

Interim Core Map Documentation for Pennell's Bird's-Beak

Date Uploaded to EPA's GeoPlatform: October 2025

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

Species Summary

The Pennell's bird's-beak (*Cordylanthus tenuis ssp. capillaris*, Entity ID 1023) is an endangered terrestrial plant (dicot). The U.S. Fish and Wildlife Service (FWS) has not designated a critical habitat for the Pennell's bird's-beak. Known occurrences of Pennell's bird's-beak are found in Sonoma County, CA. This species typically occupies serpentine flats among chaparral and closed pine forests. Elevations of sites with known populations range from approximately 45 to 245 meters (150-800 feet). Pennell's bird's-beak is hemiparasitic, and although it contains chlorophyll, it collects water and other nutrients from the roots of a host plant. Additional information on the species is provided in **Appendix 1**.

Description of Core Map

The core map for the Pennell's bird's-beak is biological information type based on the three locations identified by FWS where the species is extant, Bohemia Ecological Preserve, Harrison Grade Ecological Reserve and the area near Porter Creek.

Figure 1 depicts the resulting interim core map for the Pennell's bird's-beak. The size of this core map is approximately 1493 acres.

The core map developed for the Pennell's bird's-beak is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the Pennell's bird's-beak. 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" best professional judgment classification to describe major uncertainties/limitations. The map is based on known locations described by FWS. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

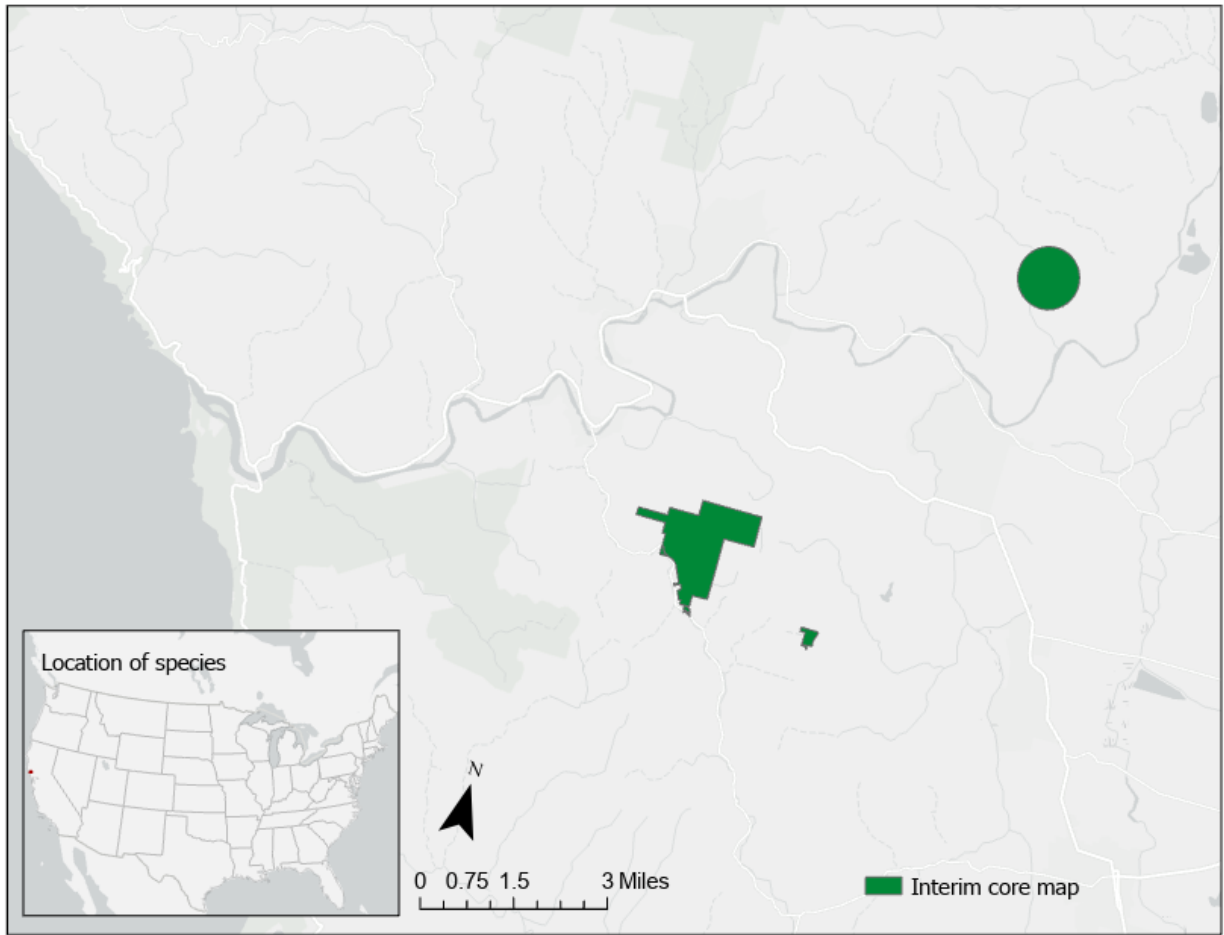


Figure 1. Interim core map for the Pennell's bird's-beak.

