

5-YEAR REVIEW

Marin dwarf-flax (*Hesperolinon congestum*)

GENERAL INFORMATION:

Species: Marin dwarf-flax (*Hesperolinon congestum*; also referred to as Marin western flax)
Date listed: February 3, 1995
Federal Register (FR) citation: 60 FR 6671 (Service 1995)
Classification: Threatened

State Listing:

The Marin dwarf-flax was listed by the State of California as threatened in 1992.

BACKGROUND:

Species overview:

Marin dwarf flax (*Hesperolinon congestum*) is an annual herb in the flax family (Linaceae). It is known to occur in serpentine soils in San Mateo, San Francisco, and Marin Counties, typically in association with bunchgrasses, chaparral, or other dry grasslands. Because the species is an annual, abundance at a particular location can vary from a few plants to thousands between years. Further, the extent of an occurrence can vary in size from a few meters to tens of acres, and the precise location and spatial extent of the plants can move from year to year. The species generally flowers from early May through June or July and is sensitive to the amount and timing of rainfall. The species is distinguished by rose-to-whitish flowers that are congested at the tips, with hairy sepals (modified leaves around the flower petals) (Service 2011, p. 1).

Most recent status review:

U.S. Fish and Wildlife Service (Service). 2011. *Hesperolinon congestum* (Marin dwarf-flax). 5-Year Review: Summary and Evaluation. U.S. Fish and Wildlife Service, Sacramento Fish and Wildlife Office, Sacramento, California. 32 pp.

We did not recommend a status change in the 2011 status review.

FR notice citation announcing this status review:

U.S. Fish and Wildlife Service (Service). 2020. Initiation of 5-Year Status Reviews of 66 Species in California and Nevada; request for information. Federal Register 85:4692–4694.

We did not receive information from the public regarding the Marin dwarf-flax in response to the notice.

ASSESSMENT:

Information acquired since the last status review:

This 5-year review was conducted by the U.S. Fish and Wildlife Service's (Service) Sacramento Field Office. Data for this review were solicited from interested parties through a Federal

Register notice announcing this review on January 27, 2020. We also contacted species experts, performed a literature search, reviewed information from our own files, including a review of 10(a)(1)(A) recovery permit annual reports, and obtained data from an occurrence search of the California Natural Diversity Database (Diversity Database) maintained by the California Department of Fish and Wildlife.

Changes in Taxonomic Classification or Nomenclature

A phylogenetic analysis of the genus *Hesperolinon* found many of the species' complexes within the genus are not monophyletic (i.e., the different species evolved from different ancestral groups) (Schneider *et al.* 2016, pp. 225–229). Schneider *et al.* (2016, pp. 230–231) recommend a full taxonomic revision of *Hesperolinon* and suggest that additional morphology research and collection of additional genetic data is needed in order to complete the revision. Because the results of Schneider *et al.* (2016) do not change the species status of Marin dwarf-flax as a distinct entity, and until a reevaluation of the taxon can be completed to further clarify the taxonomic relationships and nomenclature between the different species' complexes, the Service will continue to follow previous nomenclature for the Marin dwarf-flax as *Hesperolinon congestum*.

Distribution:

As described in the previous 5-year review, the Marin dwarf-flax is found on serpentine soils in Marin, San Francisco, and San Mateo Counties (Service 2011, p. 3) (see Figure 1). Its historical range has not been established, but likely included all occurrences at the time of listing, as well as extirpated occurrences on former serpentine areas in San Francisco and San Mateo Counties that are now developed. The 1995 final listing rule stated there were fourteen known occurrences: six from Marin County, one from San Francisco County, and seven from San Mateo County (Service 1995, p. 6679). The previous 5-year review reported 23 extant, 2 unreliable, and 5 extirpated occurrences of the Marin dwarf-flax. Of these extant occurrences, 11 were from Marin County, 2 from San Francisco County, and 10 from San Mateo County (Service 2011, pp. 3–6).

