4.98	2.13	0.69		Standard	Low
Rorippa gambellii	Gambel's watercress	88	3131441.92	33.95	100		19.07	65.61	3.12	2.710	CalPUR	Low
Sarracenia oreophila	Green pitcher-plant	49	2499443.20	23.29	0		9.72	21.10	0.91		Standard	Low
Sarracenia rubra ssp. jonesii	Mountain sweet pitcher-plant	89	2074905.10	28.62	0		16.94	50.31	1.35		Standard	Low
Schwalbea americana	American chaffseed	50	33590477.77	***	0		***	***	***		Standard	Low
Sibara filifolia	Santa Cruz Island rockcress	90	80170.38	50.02	100		2.15	50.20	0.11	0.107	CalPUR	Low
Sidalcea nelsoniana	Nelson's checker-mallow	51	9213310.12	19.31	0		11.78	40.61	2.03		Standard	Low
Sidalcea pedata	Pedate checker-mallow	31	69047.09	100.00	100	Only occurs on Federal Lands	0	0	0	No usage overlap	CalPUR	Low
Silene polypetala	Fringed campion	52	1553653.51	0.41	0		18.87	67.10	2.32**		Standard	Low
Solidago spithamaea	Blue Ridge goldenrod	32	1418843.72	37.43	0		9.43	0.04	0.96		Standard	Low
Spiraea virginiana	Virginia spiraea	53	9536257.95	29.70	0		7.76	12.24	0.62		Standard	Low
Stephanomeria malheurensis	Malheur wire-lettuce	33	69761.08	90.24	0		0.56	0	0.32		Standard	Low
Streptanthus niger	Tiburon jewelflower	91	11527.87	0.00	96	100% range is in CA.	71.97	100.25	4.01	3.579	CalPUR	Low

Scientific Name	Common Name	Number	Acres in Species Range*	% Range Overlap with Federal Lands*	% Range in CA*	Comments for % Range in CA*	Total Overlap % (All Agricultural and Residential 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
Thysanocarpus conchuliferus	Santa Cruz Island fringepod	34	18660.79	100.00	0		0	0	0	No usage overlap	Standard	Low
Trifolium amoenum	Showy Indian clover	92	3077194.49	16.98	100		11.34	20.14	1.61	0.496	CalPUR	Low
Verbesina dissita	Big-leaved crownbeard	93	14417.50	0.06	100		59.75	101.11	3.26	2.973	CalPUR	Low
Warea carteri	Carter's mustard	6	5175501.74	18.88	0		20.28	63.40	6.15**		Standard	Medium
Yermo xanthocephalus	Desert yellowhead	35	419117.46	81.30	0		0.12	19.27	0.04**		Standard	Low
Ziziphus celata	Florida ziziphus	7	1995189.22	5.52	0		25.66	61.96	13.19		Standard	High

* Information in this column was used to inform the ranking metrics or the draft determination when relevant
**Usage anticipated from mosquito control applications was not included as a data column in this table. The anticipated usage for mosquito control for these species is above 5.0%. Although the numbers are not all listed here, as described in the Analysis for Plants and Effects of the Action sections of this Opinion, we considered usage from mosquito control in our analysis of all species. We expect the effects to pollinators and seed dispersers of these species from mosquito control usage will be substantially reduced by the mosquito adulticide timing restriction conservation measure described below, thus substantially limiting reproductive effects to these species.
***Qualitative assessments necessary for these species, see individual rationales in the *Rationale for Species Conclusions* section, below

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, 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.

Reduced citrus application rate: For citrus applications outside of California, label restrictions will include a reduction in the maximum application rate, which is anticipated to reduce potential environmental concentrations to one-third of modeled values, reducing the effects to species and their seed dispersers on and adjacent to these use areas. For citrus applications in California, instead of reducing application rates, users can only apply once per year, and by ground application only.

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.

Species-Specific Conservation Measures

The following species-specific measures are now part of the Action and will be included in *BulletinsLive! Two*.

In addition to the general conservation measures described above, two species (Garrett’s mint and Florida ziziphus) will also have a species-specific conservation measure that allows for a choice of application restrictions, described below.

For the conservation measures that include a choice of application restrictions, the measures direct agricultural applicators in the vicinity of suitable habitat for these species to choose one of three options when applying malathion, any one of which we anticipate would be protective of the species’ insect pollinators and/or seed dispersers: 1. Apply malathion before dawn or after dusk, thus avoiding the active period of the species’ pollinators OR 2. Apply malathion only when wind is blowing away from suitable habitat for the species, thus reducing exposure to pollinators OR 3. Use a 50-foot ground buffer from suitable habitat or an aerial buffer. For the third option, the aerial buffer is measured from suitable habitat (identified by species) according to application rate: (1) 50 feet for <0.5 lbs ai/A; (2) 75 feet for 0.5 - <1 lb ai/A; (3) 150 feet for 1-2.5 lbs ai/A; (4) 200 feet for >2.5 lbs ai/A. Buffer sizes may be reduced by 25 feet for application rates (1) and (2) if a full swath displacement upwind is used during aerial application. Buffer sizes may be reduced by 50 feet for application rates (3) and (4) if a full swath displacement upwind is used during aerial application.

Swath displacement is a typical practice in the aerial application of pesticides where applicators adjust the position of spray to account for pesticide that may drift into adjacent areas. For example, applicators may skip an outer row of trees or avoid spraying to the edge of the field. In our conservation measure for Garrett’s mint and Florida ziziphus, we allow applicators to reduce the required buffer size by 50 feet if using a full swath displacement, which we anticipate will generally be roughly equivalent to this distance. The full swath displacement effectively acts as a buffer and the resultant distance from species habitat is expected to be the same size whether swath displacement is used or not.

Species-specific conservation measures are referenced, where applicable, in the Rationale for Species Conclusions section below Table 4.

Table 4: Summary of Conclusions

Number	Scientific Name	Common Name	Vulnerability Ranking	Risk Ranking	Usage Ranking	Species Conclusion (J, NJ)*
1	*Chionanthus pygmaeus*	Pygmy fringe-tree	High	High	Medium	NJ
2	*Dicerandra christmanii*	Garrett's mint	High	High	High	NJ
3	*Eriogonum pelinophilum*	Clay-Loving wild buckwheat	High	High	High	NJ
4	*Eryngium cuneifolium*	Snakeroot	High	High	High	NJ
5	*Hoffmannseggia tenella*	Slender rush-pea	High	High	High	NJ
6	*Warea carteri*	Carter's mustard	High	High	Medium	NJ
7	*Ziziphus celata*	Florida ziziphus	High	High	High	NJ
8	*Clitoria fragrans*	Pigeon wings	Medium	High	Medium	NJ
9	*Gilia tenuiflora ssp. arenaria*	Monterey gilia	Medium	High	Medium	NJ
10	*Polygala lewtonii*	Lewton's polygala	Medium	High	Medium	NJ
11	*Acanthomintha ilicifolia*	San Diego thornmint	Medium	Low	Low	NJ
12	*Arabis hoffmannii*	Hoffmann's rock-cress	Medium	Low	Low	NJ
13	*Asclepias welshii*	Welsh's milkweed	High	Low	Low	NJ
14	*Astragalus phoenix*	Ash meadows milk-vetch	Medium	Low	Low	NJ
15	*Berberis pinnata ssp. insularis*	Island Barberry	High	Low	Low	NJ
16	*Cirsium vinaceum*	Sacramento Mountains thistle	High	Low	Low	NJ
17	*Cycladenia humilis var. jonesii*	Jones Cycladenia	Medium	Low	Low	NJ
18	*Erigeron rhizomatus*	Zuni fleabane	Low	Low	Low	NJ
19	*Hedeoma todsenii*	Todsen's pennyroyal	Medium	Low	Low	NJ
20	*Iliamna corei*	Peter's Mountain mallow	High	Low	Low	NJ
21	*Lespedeza leptostachya*	Prairie bush-clover	Low	High	Low	NJ
22	*Lilaeopsis schaffneriana var. recurva*	Huachuca water-umbel	Medium	Low	Low	NJ
23	*Malacothrix squalida*	Island malacothrix	High	Low	Low	NJ
24	*Navarretia fossalis*	Spreading navarretia	Low	High	Low	NJ
25	*Nitrophila mohavensis*	Amargosa niterwort	High	Low	Low	NJ
26	*Packera franciscana*	San Francisco Peaks ragwort	High	Low	Low	NJ
27	*Penstemon debilis*	Parachute beardtongue	High	Low	Low	NJ
28	*Pilosocereus robinii*	Key tree cactus	High	Low	Low	NJ
29	*Pinguicula ionantha*	Godfrey's butterwort	Low	High	Low	NJ
30	*Pityopsis ruthii*	Ruth's golden aster	High	Low	Low	NJ
31	*Sidalcea pedata*	Pedate checker-mallow	High	Low	Low	NJ
32	*Solidago spithamaea*	Blue Ridge goldenrod	High	High	Low	NJ
33	*Stephanomeria malheurensis*	Malheur wire-lettuce	High	Low	Low	NJ

