

# Interim Core Map Documentation for Many-Flowered Navarretia

## Version 1

**Review Completed:** April 2026

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

## Species Summary

The many-flowered navarretia (*Navarretia leucocephala* ssp. *plieantha*, Entity ID 579) is an endangered terrestrial plant. The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the many-flowered navarretia. This species is found only on substrates of volcanic origin and is dependent on vernal pools, vernal lakes, and swales for survival. This species is currently found in volcanic ash substrate, clay pan vernal pools in chaparral (shrub/scrub), grassland, or mixed coniferous forest in southern Lake and Sonoma counties (FWS, 2009; FWS, 2023). Its life history is closely linked to the hydrology of these wetlands (FWS, 2009). Pollination for this species is unknown. Currently, the many-flowered navarretia is found in only Lake and Sonoma counties in California. Additional information on the species is provided in **Appendix 1**.

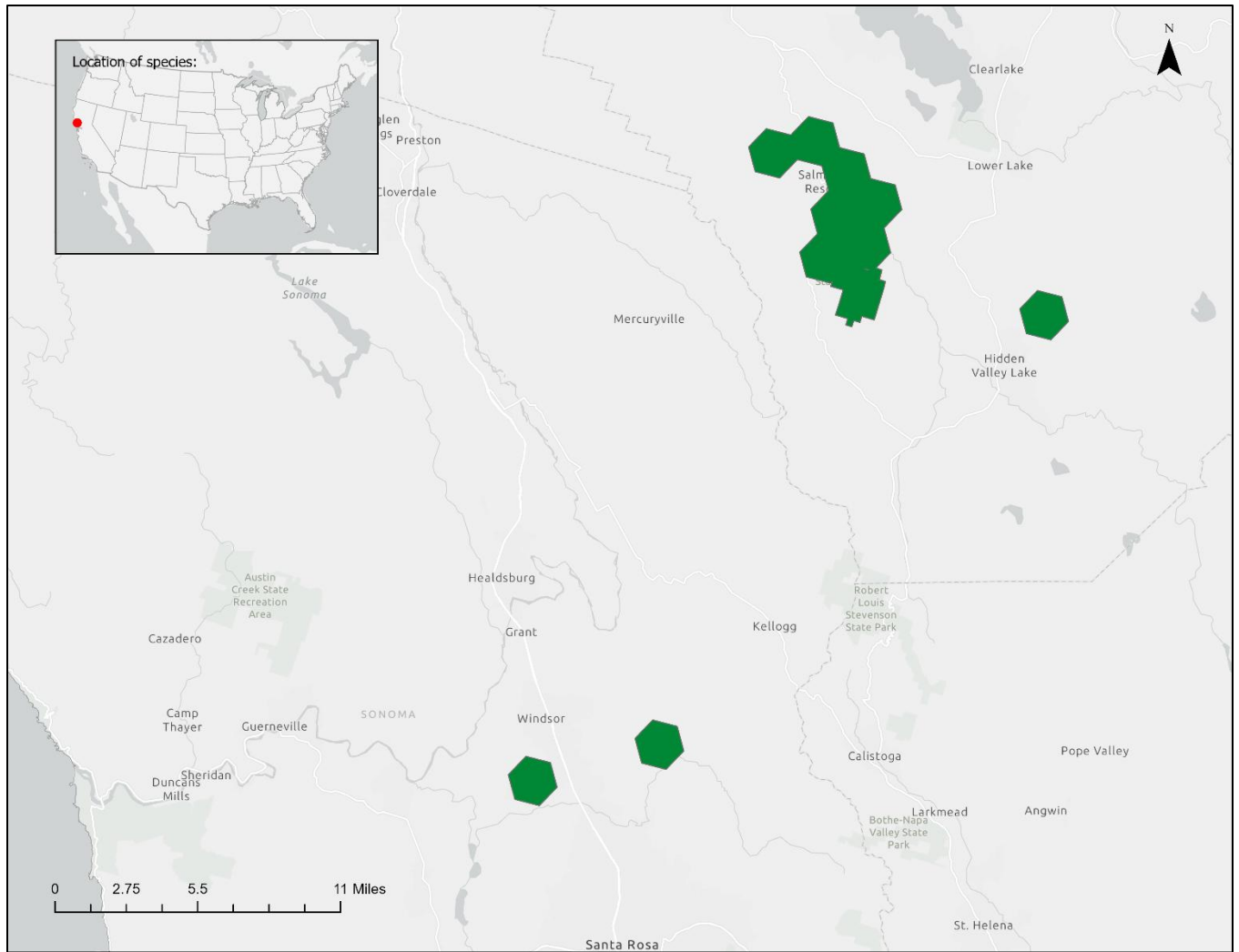
## Description of Core Map

The core map for the many-flowered navarretia is based on biological information. This core map is comprised of California Department of Fish and Wildlife's Area of Conservation Emphasis hexagons and named locations that encompass the known location information from CNDDDB. EPA considered further refining this area by landcover type. However, removing developed spaces would minimally impact most of the ACE hexagons. Additionally, the one hexagon that would be significantly refined has a known location that occurs in a developed area; therefore, this hexagon would be included in its entirety to protect this location. Consequently, a landcover refinement was ultimately not conducted.