Currently, there are 23 extant occurrences, 1 unreliable occurrence, 2 possibly extirpated occurrences, and 1 extirpated occurrence reported in the Diversity Database (2020) (see Appendix, Table A). Although CNDDDB labels 23 occurrences as “Presumed Extant,” most of these occurrences have not been seen and/or surveyed in several years and therefore are labeled as “Unknown” in the Appendix, Table A. Since the previous 5-year review, two new occurrences have been reported to the Diversity Database (occurrence #34 and #35) and some of the previous occurrences have been combined (#30 included in #3, #2 included in #1, #15 included in #14, and #10 included in #9) (see Appendix, Table A). New occurrence #34 expands the previously known range further north. New occurrence #35 is within the range known at the time of listing. Of the 23 extant occurrences, 13 are from Marin County, 2 are from San Francisco County, and 8 are from San Mateo County (Diversity Database 2020).

Marin dwarf-flax Occurrences (CNDDDB) and Survey Areas (NPS)



Figure 1. Marin-dwarf-flax occurrences from the Diversity Database (2020). Inset map shows the areas surveyed by the Golden Gate National Recreation Area (National Park Service). Detailed information about these sites is shown in the Appendix, Tables A and B.

Abundance:

The final listing rule did not provide abundance estimates for any of the known Marin dwarf-flax occurrences but did note they can fluctuate in size from hundreds to thousands of plants (Robison and Morey 1992, p. 7; Service 1995, p. 6675). In the previous 5-year review we stated abundance estimates for most locations had been occasional and often qualitative, and when recorded would vary greatly among occurrences and between years. Similar to the previous review, we do not have abundance estimates for most locations; however, for the locations we do have data for, abundance varied greatly (Chassé *et al.* 2019; Williams and O'Herron 2019, p. 68; Diversity Database 2020) (see Appendix, Table B). The widespread variability in Marin dwarf-flax abundance is not surprising as numbers are known to be greatly affected by rainfall, with more individuals in years with abundant spring rains (Service 2011, p. 6). Because of this variability, it is difficult to determine population dynamics and trends of each occurrence without multiple years of tracking, and currently only a few occurrences of Marin dwarf-flax are being regularly monitored (see Appendix, Table B). Moreover, for many occurrences the only available information is what was submitted to the Diversity Database, which often includes little quantitative information on the species, making it difficult to analyze abundance trends (see Appendix, Table A).

Threats:

At the time of listing, the primary threats to the Marin dwarf-flax were destruction of habitat due to residential and recreational development, trash dumping, foot traffic, and encroachment of native shrubs (Service 1995, pp. 6678–6682). The previous 5-year review noted habitat destruction due to urban and recreational development continued to impact the species, and that both native and nonnative plants were considered a threat for many of the known occurrences. Additional threats noted were the dam improvement project for Crystal Springs Reservoir, the deposition of atmospheric nitrogen which can accelerate invasive species encroachment, maintenance activities (i.e., access roads, utilities, transportation, disking, herbicide application, and “other”), climate change, trampling, and small population size (Service 2011, pp. 9–15). Notable invasive species in serpentine habitat that result from this increase of soil nitrogen include rye grass (*Lolium spp.*), soft brome (*Bromus hordeaceus*), and wild oats (*Avena spp.*) (Service 2011, p. 14; Fenn *et al.* 2010, p. 2408). The threats discussed in the last 5-year review continue to impact the species. An additional threat noted since the last review is soil disturbance due to gopher activity, which can damage roots and displace serpentine soil (Chassé *et al.* 2019, p. 25).

Multiple measures to address some of the threats listed above have been attempted, affirmed, and suggested since the previous 5-year review. Fencing off serpentine soil areas has proven to reduce trampling and is therefore a highly recommended conservation measure (Service 2011, p. 13; Robison and Morey 1992, p. 9; L. Stringer pers. comms. 2022; M. Chassé, pers. comms. 2022).