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover	% of core map represented by example pesticide use
Forestry	Deciduous Forest (41)	0	66
Forestry	Evergreen Forest (42)	61	66
Forestry	Mixed Forest (43)	5	66
Agriculture	Pasture/Hay (81)	0	6
Agriculture	Cultivated Crops (82)	6	6
Mosquito adulticide, residential	Open space, developed (21)	0	0
Mosquito adulticide, residential	Developed, Low intensity (22)	0	0
Mosquito adulticide, residential	Developed, Medium intensity (23)	0	0
Mosquito adulticide, residential	Developed, High intensity (24)	0	0
Invasive species control	Woody Wetlands (90)	0	27
Invasive species control	Emergent Herbaceous Wetlands (95)	0	27
Invasive species control	Open water (11)	0	27
Invasive species control	Grassland/herbaceous (71)	14	27
Invasive species control	Scrub/shrub (52)	13	27
Invasive species control	Barren land (rock/sand/clay; 31)	0	27
Total Acres	Interim Core Map Acres	~ 1493	

Table 1. Percentage of Interim Core Map Represented by NLCD¹ Land Covers and Associated Example Pesticide Use Sites/Types.

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; and
- Occurrence locations in the Global Biodiversity Information Facility (GBIF).

EPA evaluated these four sets of data before selecting the type of and developing the core map.

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

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 Habitats”² (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; and
4. Document the core map.

For step 1, EPA compiled available information for the Pennell’s bird’s-beak from FWS, as well as observation information available from various publicly available sources (including iNaturalist, NatureServe, and GBIF). The information compiled for Pennell’s bird’s-beak is included in **Appendix 1**. Influential information that impacted the development of the core map included:

- Occurrences and known locations of the Pennell’s bird’s-beak.

For step 2, EPA used the compiled information to identify the core map type including species range and known location information. In the 2024 5-year review, FWS identified four known populations of Pennell’s bird’s-beak at three named locations. Therefore, EPA based the core map on the known locations identified by FWS for extant populations. The entire range of the species was not used as the core map because the range contains areas where the species does not occur. No critical habitat has been designated for the species, so the critical habitat could also not be used as the core map.

For step 3, EPA used the best available data sources to generate the core map. Data sources are discussed in the process document. For this core map, EPA used descriptions of known locations of the Pennell’s bird’s-beak populations from the 2024 5-year review along with more refined spatial data available from the 2011 5-Year Review. Appendix 2 provides more details on the GIS analysis and specific data used to generate the core map.

² Dated 2024, available online at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>

Appendix 1. Information Compiled for the Pennell's Bird's-Beak During Step 1

1. Recent FWS documents/links and other data sources

- Five Year Review (2024)(https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/14103.pdf)
- Five Year Review (2019)(https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3445.pdf)
- Five Year Review (2011)(https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/1834.pdf)
- Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (1998) (https://ecos.fws.gov/docs/recovery_plan/980930c_v2.pdf)
- Recovery Plan Amendment for Serpentine Soil Species of the San Francisco Bay Area (2019) (https://ecos.fws.gov/docs/recovery_plan/APG%20amendment%20seven%20serpentine%20species.pdf)

2. Background information

- **Status:** Federally listed as endangered in 1995.
- **Resiliency, redundancy, and representation (the 3Rs)**
 - No SSA is available for this species
- **Habitat**
 - The Pennell's bird's-beak occupies serpentine flats among chaparral (Chuang and Heckard 1986) at elevations of approximately 45 to 245 meters (150 to 800 feet). (Recovery Plan, 1998)
 - Associated species include Baker's manzanita, California coffeeberry musk brush, and Sargent cypress. Of these, Baker's manzanita is considered rare. (Recovery Plan, 1998)
 - The Pennell's bird's-beak is known solely from records in the Outer North Coast Ranges floristic province of Sonoma County, California. (5-Year Review, 2011)
 - The Pennell's bird's-beak is associated with closed-cone coniferous forests and chaparral on serpentine soil. (5-Year Review, 2011)
 - Like others of the genus, Pennell's bird's-beak is hemiparasitic; although it contains chlorophyll, it collects water and other nutrients from the roots of a host plant. (5-Year Review, 2019)
 - Research shows many broomrape species use multiple species as hosts and might change host species throughout a season. (5-Year Review, 2019)
 - Studies on the Pennell's bird's-beak have identified Baker's Manzanita (*Arctostaphylos bakeri* ssp. *bakeri*) and Sargent's cypress (*Cupressus sargentii*) as possible host plants. (5-Year Review, 2019)
- **Pollinator/reproduction**
 - *Cordylanthus tenuis* ssp. *capillaris* flowers from June to July. (Recovery Plan, 1998)
 - The species is a root parasite, forming attachments to shrubs and possibly cypress trees. (Recovery Plan, 1998)