**Figure 1** depicts the resulting interim core map for many-flowered navarretia. The size of this core map is approximately 18,076 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly forest (deciduous, evergreen, and mixed), shrub/scrub, and grassland.

The core map developed for the many-flowered navarretia is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the many-flowered navarretia. This core map incorporates information developed by FWS and made available to the public; 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. This interim core map has an "average" (3) best professional judgment classification to describe major uncertainties/limitations. The core map was based on areas of conservation emphasis (ACE) that encompass known locations of this species.

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 many-flowered navarretia.**

**Table 1. Percentage of Interim Core Map Represented by NLCD<sup>1</sup> Land Covers and Associated Example Pesticide Use Sites/Types.**

Example pesticide use sites/types	NLCD Class/Value	% Area
Forestry	Deciduous Forest (41)	2%
Forestry	Evergreen Forest (42)	31%
Forestry	Mixed Forest (43)	2%
Agriculture	Pasture/Hay (81)	0%
Agriculture	Cultivated Crops (82)	0%
Mosquito adulticide, residential	Developed Open Space (21)	7%
Mosquito adulticide, residential	Developed Low Intensity (22)	3%
Mosquito adulticide, residential	Developed Medium Intensity (23)	2%
Mosquito adulticide, residential	Developed High Intensity (24)	1%
Invasive species control	Woody Wetlands (90)	0%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%
Invasive species control	Open Water (11)	0%
Invasive species control	Grassland/Herbaceous (71)	6%
Invasive species control	Shrub/Scrub (52)	45%
Invasive species control	Barren Land (31)	0%
<b>Total Acres</b>	<b>Interim Core Map Acres</b>	<b>18,076 Acres</b>

## Evaluation of Known Location Information

There are five datasets with known location information:

- Descriptions of locations provided by FWS
- Occurrence locations in California Natural Diversity Database (CNDDDB)
- Occurrence locations in iNaturalist
- Occurrence locations in NatureServe
- Occurrence locations in the Global Biodiversity Information Facility (GBIF)

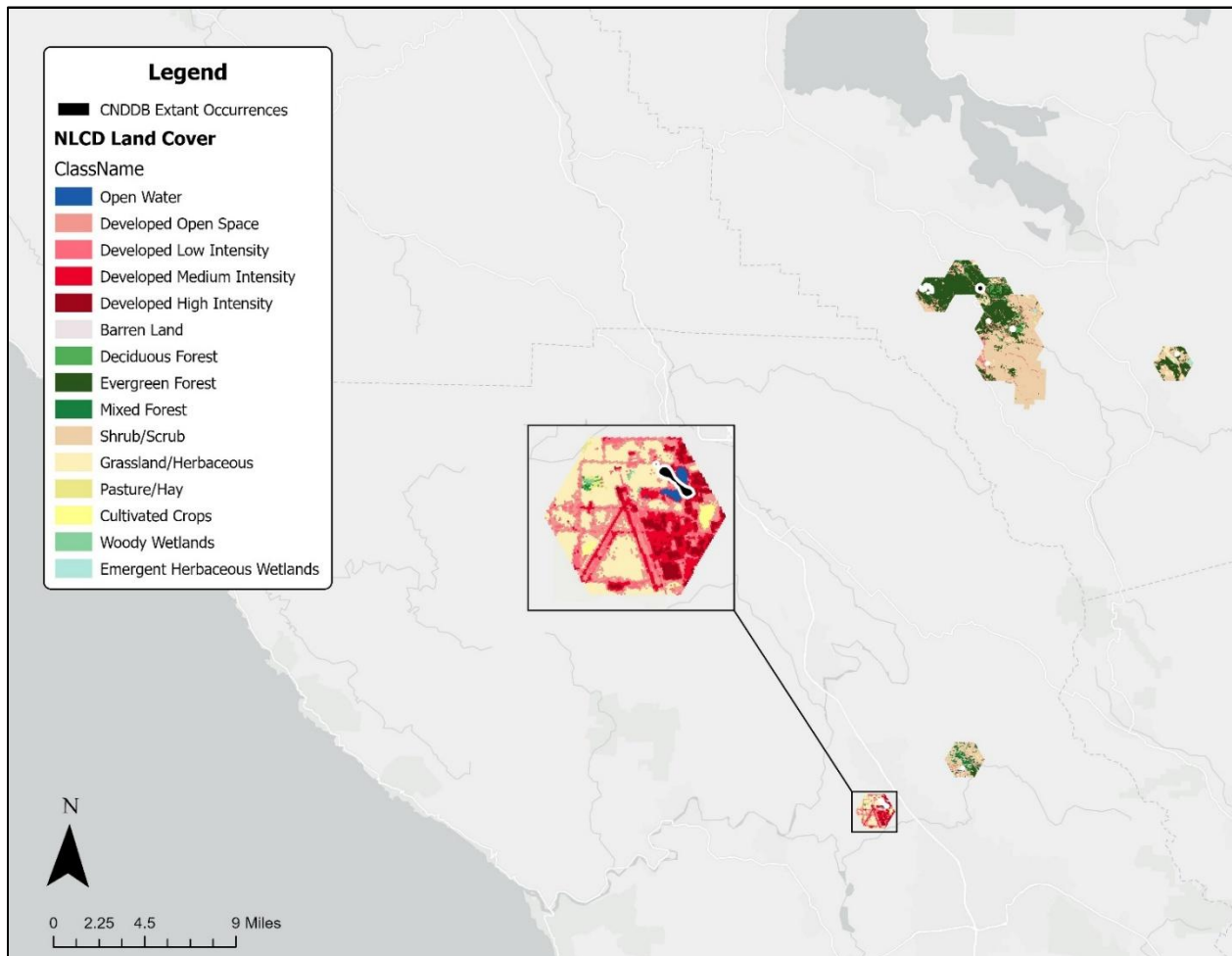
EPA evaluated these five sets of data before selecting the type of and developing the core map. CNDDDB appeared to have the finest resolution of the location information, which FWS relied on in their documentation (FWS, 2009; FWS, 2023). Occurrences in iNaturalist, GBIF, and NatureServe were consistent with those discussed in FWS documentation and seen in CNDDDB. **Appendix 1** includes more information on the available known location information.

