Interim Core Map Documentation for the Few-flowered Navarretia

Version 1

Review Completed: April 2026

Core Map Developer: U.S. Environmental Protection Agency (EPA) Office of Pesticide Programs (OPP)

Species Summary

The few-flowered navarretia (Navarretia leucocephala ssp. pauciflora (=N. pauciflora); Entity ID# 578) is extremely rare. The subspecies is dependent on vernal pools for survival, and its life history is closely linked to the hydrology of these wetlands. The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the few-flowered navarretia. The species is found in volcanic ash substrate, clay pan vernal pools in chaparral, grassland, or mixed coniferous forest in southern Lake and Napa Counties. The species occurs over a 20 square-mile area at elevations of 1,400 to 2,800 feet. Pollination for this species is poorly understood (5 Year Review 2023).

Additional information on the species is provided in Appendix 1.

Description of Core Map

The core map for the few-flowered navarretia is biological information type based on named locations in FWS documents and known occurrence data collected by California Department of Fish and Wildlife.

Figures 1-3 depicts the resulting interim core map for the few-flowered navarretia. The size of this core map is approximately 27,114 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly scrub/shrub areas.

The core map developed for the few-flowered navarretia is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the few-flowered navarretia. Due to privacy concerns from the data source (California Fish and Wildlife Service (CA FWS)), specific known locations were not disclosed. This core map incorporates information developed by FWS; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate species expert feedback from FWS. The map is based on areas of conservation concern (ACE)[1] where known locations described by FWS are reported. EPA refined the map using California state wetland[2] and US FWS California vernal pool layers[3] since this species is a vernal pool obligate. This interim core map has an “average” (3) best professional judgment classification because it consists of the

[1] Areas of Conservation Emphasis (ACE)
https://wildlife.ca.gov/Data/Analysis/Ace
[2] California's wetlands and riparian boundaries June 14th, 2023.
https://www.arcgis.com/home/item.html?id=ec8942be09ec420282eabb6d5d383e0a
[3] U.S. Fish and Wildlife Service California Vernal Pools May 9th, 2022
https://gis-fws.opendata.arcgis.com/datasets/vernal-pool/explore?location=37.672205%2C-120.202455%2C5.76

species' critical habitat and known locations compiled from online databases with a degree of uncertainty.

