Interim Core Map Documentation for Pitkin Marsh lily (*Lilium pardalinum ssp. pitkinense*); EntityID 570

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

Species Summary

The Pitkin Marsh lily (*Lilium pardalinum ssp. pitkinense*, Entity ID 570) was federally listed as endangered in 1997 and has a narrow-ranging endemic found only in Sonoma County, California. The known populations are located in Pitkin Marsh and Cunningham Marsh in Sonoma County. The habitat of Pitkin Marsh Lily includes areas like freshwater fen or marsh that are fed by groundwater and winter and spring floodwaters. The habitat is also sometimes described as riparian overstory and shrubs, predominantly covered by oak or willow canopies. These habitats are strongly influenced by enough space/soil to grow; appropriate hydrology and inundation; appropriate levels of sunlight; and enough pollinators, including butterflies and hummingbirds.

Description of Core Map

The core map is biological information type, based on known locations named in U.S. Fish and Wildlife Service (FWS) documents. Selecting habitat would be impractical because the area is laden with wetlands and there is no documentation that the species occurs anywhere other than where they've been recorded. No critical habitat has been designated for this species. The FWS range is expansive and contains areas not occupied by the species. The two known locations for the Pitkin Marsh lily are the following:

> (1) Cunningham Marsh: The population in Cunningham Marsh is protected under a conservation easement.
> (2) Pitkin Marsh: Pitkin Marsh has two occurrences; north and central populations, that were last confirmed in 1997 and 2001, respectively. The two populations in Pitkin Marsh (northern Pitkin Marsh and central Pitkin Marsh) are not protected and have not been surveyed since 2001 and 1977, respectively, due to lack of access to the private property where the populations occur.

Figure 1 depicts the resulting interim core map for the Pitkin Marsh Lily. The size of this core map is approximately 300 acres. Landcover categories within the core map area are included in **Table 1**. Landcover is predominantly Grassland/herbaceous. Since this species occurs in disturbed areas, many of these areas potentially represent habitat.

The core map developed for the Pitkin Marsh lily is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the Pitkin Marsh lily. 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 a "limited" best professional judgment classification to describe uncertainties/limitations in mapping named known locations

described in FWS documents. This core map does not replace or revise any range designated by FWS. A critical habitat was not identified by FWS for this species.

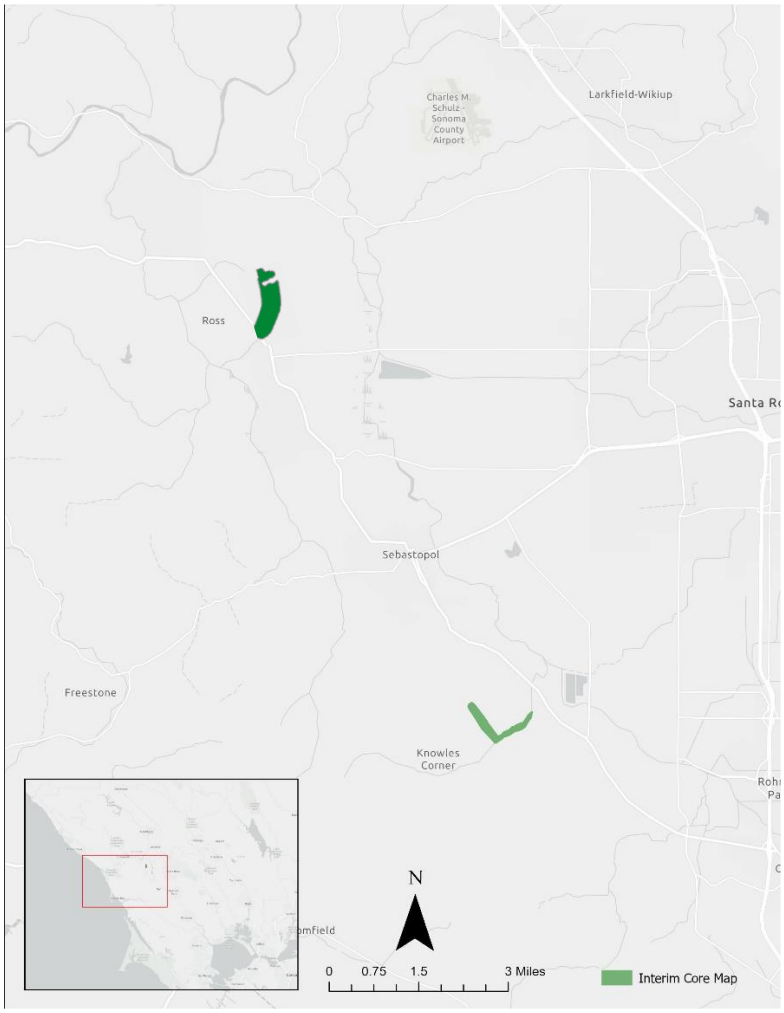

Figure 1. Interim core map for the Pitkin Marsh Lily (~300 acres).