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

EPA considered conducting a landcover refinement on this core map to only include forested areas, shrub/scrub, and wetlands. Of the hexagons that comprise this core map, there is only one that is primarily composed of

<sup>1</sup> Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, <https://doi.org/10.5066/P9JZ7AO3>

landcover outside of these categories (developed areas). However, within this hexagon, there is a known occurrence that occurs within developed areas (**Figure 2**). As such, this hexagon could not be refined and there would be little benefit in removing developed areas from the other hexagons.



**Figure 2. Landcover classes within the interim core map with known locations overlaid. Inset map shows the ACE hexagon that would be refined by a landcover refinement, with a known location present within developed areas.**

## Appendix 1. Information compiled for the Many-flowered Navarretia

### 1. Recent FWS documents

[Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon \(2005\)](#)

[5-year Review \(2009\)](#)

[5-year Review \(2023\)](#)

### 2. Background information

- **Status:** Federally listed as endangered in 1997

- **Taxonomy**

- FWS (2005) states that many-flowered navarretia is in the phlox family. The name first assigned to many-flowered navarretia was *Navarretia plieantha*. The type locality for the species is Boggs Lake, in Lake County (Mason 1946). Day (1993a) later reduced many-flowered navarretia to the rank of subspecies, under the name *Navarretia leucocephala* ssp. *plieantha*.

As explained in the species account for *Navarretia leucocephala* ssp. *pauciflora*, some populations of *Navarretia* consist of individuals intermediate in characteristics between two subspecies. According to Dr. Alva Day (*in litt.* 1997, pers. comm. 1997), these plants are not properly called hybrids nor “intercrosses,” as the final listing rule (U.S. Fish and Wildlife Service 1997b) described them. Dr. Day (*in litt.* 1997) has distinguished two types of intermediate specimens, which others have identified as *N. leucocephala* ssp. *plieantha*. One group is intermediate between *N. leucocephala* ssp. *pauciflora* and *N. leucocephala* ssp. *plieantha*, and the other is intermediate between *N. leucocephala* ssp. *plieantha* and *N. leucocephala* ssp. *bakeri* (Baker’s navarretia). For convenience, we refer to all of these as *N. leucocephala* ssp. *plieantha* throughout this plan, but the population at the type locality is referred to as “typical” *N. leucocephala* ssp. *plieantha*.

Kingdom: Plantae – plantes, Planta, Vegetal, plants  
Subkingdom: Viridiplantae – green plants  
Infrakingdom: Streptophyta – land plants  
Superdivision: Embryophyta  
Division: Tracheophyta – vascular plants, tracheophytes  
Subdivision: Spermatophytina – spermatophytes, seed plants, phanérogames  
Class: Magnoliopsida  
Superorder: Asteranae  
Order: Ericales  
Family: Polemoniaceae – phlox  
Genus: Navarretia Ruiz & Pav. – pincushionplant  
Species: Navarretia leucocephala Benth. – white-flower pincushion-plant, whitehead navarretia  
Subspecies: Navarretia leucocephala ssp. plieantha (H. Mason) A.G. Day – Many-flowered Navarretia, manyflowered navarretia

- **Resiliency, redundancy, and representation**

- Not discussed explicitly in the FWS documents reviewed but can be inferred as low.