Number	Scientific Name	Common Name	Vulnerability Ranking	Risk Ranking	Usage Ranking	Species Conclusion (J, NJ)*
34	*Thysanocarpus conchuliferus*	Santa Cruz Island fringepod	High	Low	Low	NJ
35	*Yermo xanthocephalus*	Desert yellowhead	High	Low	Low	NJ
36	*Aconitum noveboracense*	Northern wild monkshood	Medium	High	Low	NJ
37	*Amphianthus pusillus*	Little amphianthus	Medium	High	Low	NJ
38	*Arabis macdonaldiana*	McDonald's rock-cress	Medium	Medium	Low	NJ
39	*Bonamia grandiflora*	Florida bonamia	Medium	High	Low	NJ
40	*Chorizanthe robusta var. robusta*	Robust spineflower	Medium	High	Low	NJ
41	*Cordylanthus maritimus ssp. maritimus*	Salt marsh bird's-beak	Medium	Medium	Low	NJ
42	*Dalea foliosa*	Leafy prairie-clover	Medium	High	Low	NJ
43	*Echinacea laevigata*	Smooth coneflower	Medium	High	Low	NJ
44	*Fremontodendron mexicanum*	Mexican flannelbush	Medium	Medium	Low	NJ
45	*Helianthus schweinitzii*	Schweinitz's sunflower	Medium	High	Low	NJ
46	*Oxypolis canbyi*	Canby's dropwort	Medium	High	Low	NJ
47	*Ptilimnium nodosum*	Harperella	Medium	High	Low	NJ
48	*Rhus michauxii*	Michaux's sumac	Medium	High	Low	NJ
49	*Sarracenia oreophila*	Green pitcher-plant	Medium	High	Low	NJ
50	*Schwalbea americana*	American chaffseed	Medium	High	Low	NJ
51	*Sidalcea nelsoniana*	Nelson's checker-mallow	Medium	High	Low	NJ
52	*Silene polypetala*	Fringed campion	Medium	High	Low	NJ
53	*Spiraea virginiana*	Virginia spiraea	Medium	High	Low	NJ
55	*Arenaria paludicola*	Marsh Sandwort	High	High	Low	NJ
56	*Astragalus applegatei*	Applegate's milk-vetch	High	High	Low	NJ
57	*Astragalus brauntonii*	Braunton's milk-vetch	High	High	Low	NJ
58	*Astragalus tener var. titi*	Coastal dunes milk-vetch	High	High	Low	NJ
59	*Campanula robinsiae*	Brooksville bellflower	High	High	Low	NJ
60	*Clarkia franciscana*	Presidio clarkia	High	High	Low	NJ
61	*Clarkia imbricata*	Vine Hill clarkia	High	Medium	Low	NJ
62	*Clematis socialis*	Alabama leather flower	High	High	Low	NJ
63	*Coryphantha scheeri var. robustispina*	Pima pineapple cactus	High	High	Low	NJ
64	*Coryphantha sneedii var. leei*	Lee pincushion cactus	High	Medium	Low	NJ
65	*Coryphantha sneedii var. sneedii*	Sneed pincushion cactus	High	Medium	Low	NJ
66	*Dudleya abramsii ssp. parva*	Conejo dudleya	High	High	Low	NJ
67	*Dudleya stolonifera*	Laguna Beach liveforever	High	High	Low	NJ
68	*Eriodictyon altissimum*	Indian Knob mountain balm	High	High	Low	NJ
69	*Eriogonum gypsophilum*	Gypsum wild-buckwheat	High	Medium	Low	NJ

Number	Scientific Name	Common Name	Vulnerability Ranking	Risk Ranking	Usage Ranking	Species Conclusion (J, NJ)*
70	*Eriogonum kennedyi var. austromontanum*	Southern mountain wild-buckwheat	High	Medium	Low	NJ
71	*Eriogonum ovalifolium var. williamsiae*	Steamboat buckwheat	High	High	Low	NJ
72	*Erysimum menziesii*	Menzies' wallflower	High	High	Low	NJ
73	*Geum radiatum*	Spreading avens	High	High	Low	NJ
74	*Hedyotis purpurea var. montana*	Roan Mountain bluet	High	High	Low	NJ
76	*Hudsonia montana*	Mountain golden heather	High	High	Low	NJ
77	*Leavenworthia texana*	Texas golden Gladecress	High	Medium	Low	NJ
78	*Limnanthes floccosa ssp. californica*	Butte County meadowfoam	High	High	Low	NJ
79	*Mimulus michiganensis*	Michigan monkey-flower	High	High	Low	NJ
80	*Monardella viminea*	Willowy monardella	High	High	Low	NJ
81	*Pedicularis furbishiae*	Furbish lousewort	High	High	Low	NJ
82	*Penstemon penlandii*	Penland beardtongue	High	High	Low	NJ
83	*Pogogyne nudiuscula*	Otay mesa-mint	High	High	Low	NJ
84	*Primula maguirei*	Maguire primrose	High	Medium	Low	NJ
85	*Rhodiola integrifolia ssp. leedyi*	Leedy's roseroot	High	High	Low	NJ
86	*Rhododendron chapmanii*	Chapman rhododendron	High	High	Low	NJ
87	*Ribes echinellum*	Miccosukee gooseberry	High	High	Low	NJ
88	*Rorippa gambellii*	Gambel's watercress	High	High	Low	NJ
89	*Sarracenia rubra ssp. jonesii*	Mountain sweet pitcher-plant	High	High	Low	NJ
90	*Sibara filifolia*	Santa Cruz Island rockcress	High	Medium	Low	NJ
91	*Streptanthus niger*	Tiburon jewelflower	High	High	Low	NJ
92	*Trifolium amoenum*	Showy Indian clover	High	High	Low	NJ
93	*Verbesina dissita*	Big-leaved crownbeard	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, although there are some differences among vulnerability, risk of exposure, and usage, particularly as it relates to their pollinators or seed dispersers. Our rationales related to these differences are described below, with the species discussions divided into various sections and subsections. Our first section addresses species 11 through 93 discussed in part by common points or assumptions of analyses within the identified subgroupings, followed by a section for species 1 through 10 discussed on a species-by-species basis.