This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

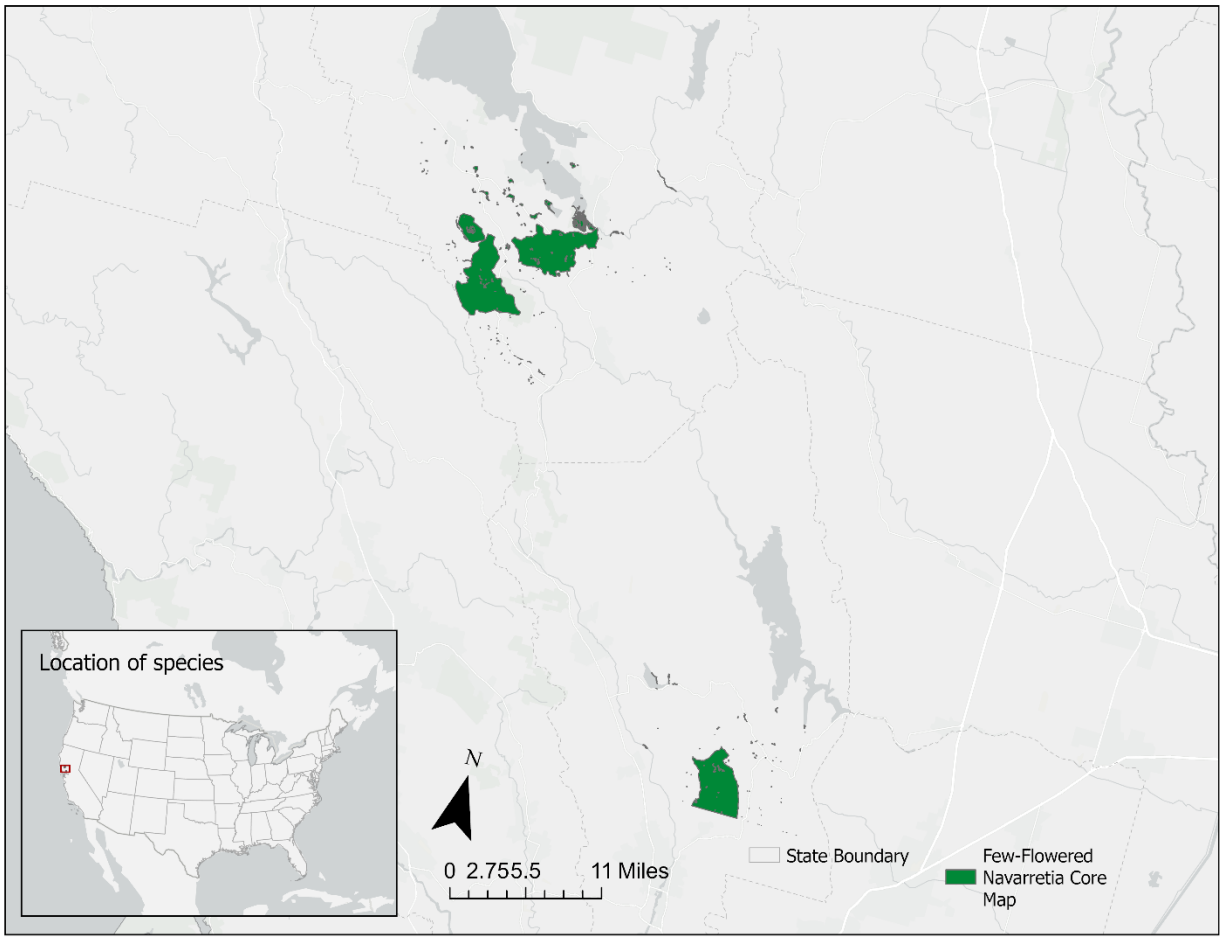

Figure 1. Interim core map for the few-flowered navarretia.

Table 1. Percentage of Interim Core Map Represented by National Land Cover Database (NLCD)[4] Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover
Forestry	Deciduous Forest (41)	2
Forestry	Evergreen Forest (42)	25
Forestry	Mixed Forest (43)	10
Agriculture	Pasture/Hay (81)	1
Agriculture	Cultivated Crops (82)	0
Mosquito adulticide, residential	Open space, developed (21)	5
Mosquito adulticide, residential	Developed, Low intensity (22)	1
Mosquito adulticide, residential	Developed, Medium intensity (23)	0
Mosquito adulticide, residential	Developed, High intensity (24)	0
Invasive species control	Woody Wetlands (90)	1
Invasive species control	Emergent Herbaceous Wetlands (95)	1
Invasive species control	Open water (11)	1
Invasive species control	Grassland/herbaceous (71)	12
Invasive species control	Scrub/shrub (52)	41
Invasive species control	Barren land (rock/sand/clay; 31)	0
Total Acres	**Interim Core Map Acres**	**~ 27,114**

Evaluation of Known Location Information

There are four datasets with known location information:

- Descriptions of locations provided by FWS
- Occurrence locations in iNaturalist
- Occurrence locations in NatureServe
- Occurrence locations in Global Biodiversity Information Facility (GBIF)

EPA evaluated these four sets of data before selecting the type of and developing the core map. FWS appeared to have the finest resolution of the location information, providing a map that depicted the current known occurrences (**Table A1 in Appendix 1**). Occurrences in iNaturalist, GBIF, and NatureServe did not support expanding the core map outside of these occurrences. **Appendix 1** includes more information on the available known location information.

Approach Used to Create Core Map

The core map was developed using the "Process EPA Uses to Develop Core Maps for Draft Pesticide Use Limitation Areas for Species Listed by the U.S. Fish & Wildlife Service (FWS) and their Designated Critical

[4] Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, https://doi.org/10.5066/P9JZ7AO3

Habitats"[5] (referred to as "the process"). EPA developed the core map using the 4 steps described in the process document:

1. Compile available information for a species
2. Identify core map type
3. Develop the core map for the species
4. Document the core map

For step 1, EPA compiled available information for the few-flowered navarretia from FWS, as well as observation information available from various publicly available sources (including iNaturalist and GBIF). The information compiled for the few-flowered navarretia is included in **Appendix 1**. Influential information that impacted the development of the core map included (2023 5 year review):

- Occurrences and known locations are restricted to Lake County and Napa County vernal pools
- Seeds do not disperse far from parent.
- Population sizes fluctuate widely year to year.
- Eight of the ten known occurrences of this species are on private land and not protected. One of these occurrences is at Loch Lomond Vernal Pool Ecological Reserve, owned by CA FWS, and one is at Mead Ranch, which is protected from development by a conservation easement held by the Napa Valley Land Trust (https://wildlife.ca.gov/Conservation/Plants/Endangered/Navarretia-leucocephala-ssp-pauciflora). Preservation of suitable habitat in core areas should be pursued to preserve known localities that are currently not protected .