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

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)	1%	12%
Forestry	Evergreen Forest (42)	2%	12%
Forestry	Mixed Forest (43)	9%	12%
Agriculture	Pasture/Hay (81)	0%	0%
Agriculture	Cultivated Crops (82)	0%	0%
Mosquito adulticide, residential	Open space, developed (21)	7%	11%
Mosquito adulticide, residential	Developed, Low intensity (22)	3%	11%
Mosquito adulticide, residential	Developed, Medium intensity (23)	0%	11%
Mosquito adulticide, residential	Developed, High intensity (24)	0%	11%
Invasive species control	Woody Wetlands (90)	8%	77%
Invasive species control	Emergent Herbaceous Wetlands (95)	10%	77%
Invasive species control	Open water (11)	0%	77%
Invasive species control	Grassland/herbaceous (71)	48%	77%
Invasive species control	Scrub/shrub (52)	10%	77%
Invasive species control	Barren land (rock/sand/clay; 31)	0%	77%
Total Acres	**Interim Core Map Acres**	~ 300	

Evaluation of Known Location Information

There are two datasets with known location information:

- Descriptions of locations provided by FWS;
- iNaturalist, GBIF and NatureServe observations.

EPA evaluated the following sets of data before selecting the type of and developing the core map:

- Sonoma County- Permit Sonoma GIS layers appeared to have the finest resolution of the location information, providing a map that depicted the current known locations all within the Pitkin Marsh and Cunningham Marsh areas.
- Although data points in iNaturalist, GBIF, and NatureServe occur outside of the interim core map, the iNaturalist occurrences overlap with the Pitkin and Cunningham Marshes when accounting for positional obscuring. Therefore, this data does not support expanding the core map.

Approach Used to Create Core Map

All available information compiled for the Pitkin Marsh Lily from FWS and Sonoma county-permit Sonoma GIS layers. The information compiled for Pitkin Marsh Lily is included in **Appendix 1**. Influential information that impacted the development of the core map included:

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

- Known locations of the Pitkin Marsh Lily are in Pitkin Marsh and Cunningham Marsh;
- The distribution of the Pitkin Marsh Lily is greatly influenced by enough space/soil to grow; appropriate hydrology and inundation; appropriate levels of sunlight; and enough pollinators, including butterflies and hummingbirds.

To identify the core map type for the Pitkin Marsh Lily, all known location information were compiled. The Pitkin Marsh Lily was historically known to occur in two locations: Pitkin Marsh and Cunningham Marsh. Therefore, the core map was based on the known locations identified by FWS.
The best available data sources were used to generate the core map. Data sources are discussed in the process document. For this core map, Sonoma County-Permit Sonoma GIS data layers were used . **Appendix 2** provides more details on the GIS analysis and data used to generate the core map. EPA's modified cultivated layer was erased from the core map, as this species does not occur on cultivated lands.

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

EPA explored using GIS datasets that describe the species' habitat to further refine the core map. The Pitkin Marsh Lily's habitat is not generalist; it is greatly influenced by enough space/soil to grow; appropriate hydrology and inundation; appropriate levels of sunlight; and enough pollinators, including butterflies and hummingbirds. However, selecting habitat would be impractical because the area is laden with wetlands, and there is no guarantee or documentation that the species occurs anywhere other than where they've been record.