Species with No Anticipated Usage in Range
The following species occur completely within California and have no malathion usage reported through the CalPUR system, or no usage anticipated for species outside of California: 15, 20, 22, 23, 25, 26, 31, and 34. In addition, species 15, 23, 26, 31 and 34 also occur 100% on federal lands (see paragraph for species on federal lands below). Given we do not expect malathion usage on any portion of the range of these species, we do not anticipate pollinator and seed disperser mortality and sub-lethal effects to cause adverse reproductive effects to these species.

Species Entirely on Federal Lands
The following species occur 100% on Federal lands: 12, 15, 23, 26, 31, 34, and 61. We anticipate usage within the range of these species will be low, based primarily on the usage data we acquired about malathion usage on Federal lands indicating that past malathion usage has occurred on public lands for a variety of uses, but usage has been minimal (see Usage section of Opinion), with only localized applications occurring on a rare basis. We expect any adverse effects to listed resources to be minimal, considering the small scale and low levels of past usage and in light of Federal agency programs that are designed to understand, avoid and minimize the effects to listed species. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of these species in the wild.

Remaining Species

Species numbered 11-35 (except those identified as having no usage reported or occurring 100% on federal lands, discussed above) have varying vulnerabilities (high, medium or low) based on their status, distribution and trends; most have low risk posed by labeled uses across the range; and all have low estimated usage within their ranges as described above. Those species with high vulnerabilities (species numbered 13, 16, 20, 25, 27, 28, 30, 32, 33, 35) all had both low risk and low estimated usage, with the exception of species 32, Blue Ridge goldenrod, which is discussed separately in the following paragraph. We anticipate these plant species would experience relatively low pollinator mortality across their ranges, which factored into the low risk ranking for many of these species. In addition, all species in this assessment group can rely on self-fertilization and/or vegetative methods for reproduction, thus decreasing their reliance on pollinators for reproduction and survival. Furthermore, we anticipate the additional conservation measures described above will further reduce the risk of exposure of both pollinators and seed dispersers 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, when many pollinators are active, 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. As a result, though malathion exposure is expected to cause some level of pollinator mortality within their range, these plants are likely to be able to reproduce successfully via other methods. As a result, and given that anticipated usage within these species' ranges is very low (all are less than one percent), we expect malathion to be applied on a very small portion of the ranges of these species (where conservation measures are in effect), resulting in a level of pollinator and seed disperser mortality that will not cause species-level reproductive effects. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of these species in the wild.

Blue Ridge goldenrod (species 32), a narrow endemic existing on three mountains in North Carolina and Tennessee, has high vulnerability due to its narrow distribution and small number of populations. This species uses insects for pollination, but specific pollinator species are unknown. As with all species in this assessment group, Blue Ridge golden rod may be able to reproduce by using self-fertilization or vegetative means, thus reducing its reliance on pollination vectors for reproduction. Insect pollinators are expected to experience moderate mortality (35%) across the range of this species. We anticipate adverse effects to the species due to the reduction in pollinating insects that would result in reduced reproductive success. Seed dispersal vectors are unknown, but wind dispersal is likely, therefore we do not anticipate adverse effects to the reproduction of this species due to loss of seed dispersers from malathion exposure. However, we anticipate very low levels (0.96%) of malathion usage within the species range. Furthermore, we anticipate the additional conservation measures described above will further reduce the risk of exposure of both pollinators and seed dispersers in the very small portion of the range where we anticipate malathion to be applied. 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. The reduced application footprint and likelihood of spray drift are a result of the allowable application methods for spot treatment (such as the use of hand-pump sprayers, which are not capable of producing broadcast use) and low amounts of chemical used.
As a result, while we anticipate adverse effects due to the loss of insect pollinators and resultant loss of reproductive success from malathion exposure, we do not expect that these adverse effects will cause species-level effects due to the very low level of malathion usage and this species ability to rely on selfing (self-fertilization) or vegetative reproduction. Therefore, we do not anticipate the action would appreciably reduce the survival and recovery of the Blue Ridge goldenrod in the wild.

Species numbered 36-54 (except those identified as having no usage reported or occurring 100% on federal lands, discussed above and species 50, American chaffseed, discussed qualitatively below) all have medium vulnerabilities based on their status, distribution and trends, high or medium risk posed by labeled uses across their ranges, and low estimated usage within their ranges as described above. These plant species are expected to experience medium to high (ranging from 7.5-100%) insect pollinator mortality within their ranges, which factored into the risk ranking for these species. However, all species in this assessment group can rely on self-fertilization and/or vegetative methods for reproduction, thus decreasing their reliance on pollinators for reproduction and survival. As a result, though malathion exposure, in some cases, is anticipated to cause pollinator mortality within their range, these plants are likely to be able to reproduce successfully via other methods. Furthermore, we anticipate the additional conservation measures described above will further reduce the risk of exposure of both pollinators, seed dispersers, and the plants themselves in the very small portion of the range where we anticipate malathion to be applied. 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. The reduced

application footprint and likelihood of spray drift are a result of the allowable application methods for spot treatment (such as the use of hand-pump sprayers, which are not capable of producing broadcast use) and low amounts of chemical used.
Anticipated usage within these species' ranges is low, and we anticipate malathion to be applied on a very small portion of the ranges of these species. Thus, we do not anticipate pollinator and seed disperser mortality to cause species-level reproductive effects. Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of these species in the wild.

Species 49, the green pitcher-plant, as described in the General Effects to Plants section, could experience greater effects from direct exposure to malathion due to the potential presence of digestive glands within its pitchers. These digestive glands have been shown to increase uptake of chemicals into the plant and cause an increased plant mortality. Plant mortality due to malathion exposure is only anticipated for a limited number of malathion use types, including vegetables and ground fruit, developed and open space developed (residential uses), nurseries and Christmas trees. Usage data indicates there is very little overlap of the green pitcher's range with agricultural and residential use (0.91%), thus we do not anticipated substantial effects to this species from direct application of malathion. In addition, as described above, we anticipate the additional conservation measures will further reduce the risk of exposure to the plants themselves and their pollinators and seed dispersers in the small portion of the range where we anticipate malathion to be applied. There for, we do not anticipate the proposed action would appreciably reduce the survival and recovery of the green pitcher-plant in the wild.

Species 50, American chaffseed is a perennial herb found in scattered populations across eight states in the eastern and southeastern U.S. in wet, acidic grasslands. Forty-one out of the 43 extant chaffseed populations occur on protected land with long-term protection secured through management plans on Federal and State property and landowner agreements (such as Safe Harbor Agreements), and through conservation easements on private lands. As a result, twenty chaffseed populations currently meet downlisting criteria as described in the Recovery Plan (USFWS 1995). Prior to finalizing this Biological Opinion, we discovered that the overlap of malathion use sites with the species range was calculated based on an inaccurate range map for this species. More specifically, the range for this species that was calculated in the original overlap analysis for our draft Opinion included most of the state of Florida. Based on further review of Service documentation, we determined the species' range should only include small portions of Florida. As a result, we did not carry forward the overlap values from the draft Opinion into this final Opinion. Instead, we qualitatively estimated the types and extent of malathion use sites occurring within the range by visually examining mapped crop data layers in proximity to the species range. Thus, the estimated usage has changed from what was originally calculated based on the larger area previously considered. A visual inspection of Cropland Data Layers indicates corn, wheat, other crops, citrus, other orchards and cotton use sites as overlapping with the accurate range. In addition, up to 5% of overlapping residential use sites (developed and open space developed layers) are anticipated to undergo some level of malathion application. Based on the available data, we do not anticipate mosquito adulticide usage will occur in four of the eight states within the accurate range. Although we know there is usage in the remaining four states within the range, and in some counties this usage is anticipated to be high, almost all populations occur on protected lands where we anticipate low mosquito control use of malathion. In addition, the conservation measure restricting the timing of mosquito adulticide use will prohibit application during most daylight hours when pollinators of this species are most active, thus reducing pollinator exposure and resultant mortality. Thus, we anticipate very small numbers of the chaffseed's pollinators will be exposed during mosquito adulticide applications within its range.