Invasive species also continue to pose a major threat to Marin dwarf-flax (L. Stringer pers. comms. 2022; M. Chassé, pers. comms. 2022). Thatch and soil buildup from nonnative species enriches serpentine soil, increasing its suitability for additional encroachment of invasive plants (Service 2011, p. 14). This positive feedback loop can greatly disturb the soil chemistry of serpentine soil (i.e., elevated mineral toxicity, low calcium-magnesium ratio, and low soil

nitrogen, potassium, and phosphorous) that provides Marin dwarf-flax with its required conditions for survival (Service 2011, pp. 7, 13-14). Manual vegetation removal, tarping, and application of herbicides are all possible conservation measures that could be implemented to reduce invasive species in serpentine soil habitats (L. Stringer pers. comms. 2022).

Since the last 5-year review, the Pacific Gas and Electric Company's Bay Area Operations and Maintenance Habitat Conservation Plan has been permitted and includes the Marin dwarf-flax as a covered species (Service 2017, entire). In the Habitat Conservation Plan, suitable Marin dwarf-flax habitat was estimated using Diversity Database polygon data with an accuracy class of 1 or 2 (records that have a specific, known location) (ICF 2017, pp. 2-16–2-17). The estimated habitat was then overlaid with Pacific Gas and Electric Company's facility corridor (Plan Area), which defines the area within which covered activities could affect the Marin dwarf-flax. This approach provides a quantitative assessment of where covered activities could result in impacts to the species (ICF 2017, pp. 4-77–4-81; Service 2017, pp. 41–43).

Covered activities associated with utility transmission and distribution are anticipated to affect 1.95 acres of Marin dwarf-flax habitat over the permit term of 30 years. These impacts are anticipated to result in the loss of 17,000 individuals over the 30-year permit term (Service 2017, pp. 89, 200–201, 219–220). Covered activities could directly and indirectly affect Marin dwarf flax at eight occurrences and would result in direct effects to individuals at six locations (ICF 2017, pp. 4-77–4-81; Service 2017, pp. 200–201). As compensation for these impacts, the Pacific Gas and Electric Company has committed to offset effects to the species by salvaging and replacing topsoil as a component of right-of-way restoration and including a monitoring component to assess restoration success. Measures requiring the stockpiling of topsoil for use in reclaiming a site are expected to allow the species to remain after excavation at any location, so the loss or extirpation of any occurrence of Marin dwarf-flax is not expected to result from covered activities (Service 2017, p. 201). The Pacific Gas and Electric Company has also committed to coordinate with the San Francisco Public Utilities Commission (SFPUC) to fund restoration activities (Service 2017, p. 89).

Recovery criteria:

Recovery criteria for delisting are described in the *Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area* (Service 1998, pp. II-101–II-103). Delisting criteria for the Marin dwarf-flax have not been met (see Table 1).

Table 1. Delisting criteria for Marin dwarf-flax. Status in Service (2011) and current assessment. Delisting criteria are not met.

Delisting Criteria	Criterion still valid?	2011 Status	2022 Status
Secure and protect specified recovery areas from incompatible uses: Occupied habitat or 21 populations representing the range of the species along with adjacent unoccupied habitat and a 150-meter (500-foot) buffer.	Yes*	Not met	The status remains as described in Service (2011), with only a few occurrences secured and protected. This criterion is difficult to assess as the species can take different forms and occurrence reporting cannot be equated to a consistent definition of population. Further, secure and protect was not defined in the recovery plan and urbanization restricts the 150-meter buffer at many locations.
Management plan approved and implemented for recovery areas, including survival of the species as an objective; for all populations and any occupied or unoccupied habitat identified as essential to survival.	Yes*	Not met	The status remains as described in Service (2011). Where management efforts are occurring, most are general practices aimed at conserving sensitive species, but are not specific to Marin dwarf-flax.
Population monitoring in specified recovery areas shows stable or increasing plant numbers for a period of 20 years that include the normal precipitation cycle (or longer if suggested by the results of demographic monitoring)	Yes*	Not met	The status remains as described in Service (2011). The recovery plan lacks a sufficient definition of how the term "stable" would apply to this species as the spatial extent of occurrences and the number of plants can vary considerably with the amount of rainfall. Further, inconsistent surveying restricts analysis of population trends.

* see "Recommendations for Future Actions" #1

Conclusion:

After reviewing the best available scientific information, we conclude the Marin dwarf-flax remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Endangered Species Act and analysis of the status of the species in the 2011 status review (Service 2011) remain an accurate reflection of the species' current status. As described below, we recommend regular surveys at each of the known occurrences to better determine the status of the species at these locations.