For step 2, EPA used the compiled information to identify the core map type including species range and known location information. The occurrences are located within the species' range and the range is based on ACE polygons. Therefore, the outer extent of this core map is defined by ACE polygons that known locations identified by CA FWS are within. The entire range of the species was not used as the core map because the range contains areas where the species does not occur. In addition:

- No critical habitat designated
- Species range is not highly refined

For step 3, EPA used the original occurrence data from California FWS to confirm ACE polygons then refined based on two California wetland/vernal pool datasets. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

[5] Dated 2024, available online at: https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas

Discussion of Approaches and Data that were Considered but not Included in Core Map

EPA explored using GIS datasets that describe elevation to further refine the core map. However, this approach was not used because EPA believed it would add uncertainty relative to the potential benefit.

Appendix 1. Information Compiled for this Species

1. **Recent FWS documents/links and other data sources**
    - Recovery Plan (2005): https://ecos.fws.gov/docs/recovery_plan/Vernal%20Pool%20Ecosystem%20Final%20Recovery%20Plan.pdf
    - Five Year Review (2023): https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/9582.pdf
    - Species Status Assessments: N/A
    - Critical Habitat Designation: N/A
    - Other documents
        - 5-Year Species Review for Lake County stonecrop (Sedella leiocarpa) has similar habitats as the few-flowered navarettia. Used document to understand occurrence locations https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=222433

2. **Background information**
    - **Status**: Federally listed as endangered in 1997
    - **Resiliency, redundancy, and representation** (the 3Rs) (Recovery Plan, 2005)
        - Resiliency:
            - High (Recovery Priority 3)
        - Redundancy:
            - Low
            - Restricted to Lake County and Napa County vernal pools.
                - Could suggest species is vulnerable to natural disaster.
        - Representation:
            - Low
            - Seeds to not disperse far from parent.
            - Population sizes fluctuate widely year to year.
            - Priority level 1 for seed collection and storage (Recovery Plan, 2005)

    - **Habitat**
        - The species is found in volcanic ash substrate, clay pan vernal pools in chaparral, grassland, or mixed coniferous forest in southern Lake and Napa Counties. The species occurs over a 20 square-mile area at elevations of 1,400 to 2,800 feet. (2023 FWS 5 Year Review)
        - Diet: NA

    - **Pollinator/reproduction**
        - produces small pale blue or white flower heads that typically appear from May to June (https://wildlife.ca.gov/Conservation/Plants/Endangered/Navarretia-leucocephala-ssp-pauciflora)
        - the overall importance of pollinating insects for the few-flowered navarretia is poorly understood and additional research is needed (2023 5-year review FWS)

    - **Taxonomy**
        - Aquatic plant and terrestrial plant (unsure how we classify vernal pool species)

- Navarretias are members of the phlox family (Polemoniaceae)

- **Relevant Pesticide Use Sites**
  - Golf courses (Recovery Plan, 2005)
  - Irrigated agricultural lands (Recovery Plan, 2005)
  - Landscaped residential areas (Recovery Plan, 2005)
  - No specific pesticide use sites are named. "Agriculture" is identified as a threat for a few populations in Lake County.

- **Recovery Criteria/Objectives**

Habitat protection
  - "For downlisting, 95 percent of suitable vernal pool habitat within each prioritized core area (Berryessa, Boggs Lake-Clear Lake, and Dry Lake) for the species is protected.
  - 100% of species localities distributed across the species geographic range and genetic range are protected. Protection of extreme edges of populations protects the genetic differences that occur there.
  - Reintroduction and introduction must be carried out and meet success criteria.
  - In 2007, the Jordan Park property owner allowed Caltrans to survey but no habitat for the few-flowered navarretia was discovered at that time. More field work is needed to determine presence or reintroduction potential. Adaptive management, restoration, and monitoring.
  - Additional localities that are detected (and determined essential to recovery goals) are permanently protected.
  - Since the 2008 status review, one historical occurrence and one newly identified occurrence were added to the Diversity Database, but no additional localities have been protected (occurrence #11 Thurston Creek Road and #12 Breems Lake) in Lake County
  - Habitat protection results in protection of hydrology essential to vernal pool ecosystem function…" (5 Year Review, 2023)