- **Habitat**
  - FWS (2009) states that *Navarretia leucocephala* ssp. *plieantha* is extremely rare. This species is found only on substrates of volcanic origin and is dependent on vernal pools, vernal lakes, and swales for survival. Its life history is closely linked to the hydrology of these wetlands. The California Natural Diversity Database (CNDDDB) reports seven known occurrences of this species; five in Lake County and two in Sonoma County (CNDDDB 2007). In 2007, all seven occurrence in the CNDDDB were extant. Two localities for *N. leucocephala* ssp. *plieantha* are protected as reserves. The only typical population of *N. leucocephala* ssp. *plieantha* occurs at Boggs Lake Ecological Reserve that is co- owned and managed by California Department of Fish and Game and The Nature Conservancy. The California Department of Fish and Game manages the Loch Lomond Vernal Pool Ecological Reserve.
  - In FWS (2023), FWS states that a new occurrence was added to the CNDDDB. This new occurrence is located near five other occurrences that were known at the time of the listing and therefore does not change the understanding of the species distribution (FWS, 2023).
- **Relevant Life History**
  - Little is known about this species life history, including how pollination occurs (FWS, 2023).
- **Recovery Criteria:**
  - The Recovery Plan for this species uses an ecosystem level approach to account for species in the same natural ecosystem than share the same threats (FWS, 2005; FWS, 2023). The recovery criteria therefore include both generalized and individualized criteria:
    - At the ecosystem level:
      - protection from further habitat loss, fragmentation, and incompatible uses of the habitat to protect and maintain the full range of genetic and geographic variation in each species
      - development and implementation of appropriate habitat management plans for each species and area identified for protection
      - achievement of self-sustaining populations as determined through species monitoring and status surveys
      - completion of research necessary to refine measures to ameliorate or eliminate threats, and incorporation of results into habitat protection, management, and species monitoring efforts
      - establishment of regional recovery implementation working groups and development of outreach and education programs to ensure public support and participation in recovery efforts
- **Threats**
  - At the time of listing, the primary threats to this species were the direct destruction of the plants and their habitat or hydrologic changes to the vernal pool habitat. These threats include: wetland drainage, off-highway vehicle use, road maintenance, residential development, competition from invasive weeds, and climate change (FWS, 2023). Additional threats include rooting by feral pigs, horseback riding, and foot traffic related to human recreational activity (FWS, 2005).

- **Delisting Criteria**

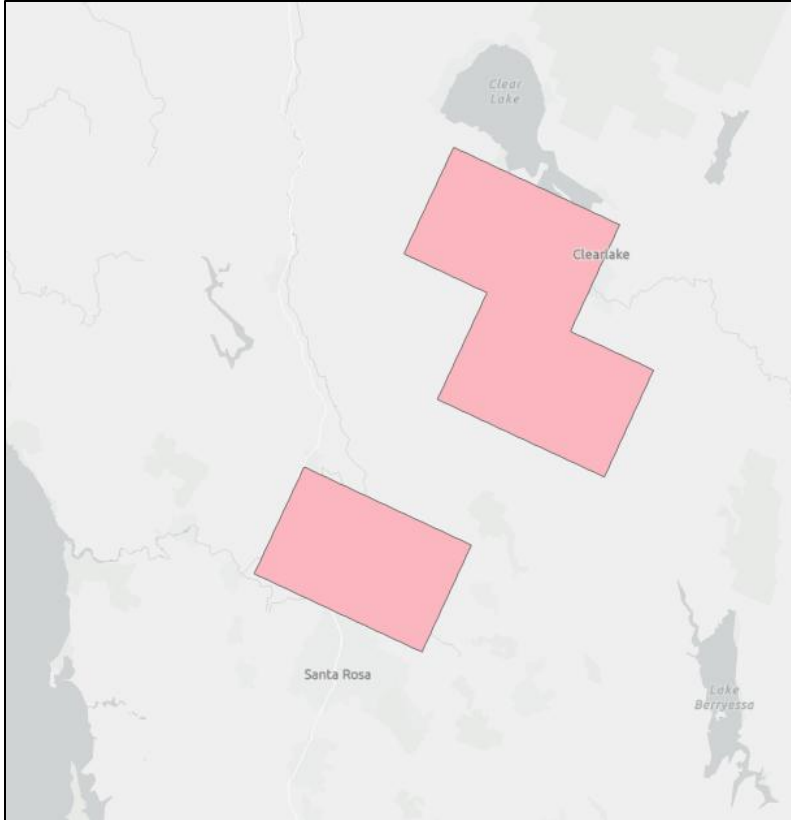
- Downlisting criteria is discussed in detail in FWS (2023), in general criteria includes:
  - Habitat protection
  - Adaptive habitat management and monitoring
  - Status surveys
  - Research
  - Public participation and outreach