While the American chaffseed is known to be pollinated by bumblebees and other insects, the Recovery Plan (1995) indicates that pollinators are not a requirement for fruit and viable seed production (i.e., it can self-pollinate). As a result, it is likely to experience fewer reproductive effects if there is a temporary loss of pollinators within its range due to malathion use. In addition, the chaffseed uses wind to disperse its seeds, and thus no reproductive effects are expected. Moreover, the new restrictions to be implemented for residential, agricultural and mosquito control uses of malathion, are anticipated to substantially reduce exposure to the pollinators of this species, as described above in the *General Conservation Measures* section. For example, new bloom restrictions on citrus and other orchards will prohibit application of malathion within three days prior to bloom, during bloom, and until petal fall is complete, thus resulting in reduced exposure to pollinators attracted to the flowers of these crops. Finally, new restrictions on corn, cotton, and citrus will lower the maximum allowable number of applications and reduce pollinator exposure on these use types within the range of the species. As a result, we expect that only very small numbers of the American chaffseed's pollinators will be exposed to malathion, and that any small losses of pollinating insects would be unlikely result in adverse effects to the species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the American chaffseed in the wild.

Species numbered 55-93 (except those identified as having no usage reported or occurring 100% on federal lands, discussed above and species 60 and 85, presidio clarkia and Leedy's roseroot, discussed qualitatively below) all have high vulnerabilities based on their status, distribution and trends, high or medium risk posed by labeled uses across their ranges, and low estimated usage within their ranges as described above. Due to their high vulnerabilities, these species are less likely to be able to withstand additional stressors in their environment, including declines in available pollinator and seed disperser populations across their range from malathion exposure. Most of these species rely on insects for pollination, though there are a few species (59 and 75) that use birds in combination with insect pollinators. Insect pollinators are expected to experience mortality (greater than 40%) across the ranges of many of these species from exposure to malathion, while the insect pollinators of other species are expected to experience relatively low mortality (for example, southern mountain wild-buckwheat at 1.65% pollinator mortality and Texas golden gladecress at 5.71%). Bird pollinators are also anticipated to experience relatively high mortality from malathion exposure as indicated in Table 2 (Effects to Pollinators column). However, all species in this assessment group can rely on self-fertilization and/or vegetative methods for reproduction, thus decreasing their reliance on pollinators for reproduction and survival. Furthermore, we anticipate the additional conservation measures described above (between Tables 3 and 4) will further reduce the risk of exposure of both pollinators and seed dispersers in the very small portion of the range where we anticipate malathion to be applied. 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.

These species also rely on seed dispersal vectors to maintain populations and colonize new sites within their range. If the species uses insects or birds for seed dispersal, populations of these dispersal animals are expected to experience losses due to malathion exposure (refer to Table 2, column titled Seed Dispersal Vector).

Regardless of the risk to the species anticipated, the expected usage, and thus the portion of the range where malathion may be applied for species 55-93 is expected to be low; all are 3.86% or less, with the vast majority at 2% or less. As a result , we anticipate the adverse effects in the form of pollinator and seed disperser mortality, and resultant loss of reproductive capacity in these plant species will not occur over a large enough portion of their range to result in species-level effects, and conservation measures will further reduce exposure of pollinators and seed dispersers in the small area of the range where malathion is anticipated to be applied Therefore, we do not anticipate the proposed action will appreciably reduce survival and recovery of these plant species in the wild.

Species 60, **Presidio clarkia** is a small annual in the evening primrose family, is endemic to California and restricted to serpentine soils in grassland and scrub communities. Currently, it is known to occur in only two locations, the Presidio in San Francisco County and Oakland Hills in Alameda County. Some of the Presidio sites and the site at Redwood Regional Park (Oakland Hills) are managed and have increased in abundance and local distribution. Two of these managed sites are the largest and most productive within the range of the species. However, the remaining sites at Oakland Hills are highly fragmented and surrounded by development. These fragmented sites are likely all that remains of what was once a single population (2010 5-year Status Review). Prior to finalizing this Biological Opinion, we discovered that the overlap of malathion use sites with the species range was calculated based on an inaccurate range map for this species. More specifically, the range for this species that was calculated in the original overlap analysis included portions in San Francisco and Alameda Counties, as well as coastal California from San Jose to Long Beach and into the Pacific Ocean. Based on further review of Service documentation for this species, the range should only be the areas within San Francisco and Alameda Counties. As a result, we did not carry forward the overlap values from the draft Opinion into this final Opinion. Instead, we qualitatively estimated the types and extent of malathion use sites occurring within the range by visually examining mapped crop data layers in proximity to the species range. Thus, the usage has changed from what was originally calculated. A visual inspection of Cropland Data Layers indicates the majority of usage is residential, where up to 5% of developed and open space developed use sites (residential) would undergo some level of treatment with malathion. There is no usage for mosquito control or on agricultural use sites in these counties within the range.

While the Presidio clarkia is known to be pollinated by bees and other insects, the 2010 5-year Status Review indicates this species is thought to be largely self-pollinating, and thus it is likely to experience fewer reproductive effects if there is a temporary loss of pollinators within its range due to malathion use in residential areas. While pollinator loss is listed as a potential threat to this species in the 2010 5-year Review, this threat was primarily based on worldwide and national losses of pollinators. The 5-year Status Review also reports a rich diversity of bees at one of the two sites, indicating pollinator populations are likely not restricted at that site. The Presidio clarkia is thought to rely on a variety of animal taxa for seed dispersal in addition to abiotic vectors such as wind. As a result, we do not anticipate adverse reproductive effects to this species from loss of seed dispersers due to the species ability to rely on multiple avenues for seed dispersal if the insect or avian seed dispersers experience a temporary decline from malathion usage. Furthermore, the new restrictions to be implemented for residential uses of malathion, the main use driver for this species, are anticipated to substantially reduce exposure to the pollinators and seed dispersers of this species, as described above in the *General Conservation Measures* section. As a result, while we anticipate a low level of adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from malathion exposure, we do not expect that these adverse effects will result in species-level effects due to the diversity and array of pollinators and seed dispersers available to this species, and the conservation measures that will be implemented that will reduce exposure of pollinators and seed dispersers to malathion. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the Presidio clarkia in the wild.