- **Recovery Actions**
  - "The majority of known localities of this species are on private land and not protected. Preservation of suitable habitat in core areas should be pursued to preserve known localities that are currently not protected.
  - Comprehensive mapping of Lake County and Napa County vernal pool habitat should be completed to better understand the amount of suitable habitat available for the species within the recovery core areas." (5 Year Review, 2023)
  - "Protection of Zone 2 core areas is generally necessary to prevent significant declines or negative impacts short of extinction for one or more species, but in certain cases where rare or localized species have significant populations in Zone 2 core areas (i.e., Navarretia leucocephala ssp. Pauciflora…) it is also necessary to prevent the extinction or irreversible decline of those species." (Recovery Plan, 2005)
  - "Several Zone 2 core areas are also considered Priority 1 with respect to specific species (i.e., …Navarretia leucocephala ssp. Pauciflora" (Recovery Plan, 2005)

3. **Description of Species Range**
    - **Figure A1-1** depicts the FWS range. The range was last updated on 10/30/2015. Total acreage of range is around 258,948 acres.

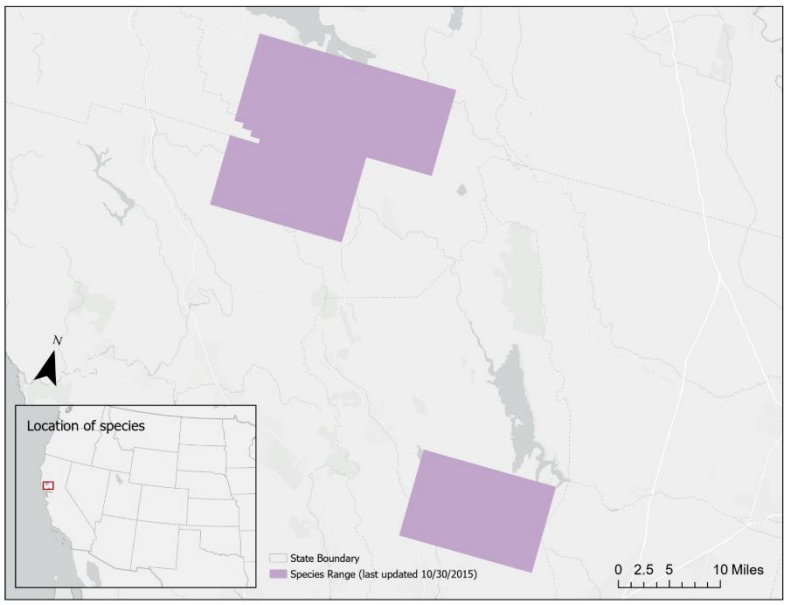

Figure A1-1. FWS range for the few-flowered navarretia. The total acreage of the range is around 258,948 acres.

4. **Critical Habitat**
    - FWS has not designated a critical habitat for this species (https://ecos.fws.gov/ecp/species/8242)

5. **Known Locations**
    - Known Locations Described in FWS Recovery Documents
        - Currently found in Lake County and Napa County California vernal pools.
        - 10 extant populations
            - 8 in Lake County
            - 2 in Napa County
        - Navarretia leucocephala ssp. pauciflora is restricted to the Lake-Napa Vernal Pool Region. (Recovery Plan, 2005)
        - **Table A1-1** depicts the currently known locations from FWS.

Table A1-1. Few-flowered navarretia occurrences (5-YEAR REVIEW, 2023)

Few-flowered navarretia (Navarretia leucocephala ssp. pauciflora 2023 FWS; Diversity Database 2022).

Diversity Database Occurrence Number	County	Occurrence Name	Date Last Seen	Description	Threats
1	Lake County	Loch Lomond	2007-XX-XX	1978: 3,000 plants observed. 1985: No plants observed. 1993: Seeds collected. 2007: Plants seen, along with many-flowered navarretia. Plants at this site may be intermediates between many-flowered navarretia.	Off-road vehicle activity; recreational use
3	Lake County	Lower Lake	1951-05-21	1938: Collection by Dutton. 1951: Collection by Holm from "between Lower Lake and Middleton" is also attributed to this site.	Unknown
4	Lake County	Manning Flat	2011-05-31	1977: 40 plants observed. 1985: 200–225 plants. 1989: thousands of plants. 1990: < 1,000 (dry year). 2003: 1,000–2,000. 2007: Not located in 2007. 2011: Approximately 500. Several collections from 1945 through 1999 are also attributed here.	Erosion problems resulting from attempts to drain flat. Past off-road vehicle use. Vulnerable to impacts from widening Highway 29.
5	Lake County	Hesse Flat	1990-05-14	1951: Collected in Hess Flat. 1985: Searched for but not found; suitable habitat was found. 1990: Many 100s of plants observed. 2007: No plants found; surveys revealed only vernal marsh. 2011: No plants found; vernal pools uncommon here.	Altered flood/tidal/hydrological regime; grazing; non-native plant impacts
7	Napa County	Milliken Creek,	2010-05-31	1987: > 1,000 plants seen by Ruygt. 2010: A Ruygt photo from "South of Foss Valley" is attributed to this site.	Potential for sheep grazing