- Members of the *Cordylanthus* genus require bees for effective pollination. (5-Year Review, 2011)
- Most species of *Cordylanthus*, *C. tenuis* ssp. *capillaris* included, flower in the hottest time of the year, from mid-July through September. (5-Year Review, 2011)
- The uncommon flowering period of *Cordylanthus* ssp. in arid climates may be the result over evolutionary time of competition for pollinators. (5-Year Review, 2011)
- **Taxonomy**
 - Terrestrial Plant
- **Relevant Pesticide Use Sites**
 - The 2024 5-Year Review notes that pesticide applications to surrounding agricultural areas such as vineyards may represent a risk to the Pennell's bird's-beak
 - The 2024 5-Year Review specifically notes risks to pollinator populations from insecticide applications to nearby agricultural sites as a potential threat due to the reliance of the Pennell's bird's-beak on bees for pollination.
- **Recovery Criteria/Objectives (from 2019 recovery plan amendment)**
 - (A/1). A minimum of five populations of the Pennell's bird's-beak are fully protected and managed with the primary intention of preserving the populations in perpetuity. Each protected area should include occupied habitat with adjacent unoccupied habitat and a 150-meter (500-foot) buffer. Occupied habitat is secured and voluntarily protected in at least five sites (or populations).
 - (A/2). All known populations, and any occupied or unoccupied habitat identified as essential to survival, are voluntarily protected in perpetuity on parcels large enough to incorporate the spread and establishment of new colonies.
 - (A/3). Management plan(s), approved by the Service, are implemented for the populations described in **A/1** and any occupied or unoccupied habitat identified as essential to survival. The plans include provisions for standardized annual monitoring of populations.
 - (C/1). The spread of pathogenic species that might be harmful to Pennell's bird's-beak habitat is controlled at or below a level at which a population viability analysis indicates it does not pose a threat to the persistence of Pennell's bird's-beak.
 - (E/1). Until research shows otherwise, recovery efforts will target securing protected populations containing a minimum of 2,000 individual plants each, but preferably many more.
 - (E/2). Population trends at all sites are stable or increasing over 20 years that include two normal precipitation cycles (or longer if suggested by the results of demographic monitoring).
 - (E/3). Impacts from plants that are nonnative to serpentine habitats have been managed at levels that do not pose a threat to the persistence of the Pennell's bird's-beak.
 - (E/4). Seeds representative of the breadth of the species' genetic diversity are stored in at least two Center for Plant Conservation certified facilities; seed germination, propagation, and out planting propagation techniques are understood.

- **Recovery Actions (from 2019 recovery plan amendment)**

- Establish or protect additional populations of Pennell's bird's-beak.
 - Conduct botanical field surveys to discover additional populations.
 - Protect additional populations through voluntary conservation agreements or land acquisitions.
 - Collect and introduce Pennell's bird's-beak seeds in areas of appropriate habitat on protected lands.
 - Survey reintroduction sites annually to determine abundance and extent.
- Conduct research to increase understanding of Pennell's bird's-beak life history and annual establishment.
 - Conduct research to determine the full range (area and extent) of the species.
 - Conduct demographic surveys and long-term monitoring that includes, but is not limited to, habitat surveys, genetic research, host-parasite dynamics, and annual establishment.
 - Investigate and monitor potential management methods to maximize population success. Adapt and modify management as necessary.
- Conduct genetic research to determine if genetically distinct populations exist outside of protected areas.
- Monitor and manage Pennell's bird's-beak populations on protected lands.
 - At locations where the plant is protected, establish management plans to ensure the quality of existing habitat is maintained and/or degraded habitat is restored.
 - Conduct regular patrols to deter illegal dumping in habitat. If needed, mitigate the effects of illegal dumping on habitat.
 - Store seeds in at least two Center for Plant Conservation certified facilities. Unless storage techniques and/or research show otherwise, replenish seed stock every 10 years to ensure seed viability.
 - Establish an FWS-approved monitoring plan to cover a minimum of 5 years post-delisting. The plan will be ready for implementation at the time of delisting to ensure the ongoing conservation of the species and the continued effectiveness of management actions. Adequate funding must be dedicated to implement the delisting management plan.