RECOMMENDATIONS FOR FUTURE ACTIONS:

Here we propose several habitat conservation and ecological research recommendations which will aid in the recovery and conservation of the Marin dwarf-flax. Recommendations #2–5 were discussed in the previous 5-year review (Service 2011, pp. 19–20) and remain valid.

1. Work with partners to develop a standardized methodology to delineate Marin dwarf-flax populations to allow the Service and partners to accurately assess population trends.
2. Secure and protect all occurrences and potential habitat (i.e., unoccupied serpentine grasslands) necessary for recovery of Marin dwarf-flax on SFPUC lands in the Crystal Springs group. Conservation easements, together with a comprehensive and complete management plan, should be sought to permanently protect all occurrences and potential habitat from future habitat loss due to changes in land use. The management plan should include provisions for monitoring, actions as necessary to quantify and address threats of non-native species encroachment and means to resolve foreseeable potential conflicts created by human use or operations and maintenance activities.
3. Secure and protect to the maximum extent practicable, all occurrences and potential habitat (i.e., unoccupied serpentine grasslands) necessary for recovery of Marin dwarf-flax at the St. Hilary's Church (Diversity Database #6) and Middle Ridge (Diversity Database #8) occurrences. In addition to recreation and non-native plant encroachment, portions of these sites are threatened by potential conversion to housing developments. Avoidance of any loss is the preferred strategy and permanent conservation easements should be sought to preclude future loss. Additionally, there need to be assurances that management, including regular monitoring, will be implemented as needed to address other primary threats of non-native vegetation and recreational use. Reported adverse human impacts from recreational uses (primarily dog-walking; other uses mentioned include hiking, biking, photography, horse-back riding, photography) to this species or its habitat should be investigated, monitored, and prevented by necessary means, including restricted use/entry where other means have proven ineffective.
4. Conduct surveys at least once (preferably more often) over the next five years at all known locations of Marin dwarf-flax. Develop a survey protocol, which will ideally allow detection of the peak flowering period, a reasonable estimate of occupied area and size, photo documentation (of entire area, and closeups of plant forma), establishment of reproduceable photo points, and a rapid assessment of the extent of visible threat factors of human-caused ground disturbance, and non-native/native species encroachment.
5. Assess the effectiveness of one or more weed control measures on promoting Marin dwarf-flax growth. This may involve comparing weed densities in areas (occurrence area and adjacent buffer) which are controlled for weeds versus those which are not, evaluating areas before, during, and after weed control measures, or comparing different measures. For example, where grazing is used, a study might seek to establish empirical relationships between the control measure (e.g., grazing or grazer density) and weed densities, and the response by Marin dwarf-flax (or lack thereof).

6. There are a variety of other key research needs for the recovery of this species mentioned in our recovery plan that should also be conducted, including: (1) studies on the effects of vegetation management practices (grazing, burning, herbicide), fertilizer, and runoff; (2) demographic studies such as soil seed bank, and other reproductive features (mating system, pollination); and (3) surveys of potential habitat to identify new occurrences. Surveys of potential habitat could also be useful to identify candidate unoccupied serpentine areas for enhancement (i.e., usually tree/scrub removal) and outplanting. Population genetic studies could be done to determine the extent of differentiation throughout the species' range and how this compares to phenotypic variation noted between occurrences (Smith, *in litt.* 2011a *in* Service 2011, p. 7, cover photo). These studies may be useful to select outplanting material should unoccupied restoration sites be identified. If such studies are warranted, collection and preservation of material for genetic study could be done at the same time of surveys (recommendation #2, above). As mentioned in the Recovery criteria section above, there is also a need to refine the recovery criteria in order to objectively assess progress towards recovery. These actions and others listed in our recovery plan may be essential for recovery of the species but may require additional information and analysis to prioritize and implement.

Field Supervisor, Sacramento Fish and Wildlife Office

Approve MICHAEL FRIS Digitally signed by MICHAEL FRIS
Date: 2023.01.31 15:05:25 -08'00' Date _____

Resources Cited

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Personal Communications

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APPENDIX:

Table A. CNDDDB report of Marin dwarf-flax occurrences.