Diversity Database Occurrence Number	County	Occurrence Name	Date Last Seen	Description	Threats
8	Napa County	Mead Ranch	2010-05-16	1990: > 10,000 plants seen. 1992: > 10,000 plants seen. 1993: 10,000–20,000 plants seen. 1994: 2,000 plants. 1997: > 2,000 plants. 1998–9: Unknown number. 2000: > 10,000 plants. 2010: Unknown number. Site is within a conservation easement held by the Napa Valley Land Trust.	Feral pigs, grazing, recreational use, and road/tail construction and maintenance
9	Lake County	Ely Flat	1989-06-09	1989: 120,000 plants, identification confirmed by Day. 2007: Survey revealed much of the area has been converted to viticulture, neither vernal pool habitat nor navarretia found. 2015: Based on aerials from this year, this specific site has not been converted to viticulture.	Agriculture and grazing
10	Lake County	Jordan Park	1932-05-01	1932: Collection by Jussel. 2007: Property owner allowed Caltrans to survey; no habitat for Navarretia discovered.	Unknown
11	Lake County	Thurston Creek Road	2011-05-03	2003: > 10,000 plants estimated. 2011: Approximately 500 plants.	Agriculture, development, and road/trail construction and maintenance.
12	Lake County	Breems Lake	1935-05-17	1923: Collection by Blankinship from “Kelseyville near Breens Lake”. 1935: Collection from “W Base of Mt Konocti, Breens Lake, 1600 ft elevation.”	Unknown

- **Occurrences Included in Public Databases**
  EPA queried:
    - iNaturalist and GBIF
        - https://www.inaturalist.org/observations?d1=2010-01-01&d2=2025-04-08&subview=map&taxon_id=80055
            - Jan 2010-April 2025 (accessed 4/8/2025)
        - 7 research grade observations (1 repeated on GBIF); 1 outlier outside of species range
    - NatureServe. Occurrences in NatureServe were also consistent with other occurrence data (https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.133130/Navarretia_leucocephala_ssp_pauciflora).

Collectively, the occurrence data from iNaturalist, GBIF, and NatureServe are consistent with the known occurrences from FWS and did not warrant further expansion of the core map.

Appendix 2. GIS Data Review and Method to Develop Core Map

Source Information
This core map was created based on biological information, obtained directly from the California FWS.

EPA developed the interim core map by refining the ACE polygons known locations were found in by habitat descriptions.

1. **Datasets and Software**
   Datasets used:
   1.1. FWS species range
   1.2. USA Annual NLCD Land Cover
   1.3. CA Wetlands
   1.4. US FWS CA Vernal Pools

   Software used: ArcGIS Pro, version 3.5.1

2. **Creating the core map**
   2.1. Determining outside extent of the core map

ACE were selected based on any ACE that contained a known location (which matches the species range).

2.2. Refining species range based on suitable habitat

A review of FWS's documentation discovered specific key aspect of the suitable habitat for this species:

FWS 2023 states:

- The subspecies is dependent on vernal pools for survival, and its life history is closely linked to the hydrology of these wetlands.

3. **GIS Process Used**
   3.1. Georeferencing

To refine the ACE, California wetland[2] and California vernal pool[3] layers were clipped to the ACE to only include wetland areas for the final core map. The two clipped layers were then merged to create a single wetland core map layer.

3.2. Refining NLCD

After finalizing the wetlands, EPA added the NLCD dataset to the map and clipped the raster to extent of the species core areas for efficient data processing:

Clip Raster (tool):

- Input raster: *USA NLCD Land Cover*
- Output extent: *pariette_cactus_core_areas*

The clipped NLCD raster was then converted to polygon format, using the *Raster to* Polygon tool to be able to create a new layer that only represents the area within the extent of the combined area and named location layer. Duplicate attributes were merged by using the Pairwise *Dissolve* tool.