3. Description of Species Range

- Figure A1-1 depicts the FWS range for the Pennell's bird's-beak. The range was last updated on October 20, 2015. The total area of the range is approximately 112,143 acres.



Figure A1-1. FWS range for the Pennell's bird's-beak. The total area of range is around 112,143 acres.

4. Critical Habitat

- FWS has not designated a critical habitat for this species.
(<https://ecos.fws.gov/ecp/species/3175>)

5. Known locations

- Known Locations Described in FWS Recovery Documents
 - The 2024 5-Year Review describes 4 known extant occurrences of Pennell's bird's-beak: "There are two occurrences within the Bohemia Ecological Preserve, which is still managed by LandPaths; one on Harrison Grade Ecological Reserve, owned and managed by the Department; and one assumed to be extant on privately owned lands near Porter Creek that has not been surveyed since it was identified in 1997". (5-Year Review, 2024)
 - The 2011 5-Year Review includes a map with approximate locations of occurrences described at the time. Note that as of the 2024 5-Year review, two of the occurrences from the map had been combined into a single occurrence. Occurrences 1, 4, and 6 were within Bohemia Ecological Preserve. Occurrence 2 was within Harrison Grade Ecological Reserve, and occurrence 5 corresponds to

the Porter Creek population (the text accompanying the map notes that no population #3 exists). The map is reproduced below in Figure A1-2.



Figure A1-2. Known CNDDDB occurrences of *Cordylanthus tenuis ssp. capillaris* from 2011 5-Year Review (5-Year Review, 2011).

- EPA queried iNaturalist, GBIF, and NatureServe. Collectively, the occurrence data are consistent with the FWS location data used to identify the core map.
- iNaturalist (available [here](#)) had 16 research grade observations for this species. Location data for these observations were in the vicinity of the locations used for the core map, however, the positional accuracy of the points does not allow EPA to determine if these occurrences fall within the area covered by the core map.
- GBIF (available [here](#)) included 72 occurrences and human observations. Location data for these observations were in the vicinity of the locations used for the core map, however, the positional accuracy of the points does not allow EPA to determine if these occurrences fall within the area covered by the core map.
- Occurrences in NatureServe (available [here](#)) are consistent with other occurrence data. Location data for these observations were in the vicinity of the locations used for the core map; however, the positional accuracy of the points does not allow EPA to determine if these occurrences definitively fall within the area covered by the core map.

Appendix 2. GIS Data Review and Method to Develop Core Map (Step 3)

This core map was created based on biological information, including occupied locations and species habitat. EPA used the species range layer from the FWS (last updated in 2015) as the starting point (outer extent) for developing the core map. Known location information from the 2011 and 2024 5-Year Reviews were used to further refine the core map.

- Dataset References and Software
 - Software used: ArcGIS Pro 3.3.0
 - FWS Species Range (available [here](#)) – last updated on October 20, 2015
 - Reference for boundary of Bohemia Ecological Preserve:
 - LandPaths Preserves ArcGIS Layer (available [here](#)).
 - Reference for boundary of Harrison Grade Ecological Reserve:
 - CDFW Owned and Operated Lands and Conservation Easements ArcGIS Layer (available [here](#))
 - Reference for location of Porter Creek population:
 - FWS 2011 5-Year Review (available [here](#))
- Datasets Used in Core Map Development
 - All datasets used in core map development are described in EPA’s process document.
- Core Map Development
 - EPA started with the most recent FWS range map (last updated in 2015) which was used as the outer extent of the core map.
 - EPA then limited the core map to the three known locations described in the 2024 5-Year Review (Bohemia Ecological Preserve, Harrison Grade Ecological Reserve, and “near Porter Creek”)
 - The boundary of Bohemia Ecological Preserve was obtained by loading the LandPaths preserves layer (linked above), selecting rows of the attribute table where Name== "Bohemia Ecological Preserve", and creating a new layer from the selection.
 - The boundary of Harrison Grade Ecological Reserve was obtained by loading the CDFW Owned and Operated Lands and Conservation Easements ArcGIS Layer (linked above), selecting rows of the attribute table where Name== "Harrison Grade Ecological Reserve" and creating a new layer from the selection.
 - The boundary of the Porter Creek population was generated by finding the lat/long coordinates of the centroid for occurrence #5 in Figure 1 of the 2011 5-Year Review (estimated to be (38.52977837, -122.8924991)), creating a point at that location in ArcGIS Pro (using the “XY Table To Point” tool) and then using the “Buffer” tool to create a 0.5 mile buffer around the centroid.
 - Once polygons were obtained for the three known locations, the layers were merged using the “Merge” tool, to create the final core map layer.