Species 85, Leedy's roseroot is a member of the stonecrop family and occurs in small areas of Minnesota, New York, and South Dakota on cliff faces with seepage areas. The roseroot is found in only six locations in these three widely separated states. The extant populations in these three states vary in their level of protection and overall trends in numbers of individuals. Prior to finalizing this Biological Opinion, we discovered that the overlap of malathion use sites with the species range was calculated based on an inaccurate range map for this species. More specifically, the range for this species that was calculated in the original overlap analysis included small areas in Minnesota, New York, and South Dakota as well as Rockland and Westchester counties plus New York City and Long Island in New York. Based on further review of Service documentation for this species, the range should only be the small areas in Minnesota, and South Dakota, and the areas in New York without the addition of Rockland, and Westchester Counties, New York City, and Long Island. As a result, we did not carry forward the overlap values from the draft Opinion into this final Opinion. Instead, we qualitatively estimated the types and extent of malathion use sites occurring within the range by visually examining mapped crop data layers in proximity to the species range. Thus, the usage has changed from what was originally calculated based on the larger area previously considered. While the numeric extent of overlap between the range of Leedy's roseroot and malathion use sites is not available, a visual inspection of Cropland Data Layers indicates that crops within the corn, developed, other crops, wheat, grapes, open space developed, and pasture UDLs have the most overlap with the range of this species. We estimate that up to 5% of developed and open space developed use sites (residential uses) within the species range could undergo some level of treatment with malathion. There is no indication of malathion usage for mosquito control within the range of this species.

The Recovery Plan for this species indicates a variety of bees and flies are pollinators for this species, and it uses wind for seed dispersal. The Recovery Plan further states that clonal, non-sexual growth has been observed in cultivated plants, though it is unknown whether this is a viable form of reproduction in the wild. No loss of seed dispersers from malathion use are expected due to the abiotic nature of the dispersal vector for this species. We

anticipate that insect pollinators for this species would experience mortality if they come into contact with malathion applied within the range of the species, and, in the absence of effect conservation measures, may reduce reproductive success for the species. However, since this species can rely on a variety of pollinator species for pollen transfer, it is anticipated the roseroot will experience fewer reproductive effects since plants will likely continue to have visits from pollinators even if some pollinator species or individuals experience a temporary loss from malathion application.

Conservation measures will be implemented that are anticipated to substantially reduce exposure to pollinators from malathion application on residential and agricultural use sites. For example, new bloom restrictions on grapes, pasture, and other crops will prohibit application of malathion within three days prior to bloom, during bloom, and until petal fall is complete, thus resulting in reduced exposure to pollinators attracted to the flowers of these crops. In addition, new restrictions on corn, pasture, and grapes will lower the maximum allowable number of applications and reduce pollinator exposure on these use types within the range of the species. As a result, while we anticipate a low level of adverse effects due to the loss of small numbers of insect pollinators and reduced reproductive success from malathion exposure for small numbers of individual plants, we do not expect that these adverse effects will result in species-level effects, due to its ability to rely on multiple pollinator species. Moreover, the conservation measures that will be implemented will further reduce the likelihood of exposure of the species' pollinators. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of Leedy's roseroot in the wild.

Species 89, the mountain sweet pitcher-plant, as described in the General Effects to Plants section, could experience greater effects from direct exposure to malathion due to the potential presence of digestive glands within its pitchers. These digestive glands have been shown to increase uptake of chemicals into the plant and cause plant mortality. Plant mortality due to malathion exposure is only anticipated for a limited number of malathion use types, including vegetables and ground fruit, developed and open space developed (residential uses), nurseries and Christmas trees. Usage data indicates there is very little overlap of the mountain sweet pitcher's range with agricultural and residential use (1.35%), thus we do not anticipated substantial effects to this species from direct application of malathion. In addition, as described above, we anticipate the additional conservation measures will further reduce the risk of exposure to the plants themselves and their pollinators and seed dispersers in the small portion of the range where we anticipate malathion to be applied. There for, we do not anticipate the proposed action would appreciably reduce the survival and recovery of the mountain sweet pitcher-plant in the wild.

Species numbered 1-7 all have high vulnerabilities based on their status, distribution and trends, high risk posed by labeled uses across their ranges, and high or medium estimated usage within their ranges as shown above. A rationale for each species is outlined below.

Species 1, the pygmy fringe-tree, a member of the olive family, has a high vulnerability based in its status as an endangered species and limited distribution, as shown above. Pygmy fringe tree is a narrow endemic species restricted to the Lake Wales ridge area of central Florida. The Lake Wales ridge is a narrow ridge of ancient sand dunes that runs down the central peninsula of Florida and harbors a large diversity of endemic plants and animals. Pygmy fringe-tree exists at 46 occurrences in the Lake Wales and Winter Haven ridges in Highland, Polk, Lake, Orange and Osceola counties (2009, 5-year review). Thirty-one of these occurrences are found within protected and managed conservation areas. The remaining unprotected occurrences are primarily threatened by development, fire suppression, ORV use and invasive non-native plant species (2009, 5-year review).

The pygmy fringe-tree relies on insect species for pollination, including honeybees and bee flies. Little other pollinator data is available (2009 5-year review). Insect pollinators are expected to experience mortality within the range of this species (100%) from exposure to malathion. We anticipate adverse effects to the species due to the reduction in pollinating insects that would result in reduced reproductive success. Furthermore, this tree has been identified as using a dioecious reproductive strategy, meaning individual trees produce either male or female flowers and thus require insect pollinators to transport pollen between trees for successful reproduction (2009 5-year review). This trait may increase the magnitude of anticipated adverse effects to this species from pollinator loss due to malathion exposure within its range. Specific seed dispersal vectors for this species are unknown, though a variety of birds and mammals are likely dispersers. No mortality or sub-lethal effects are expected for mammalian seed dispersers, however avian seed dispersers are expected to experience losses due to malathion exposure. Given that this species may be able to rely on a variety of seed dispersal vectors, we do not anticipate the effects to its avian seed dispersers to cause significant adverse effects to the reproductive capacity of this species.

However, we anticipate a medium level of malathion usage (5.06%) within the species' range. While we anticipate adverse effects from small losses of insect pollinators and seed dispersers and resultant decrease in reproductive success of the pygmy fringe-tree, we do not expect these adverse effects will cause species-level effects due to the relatively low level of usage across the range, and the fact that 67% of this species range is protected from the adverse effects of malathion on pollinating species. Furthermore, we anticipate the additional conservation measures described above will further reduce the risk of exposure of both pollinators and seed dispersers in the portion of the range where we anticipate malathion to be applied. For example, the pygmy fringe-tree exists in an area of high citrus production. Given the conservation measure reducing the maximum application rate for citrus that is anticipated to lower potential environmental concentrations to one-third of modeled values, we anticipate a reduction in effects to this species and its pollinators and seed dispersers on and adjacent to citrus groves prevalent within its range.
Therefore, we do not anticipate that the proposed action would appreciably reduce survival and recovery of the pygmy fringe-tree in the wild.

Species 2, Garrett's mint is also a narrow endemic of the Lake Wales Ridge region of central Florida. It has a high vulnerability based on its endangered status and limited distribution, as shown above. Garrett's mint exists in five occurrences in an extremely restricted range in Highlands County (2019 Recovery Plan amendment). Only one population is on protected lands, the Lake Wales Ridge NWR. However, even on the Refuge, inadequate

fire management continues to be a threat to the viability of this species. An additional population has recently been established on the Carter Creek unit of the Lake Wales Ridge NWR. The status of the three populations on private, unprotected lands is unknown as range-wide survey data are lacking. Unprotected habitats in the area continue to be developed for agriculture, housing and other uses, thus the unprotected populations of this species are expected to experience continued habitat loss and fragmentation and at least two may already be extirpated (2019 Recovery Plan Amendment). Additionally, the limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of this species (2019 Lake Wales Ridge Plants Recovery Plan Amendment). Furthermore, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lienert, T. 2004; Spira, t. 2001; Lennartson, T. 2002, Setsuko, S. et al 2013).