- **Recovery Actions**

- The Recovery Plan for this species uses an ecosystem level approach to account for species in the same natural ecosystem than share the same threats (FWS, 2005; FWS, 2023). The overarching recovery strategy for this species is habitat protection and management. There are five key elements to this strategy:
  1. Habitat protection
  2. Adaptive management, restoration, and monitoring
  3. Status surveys
  4. Research
  5. Public participation and outreach

### **3. Description of Species Range**

FWS (2023) states that distribution of the many-flowered navarretia is similar to what was described in the 1997 listing rule and the 2009 status review. The many-flowered navarretia is known from only a small number of widely separate populations. This species is currently found in volcanic ash substrate, clay pan vernal pools in chaparral (shrub/scrub), grassland, or mixed coniferous forest in southern Lake and Sonoma counties. The species occurs over a 390 square-mile area (approximately 223,641 acres) at elevations of 110 to 2,800 feet.



**Figure 3. Species range, taken from FWS Environmental Conservation Online System (ECOS). This range encompasses approximately 223,641 acres.**

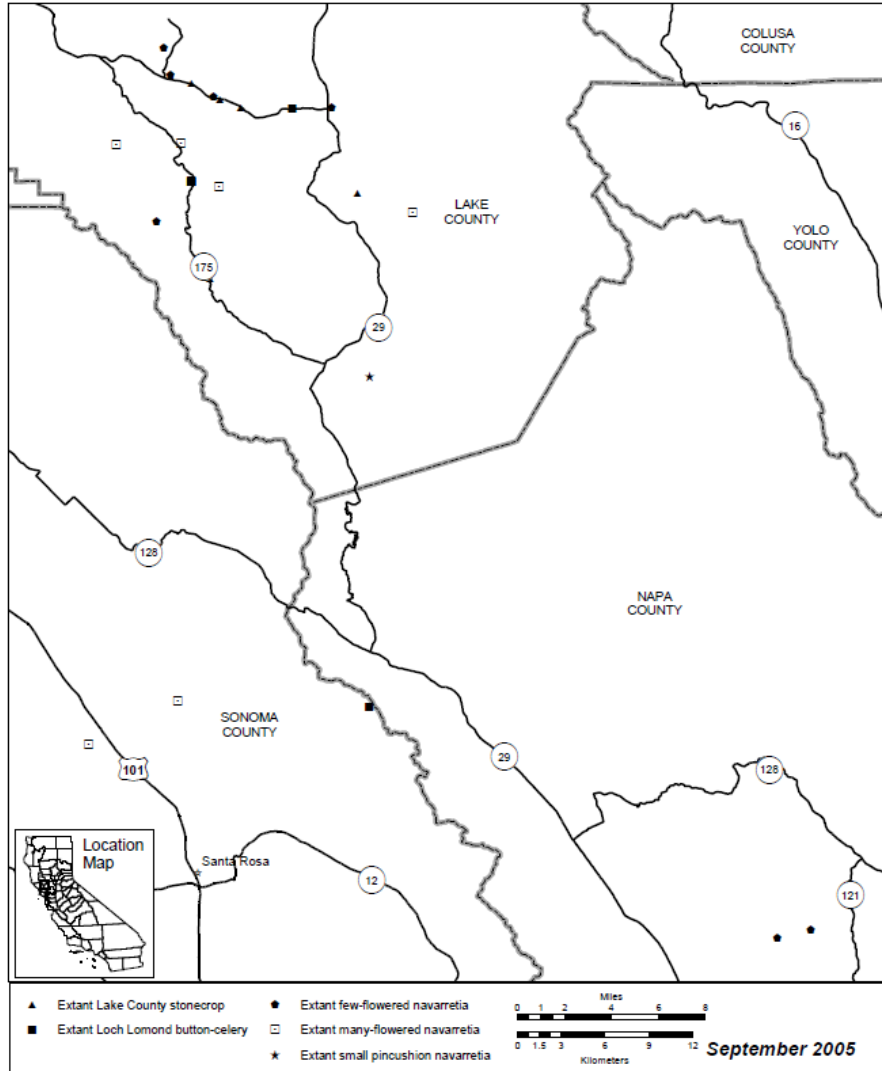


Figure II-5. Distribution of *Parvisedum leiocarpum* (Lake County stonecrop), *Eryngium constancei* (Loch Lomond button-celery), *Navarretia leucocephala* ssp. *pauciflora* (few-flowered navarretia), *Navarretia leucocephala* ssp. *pliantha* (many-flowered navarretia), and *Navarretia myersii* ssp. *deminita* (pincushion navarretia).