Table B. Marin dwarf-flax survey information in the Presidio for years 2007–2022.

Table A. Current status of Marin dwarf-flax occurrences as listed in the Diversity Database (Diversity Database 2020). Asterisks indicate years in which a partner reported observation of the species to the Service. See "Personal Communications."

County	Group	Diversity Database #	Name	Status from 2011 5-Year Review	Current Status	Last Year Observed	Notes
San Mateo	Edgewood-Woodside	4	Edgewood West	Unknown	Extant	2022*	
		17	Edgewood East	Unknown	Extant	2022*	
		5	Woodside	Unknown	Unknown	2014	
		29	Stulsaft Park	No Trend Info	Unknown	2007	
		18	Canada College	Extirpated	Possibly Extirpated	197X	
San Mateo	Crystal Springs	1	Crystal Springs 1	Unknown	Unknown	2016	
		30	Crystal Springs 2	Unknown	- -	2009	#3 includes former #30
		3	Crystal Springs 3	Unknown	Unknown	2016	#3 includes former #19 and #30
		2	Crystal Springs 4	Extirpated	- -	1961	#1 includes former #2
		21	Hillsborough	Possibly Extirpated	Possibly Extirpated	1987	
		22	Polhemus Road	Unknown	Unknown	2001	
		31	Hillcrest	No Trend Info	Unknown	2003	
San Francisco	San Francisco	16	Presidio	Unstable	Extant	2022*	
		14	Laurel Hills	Extirpated	Extirpated	1912	
		15	Lone Mtn	Extirpated	- -	1877	#14 includes former #15
		20	Inspiration Point	No Trend Info	Extant	2022*	

County	Group	Diversity Database #	Name	Status from 2011 5-Year Review	Current Status	Last Year Observed	Notes
Marin	Tiburon	6	St. Hilary's Church	Unknown	Unknown	2016	#6 includes former #7
		8	Middle Ridge	Unknown	Unknown	2013	#8 includes former #24
		9	Ring Mountain	Unknown	Extant	2022*	
		10	Marin Day School	Unreliable	- -	1986	#9 includes former #10
		11	San Rafael	Unreliable	Unreliable	188X	
Marin	Central Marin	23	Alpine Lake North	Unknown	Unknown	2015	#23 includes former #27
		12	Carson Ridge	Unknown	Unknown	1998	
		13	Big Rock Ranch S	Unknown	Unknown	2014	
		32	West of Big Rock	Stable	Unknown	2009	
		35	N of Big Carson Creek Head		Unknown	2015	New occurrence since 2011 5-year review
		28	S of Nicasio Res.	Unknown	Extant	2022*	
Marin	Mount Burdell	25	N of Fire Road	Unknown	Unknown	2014	
		26	N of Saddle Marsh	Unknown	Unknown	2010	
		33	SW of Mt. Burdell	No Trend Info	Unknown	2009	
		34	NW Corner of Mt. Burdell		Unknown	2011	New occurrence since 2011 5-year review

Table B. Marin dwarf-flax survey data collected by the Golden Gate National Recreation Area for occurrences in the Presidio for years 2007–2022 (M. Chassé, pers. comms. 2022). Inspiration Point (Diversity Database # 20) is a reintroduction site where direct seeding and planting of plugs occurred in 2003 and 2009 (Service 2011, p. 8). Asterisks indicate visual estimates of abundance.

Location	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Presidio Bluffs/Yerba Buena Serpentine (NPS) (Diversity Database #16 – western portion)	87	55	28	693	34	211	313	568	1,516	5,145	7,923	>12,000*	>5,000*	>3,000*	>3,000*
World War II Memorial area (Presidio Trust) (Diversity Database #16 – eastern portion)	999	171	541	2,011	158	461	497	478	2,191	6,098	3,109	3,877	---	---	---
Inspiration Point (Presidio Trust) (Diversity Database #20)	---	---	---	173	---	---	9	13	96	94	59	917	---	---	---