The dominant pollinator of Garrett's mint is a bee-fly (*Exprosopa fasciata*), and unlike most of the other species assigned to assessment group 10, it appears to require insect pollination for seed production (2009 5-year review). Bee-flies are generalist pollinators that tend to be common and abundant. However, Garrett's mint habitat is very fragmented, leading to smaller congregations of plants that are less attractive to pollinators. In addition, the 2009 5-year review states that, as the scrub habitat this species relies on continues to be lost and degraded due to fire suppression, pollinator limitation will become stronger as plants will receive fewer pollinator visits in degraded sites. Insect pollinators, including bee-flies, are expected to experience mortality within the range of this species (45%) from exposure to malathion. We anticipate adverse effects to the species due to a reduction in pollinating insects, in addition to already existing pollinator limitations described in the 5-year review, that would result in reduced reproductive success. However, in order to address anticipated pollinator mortality from malathion exposure, in addition to the general conservation measures outlined above , label restrictions described in the specific conservation measures above will be implemented for this species. These species-specific measures direct agricultural applicators in the vicinity of suitable habitat for this species to choose one of three options when applying malathion: 1. Apply malathion before dawn or after dusk, thus avoiding the active period of this species' pollinators OR 2. Apply malathion only when wind is blowing away from suitable habitat for this species, thus reducing exposure to pollinators OR 3. Use a 50-foot ground buffer from suitable habitat or an aerial buffer according to application rate as previously described above. While the exact amount of spray drift reduction from these buffers will vary depending on the traits of the ecosystem as well as the application method, based on AgDRIFT modeling, we anticipate spray drift reductions ranging from 82 to 90%, thus substantially reducing the likelihood of exposure and effects to this species through loss of pollinators.

Garrett's mint lacks specialized seed dispersal mechanisms, so colonization of new areas may be limited. However, given this species does not appear to rely on biotic seed dispersal methods, we do not anticipate use of malathion within its range will cause adverse effects to seed dispersal or the reproductive capacity of this species.

We anticipate a high level of malathion usage (15.55%) within the species range, especially in those areas that remain unprotected. This species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction, especially given its highly fragmented range and existing pollinator limitations. We anticipate adverse effects from loss of insect pollinators and resultant loss of reproductive success from exposure to malathion that would be expected to occur over the duration of the action. However, we do not anticipate that these adverse effects will result in species-level effects because of the general and species-specific conservation measures that will be implemented for this species. Therefore, we do not anticipate the proposed action would appreciably reduce survival and recovery of Garrett's mint in the wild.

Species 3, clay-loving wild buckwheat, currently exists in 14 populations in a very narrow range found in two counties of Colorado. It has a high vulnerability based on its endangered status and limited distribution, as shown above. Almost 75% of clay-loving wild buckwheat is within private ownership with few protections and remains subject to the species' primary threats of agricultural, urban and residential development, ORV use, and non-native invasive plants (2009 5-year review). In several studies cited in the 2009 5-year review, over 50 species of insect visited buckwheat flowers, many of which were native bee and ant species. Ants may be a particularly important pollinator, and were also found to be potential seed dispersers for this species. Pollinators for this species cover a wide array of taxonomic and functional types of insects with no single pollinator being especially important for the buckwheat. Insect pollinators are expected to experience mortality within the range of this species (100%) from malathion exposure. We anticipate adverse effects to this species due to the reduction in pollinating insects that would result in reduced reproductive success. We anticipate a high level of malathion usage (11.13%) within the species range, especially in unprotected areas. However, the most recent 5-year review in 2009 points out that because this species is capable of using numerous pollinator species; pollination and preservation of specific pollinators should not be a significant concern in the conservation of this species. The status review goes on to state that the primary conservation focus for this species should be conservation of remaining undisturbed habitat and associated plant species in as many areas as possible to manage for the diversity of pollinating species. As already noted, clay-loving wild buckwheat relies on ants for some portion of its seed dispersal needs. Ants may experience some level of mortality from malathion exposure, and their loss may result in adverse effects to this species from reduced reproductive capacity, although we do not anticipate species-level effects. Additionally, we anticipate the conservation measures described above will further reduce the risk of exposure of both pollinators and seed dispersers in the portion of the range where we anticipate malathion to be applied. For example, the clay-loving wild buckwheat occurs in or near pasture in Colorado. New restrictions on the pasture UDL will prohibit application of malathion within three days prior to bloom of alfalfa (the primary constituent of the pasture UDL), during bloom, and until petal fall is complete, thus reducing mortality of pollinators attracted to the alfalfa flowers. In addition, a reduction to two applications per year will be implemented for pasture.

As a result, while we anticipate adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from malathion exposure, we do not expect that these adverse effects will cause species-level effects due to the diversity and array of pollinators available to this species, and we anticipate the conservation measures that will be implemented will further reduce the effects to this species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the clay-loving wild buckwheat in the wild.

Species 4, the snakeroot, is another narrow endemic from a small area in Highlands County, part of the Lake Wales Ridge region of central Florida. It has a high vulnerability based on its endangered status and limited distribution, as shown above. The 2010 5-year review reported 19 occurrences, eight of which were on protected lands, the remaining occurrences were highly threatened by ongoing development pressures leading to

destruction and further fragmentation of the snakeroot's preferred open scrub habitat. A diverse array of insects visit snakeroot flowers, though only bees and syrphid flies have been observed to collect pollen (2010 5-year review). This species appears to be able to produce similar numbers of seeds whether it is cross-pollinated or self-pollinated, thus reducing its dependence on pollinating species for successful reproduction (2010 5-year review). However, insect pollinators are expected to experience mortality across the range of this species (45%) from malathion exposure. We anticipate adverse effects to this species due to the reduction in pollinating insects that would result in reduced reproductive success. However, we anticipate the conservation measures described above will further reduce the risk of exposure of pollinators in the portion of the range where we anticipate malathion to be applied. For example, snakeroot exists in an area of high citrus production. Given the conservation measure reducing the maximum application rate for citrus that is anticipated to lower potential environmental concentrations to one-third of modeled values, we anticipate a reduction in effects to this species and its pollinators on and adjacent to citrus groves prevalent within its range.
Snakeroot does not use animal species for seed dispersal, but instead relies on gravity. As such, we do not anticipate adverse effects to the reproduction of this species due to loss of seed dispersers from malathion exposure.
We anticipate a high level of malathion usage (15.55%) within the species range, especially in unprotected areas. This species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction, though it is capable of reproducing successfully using self-pollination in the absence of or due to the limited availability of pollinators. As a result, while we anticipate adverse effects due to the loss of insect pollinators and resultant loss of reproductive success from malathion exposure, we do not expect that these adverse effects will cause species-level effects due the snakeroot's ability to rely on self-pollination, and we anticipate the conservation measures will further reduce effects to this species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the snakeroot in the wild.