**Figure 4. Figure II-5 from (FWS, 2005), showing the distribution of the many-flowered navarretia among other endangered species as of September 2005.**

**4. Critical Habitat**

FWS has not designated a critical habitat for this species

**5. Additional Known Locations**

- [iNaturalist](#)
  - Searched on 5/2/2025
  - 13 research grade and verifiable observations made between June 2012 – May 2024
- [GBIF](#)
  - Searched on 5/19/2025
  - 13 research grade observations have been made between 2010 – 2024

- [NatureServe](#)
  - Searched on 5/19/2025
  - Observed in 4 hexagons, with last observation dates ranging from 1989 – 2022
  
- **CNDDB**
  - Searched on 5/2/2025
  - Unmasked location data was able to be downloaded and was used to ensure that the interim core map encompasses all extant locations

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

EPA developed the interim core map by refining the species range based on ACE hexagons that encompass known locations reported in FWS documents (sourced from CNDDDB). GBIF, iNaturalist and NatureServe data were considered and visually compared to the range and named locations, but not used to refine the interim core map since they were consistent with the range and named locations.

### 1. Datasets and Software

Datasets used:

- 1.1. FWS species range
- 1.2. [California Department of Fish and Wildlife \(CDFW\) Areas of Conservation Emphasis \(ACE\) Terrestrial Significant Habitats](#)
- 1.3. California Department of Forestry and Fire Protection (CAL FIRE) [Demonstration State Forest Boundaries](#)
- 1.4. Occurrences from [California Natural Diversity Database](#), information downloaded 5/2025

Software used: ArcGIS Pro, version 3.1.0 & 3.3

### 2. Creating the core map

#### 2.1. Determining which ACE hexagons have known extant locations within them

The *Spatial Join* tool was used to select which ACE hexagons include known extant locations within them.

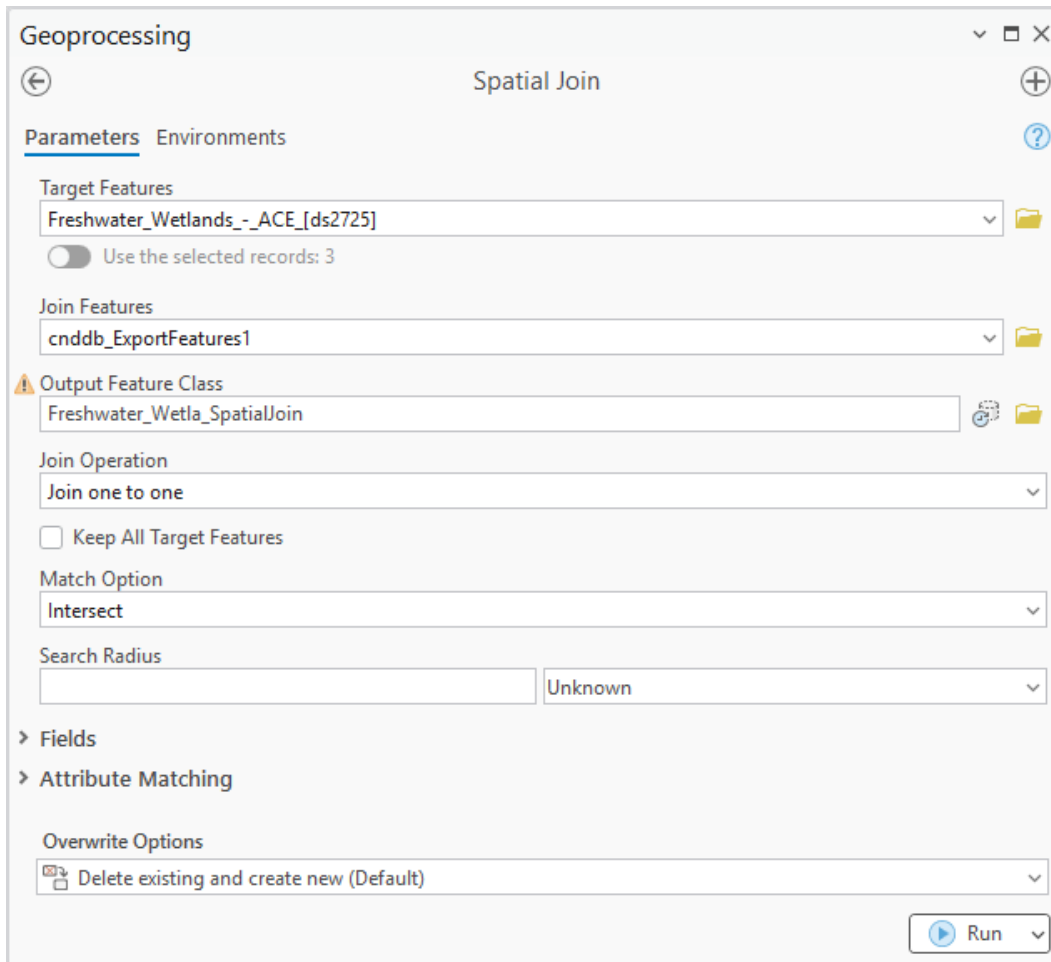


Figure 5. Set up of the *Spatial Join* tool.