Appendix 1. Information Compiled for the Pitkin Marsh Lily

1. Recent FWS documents/links and other data sources

1. Pitkin Marsh Lily 5-Year Review (2024) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/14433.pdf)
2. Species Status Assessment for Pitkin Marsh Lily (Lilium pardalinum ssp. pitkinense) (2024) (https://ecos.fws.gov/ServCat/DownloadFile/251951)
3. Draft Recovery Plan for the Pitkin Marsh Lily (2024) (https://ecos.fws.gov/docs/recovery_plan/Draft%20Pitkin%20Marsh%20Lily%20RP%207.24.2024%20508%20Comp_1.pdf)
4. Draft Recovery Implementation Strategy for Pitkin Marsh Lily (2024) (https://ecos.fws.gov/docs/recovery_plan/Draft%20Pitkin%20Marsh%20Lily%20RIS%207.24.24%20508%20Comp.pdf)

2. Background information

- **Status**: Federally listed as endangered in 1997
- **Resiliency, redundancy, and representation** (the 3Rs)
  There are 2 occurrences for this species and are at risk of extirpation. Species' recovery priority number is 6C, indicating a subspecies with a high degree of threat, low recovery potential, and conflict with construction or other development projects or other forms of economic activity. Resilient Pitkin Marsh lily populations need marsh habitat with the following: enough space/soil to grow; appropriate hydrology and inundation; appropriate levels of sunlight; and enough pollinators, including butterflies and hummingbirds. Demographic needs include the following: sexual reproduction, including pollination and germination; genetic diversity; asexual reproduction; and abundance. At the species level, the Pitkin Marsh lily needs to maintain multiple resilient populations, distributed throughout its historical range in Sonoma County, that contain the breadth of ecological and genetic diversity within the species (representation and redundancy). Resilient populations in multiple marshes in Sonoma County will help to decrease risk from potential catastrophic events and will help to preserve representation for the species. (Draft Recovery Plan, 2024)

  The recovery strategy will focus on increasing the resiliency of existing occurrences, maintaining representation by preserving the genetic and ecological diversity of the species, and increasing redundancy by out planting to new habitat areas to increase the chances of the species withstanding catastrophic events. The condition of two populations in Pitkin Marsh are currently unknown, thus the actual trajectory of the recovery strategy has been designed to be flexible depending on the actual status of these populations.
- **Habitat**
  - The Pitkin Marsh Lily inhabits freshwater fen or marsh that is fed by groundwater and winter and spring floodwaters. The habitat is also sometimes described at riparian overstory and shrubs, predominantly covered by oak or willow canopies. (Draft Recovery Plan, 2024)
  - These habitats are strongly influenced by enough space/soil to grow; appropriate hydrology and inundation; appropriate levels of sunlight; and enough pollinators, including butterflies and hummingbirds.
- **Taxonomy**
  The Pitkin Marsh Lily is an herbaceous, rhizomatous (possesses an underground stem) perennial in Liliaceae family: Lilium (genus), pardalinum (species), pitkinense (subspecies). It has slender,

erect stems which reach 1 to 2 meters (3 to 6 feet) in height and yellow-green linear leaves which are somewhat wider in the middle and up to 14 centimeters (5.5 inches) long and 1 to 2 centimeters (0.4 to 0.8 inch) wide. Leaves are scattered along the stems or occur in two or three whorls of three to six leaves near the middle of the stems. The inflorescence is a terminal raceme, meaning that the flower is at the end of the central axis of the plant. The flowers hang downwards, referred to as pendent flowers, with strongly reflexed (curved) petals. The petals are orange to red at the outer edge changing to yellow at the center with small, deep maroon dots, mostly within the yellow zone. Anthers (pollen-bearing part of the stamen) are magenta, with red or brown-orange pollen. The fruit is an elliptical capsule containing many flat seeds. The Pitkin Marsh lily is generally distinguished from the leopard lily (Lilium pardalinum ssp. pardinalum) by shorter petals and anthers. The Pitkin marsh lily flowers from June to July and grows in marshy wetlands and edges of riparian area (Service 2024, pp. 7–9).