Species 5, the slender rush-pea, is a narrow endemic known from two counties in Texas where it remains on rare patches of undisturbed prairie habitat. It has a high vulnerability based on its endangered status and limited distribution, as shown above. Row-crop agriculture is prominent within its range and is the main cause of the loss of native short-grass prairie this species relies upon. There are eleven known populations, seven of which are on private land with no protections. The populations on private lands are highly threatened by habitat loss and fragmentation from agricultural and residential development, invasive pasture grasses, and localized disturbances such as mowing and road construction. The 2018 Recovery Plan states effective pollinators of the slender rush-pea have not been observed in the field or in a greenhouse setting. The rush pea is thought to self-pollinate as the rate of fruit set is high despite the lack of observed floral visitors (2018 Recovery Plan). Insect pollinators are expected to experience mortality within the range of this species (100%) from malathion exposure, however snakeroot appears to primarily rely on self-pollination for reproduction, and thus a loss of pollinating insects in its range is not anticipated to lead to significant adverse effects to the reproductive capacity of this species. In addition, we anticipate the conservation measures described above will further reduce the risk of exposure of pollinators in the portion of the range where we anticipate malathion to be applied. For example, although this species occurs in close proximity to cotton fields undergoing treatment for boll weevil eradication by USDA APHIS under their Boll Weevil Eradication Program. USDA APHIS has active conservation measures in place (as described in the *Environmental Baseline* section of the biological opinion) to protect the black lace cactus from adverse effects potentially caused by boll weevil eradication in the area. Thus, we do not anticipate significant adverse effects to the cacti's pollinator populations from the use of malathion in these areas.
The slender rush-pea, like most legumes, likely relies on forcible or gradual dehiscence for seed dispersal (ejection of the seeds from seed pods). As such, we do not anticipate adverse reproductive effects to the rush pea from loss of seed dispersers due to malathion exposure.

We anticipate a high level of malathion usage (16.63%) within the species range, especially in unprotected areas. This species is a narrow endemic, primarily threatened by loss and modification of preferred prairie habitat and invasive non-native grasses. It is able to reproduce successfully by self-pollination and therefore does not rely on the presence of a large number of pollinators within its range in order to reproduce. As a result, we do not expect species-level effects from malathion due to the slender rush-pea's ability to rely on self-pollination, abiotic seed dispersal for reproduction, and the conservation measures that will be implemented would further reduce effects to the species . Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the slender rush-pea in the wild.

Species 6, Carter's mustard, is another endemic species from three counties in the Lake Wales Ridge region of central Florida. It has a high vulnerability based on its endangered status and limited distribution, as shown above. The 2019 Recovery Plan amendment reports there are currently 50 occurrences, 41 of which are in twelve managed areas that offer protection from this species' main threats of habitat loss due to development and altered fire regimes. A variety of generalist pollinators visit Carter's mustard, though this species can successfully reproduce by self-fertilization. As a result, the 2009 5-year review observes that the reproductive output of this species is not likely limited by its small population size or pollinator limitations. Insect pollinators are expected to experience mortality within the range of this species (100%) from malathion exposure, however Carter's mustard appears to be able to rely on self-pollination for reproduction, thus a loss of pollinating insects in its range is not anticipated to lead to significant adverse effects to the reproductive capacity of this species. In addition, we anticipate the conservation measures described above will further reduce the risk of exposure of pollinators in the portion of the range where we anticipate malathion to be applied. For example, Carter's mustard exists in an area of high citrus production. Given the conservation measure reducing the maximum application rate for citrus that is anticipated to lower potential environmental concentrations to one-third of modeled values, we anticipate a reduction in effects to this species and its pollinators and seed dispersers on and adjacent to citrus groves prevalent within its range.
Carter's mustard does not have specialized seed dispersal mechanisms, it simply uses gravity to disperse its seeds. As such, we do not anticipate adverse reproductive effects to the mustard from loss of seed dispersers due to malathion exposure.
We anticipate moderate levels of malathion usage (6.15%) within the species range, especially in unprotected areas. This species is a narrow endemic, primarily threatened by loss and modification of preferred scrub habitat and lack of appropriate fire regime. It is able to reproduce successfully by self-pollination and therefore does not rely on the presence of a large number of pollinators within its range in order to reproduce. As a result, we do not expect species-level effects from malathion due to the Carter's mustard's ability to rely on self-pollination, abiotic seed dispersal for reproduction, and the conservation measures that will be implemented will further reduce effects to this species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the Carter's mustard in the wild.

Species 7, Florida ziziphus, is another endemic species occurring in two counties (southern Polk and northern Highlands) within the Lake Wales Ridge region of central Florida. It has a high vulnerability based on its endangered status and limited distribution, as shown above. The 2019 Recovery Plan amendment states there are currently 14 known occurrences of this species, five of which are in managed areas and are protected from this species' primary threats of habitat destruction and fragmentation from development activities and fire suppression. The main pollinators of Florida ziziphus are thought to be flies, honey bees and butterflies (2009 5-year review). While this species can reproduce using vegetative root sprouting, this type of reproduction does not replace the genetic mixing that occurs with cross-pollination and cannot make up for the lack of genetic diversity this species is experiencing due to small, isolated populations (2019 Recovery Plan amendment). Additionally, the limited geographic range of this species in combination with the continuing loss of habitat has resulted in a highly fragmented landscape where the remaining scrub areas have become more and more isolated from each other, thereby decreasing the overall resiliency, redundancy, and representation of this species (2019 Lake Wales Ridge Plants Recovery Plan Amendment). Furthermore, it has been shown that rare plants in fragmented landscapes are likely to experience decreased pollinator services leading to reduced reproductive success and lower population viability (Lienert, T. 2004; Spira, T. 2001; Lennartson, T. 2002, Setsuko, S. et al 2013).

Insect pollinators are expected to experience mortality within the range of this species (100%) from exposure to malathion. We anticipate adverse effects to the species due to the reduction in pollinating insects that would result in reduced reproductive success especially given this species' existing lack of recruitment. The 2019 Recovery Plan amendment describes the Florida ziziphus' overall failure to reproduce sexually: all single genotype populations are sterile and incapable of producing seeds. In the few populations that have produced fruits, 75% of these lack viable seeds. Seed dispersal vectors for Florida ziziphus are unknown, though are likely mammalian or avian based on seed dispersers of other species in the genus Ziziphus. No mortality or sublethal effects are expected for mammalian seed dispersers from malathion exposure either on use sites or from spray drift, while some avian 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. However, in addition to the conservation measures outlined above, label restrictions described in the specific conservation measures above will be implemented for this species. These measures direct agricultural applicators in the vicinity of suitable habitat for this species to choose one of three options when applying malathion: 1. Apply malathion before dawn or after dusk, thus avoiding the active period of this species' pollinators OR 2. Apply malathion only when wind is blowing away from suitable habitat for this species, thus reducing exposure to pollinators OR 3. Use a 50-foot ground buffer from suitable habitat or an aerial buffer according to application rate (see rates outlinedabove). While the exact amount of spray drift reduction from these buffers will vary depending on the traits of the ecosystem as well as the application method, based on AgDRIFT modeling, we anticipate spray drift reductions ranging from 82 to 90%, thus substantially reducing the likelihood of exposure and effects to this species through loss of pollinators. As such, we anticipate these measures will reduce adverse effects to an extent that we do not anticipate species-level effects.

We anticipate high levels of malathion usage (13.19%) within the species range, especially in unprotected areas. This species is a narrow endemic whose reproductive success is dependent upon the presence of insect pollinators for reproduction, especially given its highly fragmented range and existing lack of genetic diversity among populations and individuals. We anticipate adverse effects in the form of loss of insect pollinators and resultant loss of reproductive success from exposure to malathion that would be expected to occur over the duration of the action. However, we do not anticipate that these adverse effects will cause species-level effects because of the conservation measures that will be implemented for this species. Therefore, we do not anticipate the proposed action would appreciably reduce survival and recovery of Florida ziziphus in the wild.