## 2.2. Merging of the ACE hexagons with known locations with other named locations

Known extant occurrences are known to occur within the Boggs Mountain Demonstration State Forest, which was not included within the ACE hexagons selected in the step above. Therefore, a layer for the Boggs Mountain Demonstration Forest was created and merged with the result of the Spatial Join.

- 2.2.1. The *Export Features* tool was used to select Boggs Mountain Demonstration State Forest from the CAL FIRE Demonstration State Forest Boundaries layer. This location was used to mask a known location. This output was saved as a separate layer: *Boggs Mountain*

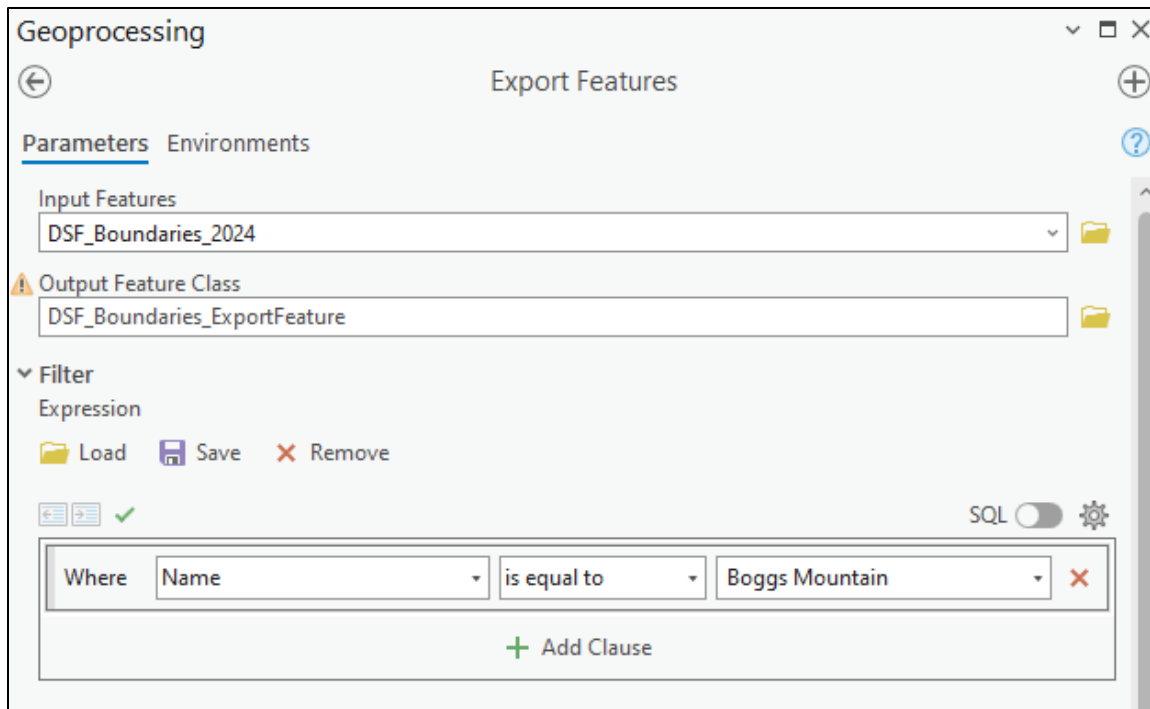


Figure 6. Set up for the Export Features tool.

The *Merge* tool was used to combine the Boggs Mountain Demonstration State Forest layer with the ACE hexagons selected from the Spatial Join.

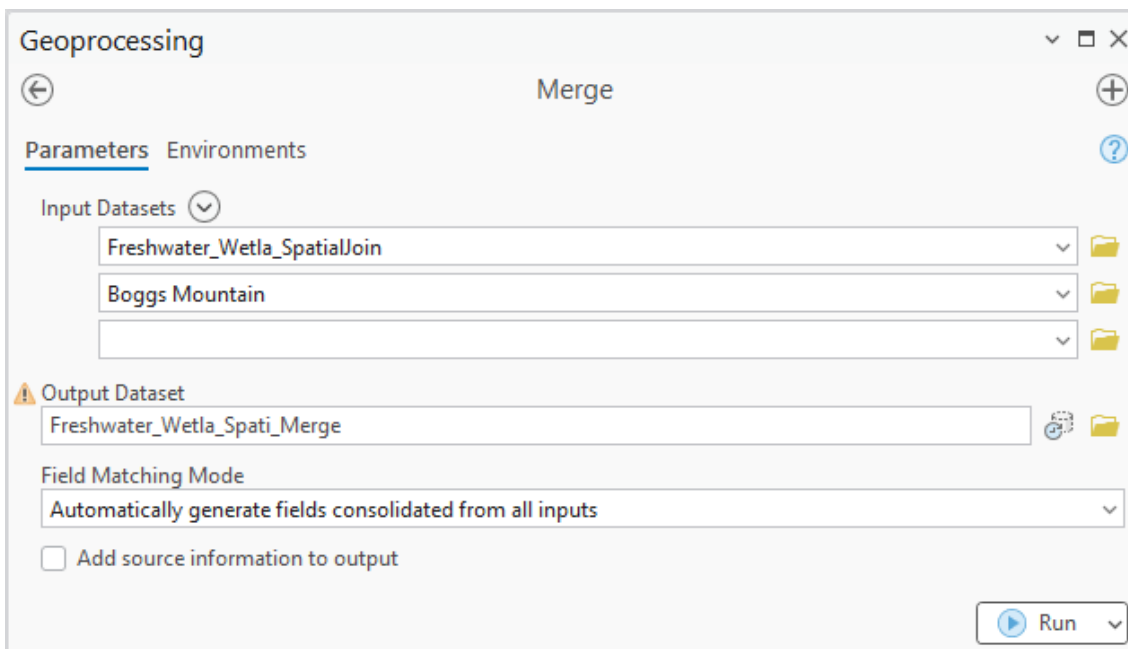
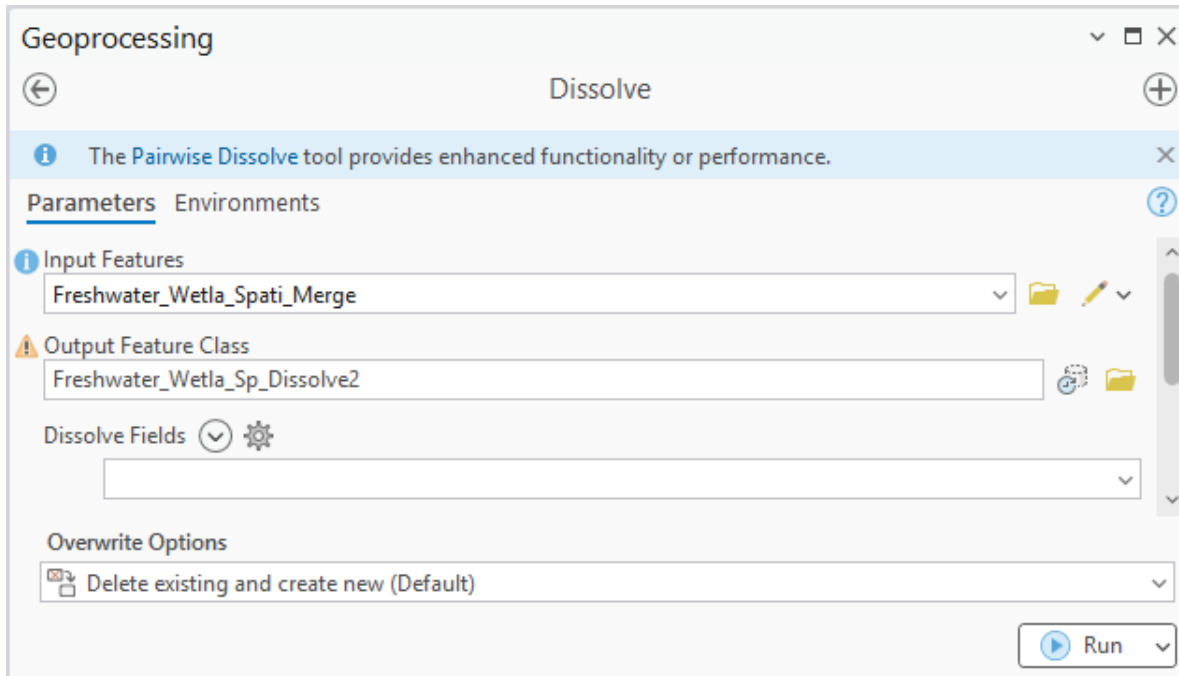


Figure 7. Set up of the Merge tool.

### 2.3. Removing internal boundaries

Internal boundaries were removed using the *Dissolve* tool, creating the final interim core map (“ManyFloweredNavarretia\_update.gdb”).



**Figure 8. Set up of the *Dissolve* tool.**

Extant occurrences were overlaid with the final interim core map to visually verify all known locations were accounted for.

## References

- CDFW, 2020. *ACE Dataset Fact Sheet: Terrestrial Significant Habitats*. 3/5/2020. California Department of Fish & Wildlife.
- FWS, 2005. *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon*. December 15, 2005. Region 1, U.S. Fish and Wildlife Service.
- FWS, 2009. *Navarretia leucocephala ssp. pliantha (Many-flowered Navarretia) 5-Year Review: Summary and Evaluation*. January 2009. Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service.
- FWS, 2023. *5-Year Review: Many-Flowered Navarretia (Navarretia leucocephala ssp. pliantha)*. August 29, 2023. Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service.