Species numbered 8-10 all have medium vulnerabilities based on their status, distribution and trends, high risk posed by labeled uses across their ranges, and medium estimated usage within their ranges as shown above. A rationale for each species is outlined below.

Species 8, pigeon wings, is a narrow endemic species that occurs in five counties in the Lake Wales Ridge region of central Florida. It has medium vulnerability based on its threatened status and number of stable populations, as shown above. The 2008 5-year review indicates there are 35 known populations of this species, 33.5 of which are stable because of their location on protected and managed lands. The remaining unprotected lands are subject to threats from development and fragmentation of scrub habitat and inadequate fire regimes. Individual plants of this species possess some flowers that can self-fertilize and others that require pollen transfer, via insect pollinators, for fruit production. While specific pollinator species are unknown, insects are suspected. Studies reported in the 2008 5-year review found that very few fruits have been recorded from outcrossed (those requiring pollen transfer) flowers; most fruits result from self-pollination. As a result, it is not likely that pigeon wings relies heavily on pollinating insects for successful reproduction and survival. Insect pollinators are expected to experience mortality within the range of this species (100%) from malathion exposure, however since pigeon wings appears to rely primarily on self-pollination for reproduction, a loss of pollinating insects in its range is not anticipated to lead to significant adverse effects to the reproductive capacity of this species. In addition, we anticipate the conservation measures described above will further reduce the risk of exposure of pollinators in the portion of the range where we anticipate malathion to be applied. For example, pigeon wings exists in an area of high citrus production. Given the conservation measure reducing the maximum application rate for citrus that is anticipated to lower potential environmental concentrations to one-third of modeled values, we anticipate a substantial reduction in effects to this species and its pollinators and seed dispersers on and adjacent to citrus groves prevalent within its range.

Seed dispersal mechanisms for pigeon wings are unknown, thus we are unable to determine if malathion may adversely affect this species' reproductive success due to loss of seed dispersal vectors.
We anticipate moderate levels of malathion usage (6.75%) within the species range, especially in unprotected areas. This species is a narrow endemic, primarily threatened by loss and modification of preferred scrub habitat and lack of appropriate fire regime. However, the majority of its populations are protected and are stable. It is able to reproduce successfully by self-pollination and therefore does not rely on the presence of a large number of pollinators within its range in order to reproduce. As a result, we do not expect species-level effects from malathion due to pigeon wings' ability to rely on self-pollination and abiotic seed dispersal for reproduction, the level of protection of the majority of its populations from stressors and the conservation measures that will be implemented will further reduce effects to this species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the pigeon wings in the wild.

Species 9, Monterey gilia, is a narrow endemic species found in the coastal dunes and maritime chaparral of Monterey County, California. It exists in 15 discontinuous populations along the coast, half of which occur on public lands that are at least partially protected from the gilia's threats of development and non-native invasive species. Monterey gilia is thought to be primarily self-pollinating, based on its stamens not protruding from the flowers, no observations of pollinators, and very viable, abundant seed production (Recovery Plan, 1998). As a result, it is not likely Monterey gilia relies heavily on pollinating insects for successful reproduction. Insect pollinators are expected to experience mortality within the range of this species (100%) from malathion exposure. However, since Monterey gilia appears to rely primarily on self-pollination for reproduction, a loss of pollinating insects in its range is not anticipated to lead to significant adverse effects to the reproductive capacity of this species. In addition, we anticipate the conservation measures described above will further reduce the risk of exposure of pollinators in the portion of the range where we anticipate malathion to be applied. For example, exposure of pollinators 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."

Monterey gilia dispersers its seeds using the strong winds blowing across its dune habitat. As such, we do not anticipate adverse reproductive effects to this species from loss of seed dispersers due to malathion exposure.

We anticipate moderate levels of malathion usage (7.65%) within the species range, especially in unprotected areas. This species is a narrow endemic, primarily threatened by loss and modification of preferred dune and chaparral habitat and lack of invasive species control. However, it is able to reproduce successfully by self-pollination and therefore does not rely on the presence of a large number of pollinators within its range in order to reproduce. As a result, we do not expect species-level effects from malathion due to Monterey gilia's ability to rely on self-pollination, and abiotic seed dispersal for reproduction, and the conservation measures that will be implemented will further reduce effects to this species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the Monterey gilia in the wild.

Species 10, Lewton's polygala, is another narrow endemic species found in six counties in the Lake Wales Ridge region of central Florida. According to the 2019 Recovery Plan amendment, Lewton's polygala exists in 44 occurrences, 28 of which are on protected, managed lands. Loss and modification of the native scrub habitat and lack of appropriate fire regimes primarily threaten the remaining, unprotected occurrences. Lewton's polygala can self-fertilize, but this method of reproduction is less likely to result in viable seeds than does outcrossing, where pollen must be transferred to other individuals via insect pollinators (2010 5-year review). The main pollinators of this species are reported as bee-flies, flower flies and leaf-cutter bees. Insect pollinators are expected to experience mortality within the range of this species (100%) from exposure to malathion. We anticipate adverse effects to the species due to the reduction in pollinating insects that would result in reduced reproductive success. At least eight species of ant are thought to be critical to the dispersal of this species' seeds. Insect seed dispersers are also anticipated to experience mortality within the range of this species, leading to additional species-level effects from loss of reproductive and colonization capacity. However, this species is amphicarpic, a rare reproductive mechanism where some of this plant's flowers and seeds are produced below ground, an adaptation for ensuring successful reproduction in uncertain environments. The underground portion of flowers and seeds are protected from threats such as herbivory and burning from wildfires. These flowers self-fertilize and do not require insects for successful fruit production. How much this species relies on underground reproductive structures for survival is unknown. In addition, we anticipate the conservation measures described above will further reduce the risk of exposure of pollinators and seed dispersers in the portion of the range where we anticipate malathion to be applied. For example, Lewton's polygala exists in an area of high citrus production. Given the conservation measure reducing the maximum application rate for citrus that is anticipated to lower potential environmental concentrations to one-third of modeled values, we anticipate a reduction in effects to this species and its pollinators and seed dispersers on and adjacent to citrus groves prevalent within its range. We anticipate medium levels of malathion usage (5.26%) within the species range, especially in unprotected areas. This species is a narrow endemic whose reproductive success is at least partially dependent upon the presence of insect pollinators for reproduction. However, it does have some capacity to reproduce via self-fertilization and underground flowers and fruits, thereby decreasing its dependence on insect pollinators. As a result, while we anticipate adverse effects due to the loss of insect pollinators and seed dispersers and resultant loss of reproductive success from malathion exposure, we do not expect that these adverse effects will cause species-level effects due to the species' ability to self-pollinate, the presence of underground reproductive structures, the low level of malathion usage across the range, and the conservation measures that will be implemented will further reduce effects to this species. Therefore, we do not anticipate the action would appreciably reduce survival and recovery of the clay-loving wild buckwheat in the wild.

References:

Lienert, J. 2004. Habitat fragmentation effects on fitness of plant populations – a review. Journal for Nature Conservation 12:53-72.

Lennartson, T. 2002. Extinction thresholds and disrupted plant-pollinator interactions in fragmented plant populations. Ecology 83(11): 3060-3072.

Setsuko, S., T. Nagamitsu, and N. Tomaru. 2013. Pollen flow and effects of population structure on selfing rates and female and male reproductive success in fragmented *Magnolia stellate* populations. BMC Ecology 13:10.

Spira, T.P. 2001. Plant-pollinator interactions: A threatened mutualism with implications for the ecology and management of rare plants. Natural Areas Journal 21(1):78-88.