- **Recovery Criteria/Objectives (2006 recovery plan)**
  1. Occupied habitat includes at least three self-sustaining populations of Pitkin Marsh lily, with at least one population in either Pitkin or Cunningham Marshes. This total may include any of the three known occurrences, any newly discovered populations, or out planted populations within the wetlands of Sonoma County. For the purposes of this recovery plan, populations shall be considered separate if they are separated by at least 0.25 mile (0.4 km). This distance of separation allows for cross-pollination by butterflies and hummingbirds.
  2. Each population described in downlisting criterion 1 has an average of at least 1,000 flowering stems within a minimum occupied area of 0.4 acre over a 10-year period of demographic monitoring. Each population described in downlisting criteria 1 has an average of at least 1,000 flowering stems within a minimum occupied area of 0.4 acre over a 10-year period of demographic monitoring.
  3. The occupied land inhabited by the populations in downlisting criterion 1 is protected via the sale by willing landowners of conservation easements to a conservation organization, deed restriction, by sale of fee title to the same, through a Memorandum of Understanding with the Service, or other durable agreement. The occupied land inhabited by the populations in downlisting criterion 1 is protected via the sale by willing landowners of conservation easements to a conservation organization, deed restriction, by sale of fee title to the same, through a Memorandum of Understanding with the Service, or other durable agreement.
  4. Each of the three populations described in downlisting criterion 1 are being managed in a way, currently and into the future, that will support continued existence of the Pitkin Marsh lily and its habitat, including management of non-native plant species and protection from herbivory.
- **Recovery Actions (from 2006 recovery plan)**
  - Action 1: “Protect extant populations and newly established or identified populations of Pitkin Marsh lily. (Priority 1)”
    - Reach out to private landowners with previously identified Pitkin Marsh occurrences on their property, as well as potential partners with existing conservation easements that may have suitable habitat to protect Pitkin Marsh lily populations.
    - 1-2 Protect the habitat with existing populations, as well as the habitat immediately surrounding those populations via land acquisition or conservation easements from willing sellers.
    - 1-3 Protect habitat for outplants or newly identified populations.
  - Action 2: “Manage habitat that supports the species to reduce or eliminate threats throughout the range, including control of competitive native and non-native vegetation, and supplemental seeding or planting. (Priority 1)”

        - 2-1 Continue management for the Cunningham Marsh pop.
          Remove non-natives
          Fencing repair
        - 2-2 Establish and maintain a relationship with landowners whose land supports the Pitkin Marsh lily to determine the population status, and discuss management/monitoring/protection
          Discussions should include, but should not be limited to, vegetation management, fencing and/or grazing.
        - 2-3 Develop and implement site-specific management plans for action 1 habitats
        - 2-4 Secure management funds
        - 2-5 Periodically review managment activities to ensure efficacy
    - Action 3: "Monitor all known populations of Pitkin Marsh lily and ensure that the monitoring protocol informs management of the taxon and allows us to accurately assess population trends. (Priority 2)
        - "3-1 Develop a monitoring protocol of both quantitative and qualitative mthods that enables evaluation of long-term population trends and changes in distribution over time; update protocol over time as needed;
        - 3-2 Monitor all populations, including the Cunningham Marsh population and those on lands protected through Action 1, and on private lands for which the landowner has allowed access, in accordance with the monitoring plan."
          Monitoring should be on all protected and non-protected habitat, with permission of the landowner.
    - Action 4: "Prior to outplanting, conduct a genetic study to confirm the taxonomic status of all known Pitkin Marsh lily plants, including those at Cunningham Marsh and any growing in living collections at botanic gardens. (Priority 2)"
        - "4-1 Collect samples from all known Pitkin Marsh lily plants, including wild plants in Cunningham Marsh, any plants growing in living collections at botanic gardens, and all voucher specimens;
        - 4-2 Conduct a genetic study investigating the taxonomic status of all known Pitkin Marsh lily plants and voucher specimens."
    - Action 5: "Outplant seeds, seedling, or bulbs to establish additional populations in appropriate habitat within the wetlands of Sonoma County. (Priority 2)"
        - "5-1 Identify property within the historical range where suitable habitat and compatible land use still exists, for potential establishment of new populations;
        - 5-2 Develop a propagation and outplanting plan compliant with the Service's propagation policy […]" and IUCN guidelines;
        - "5-3 Acquire permits for seed multiplication and outplanting;
        - 5-4 Using seeds from Activity 6-1, establish greenhouse populations in order to conduct seed multiplication to maintain a fresh supply of seed for introduction efforts;
        - 5-5 Introduce Pitkin Marsh lily within protected habitat."
    - Action 6: "Collect seeds from all populations and store in certified facilities. A subset of seed may be withheld and planted to establish additional populations. (Priority 2)"
        - 6-1 Collect and bank seeds when seed production is high in the natural populations
    - Action 7: "Conduct experimental research to inform management actions that further Pitkin Marsh lily recovery."
        - 7-1 Perform life history and ecology studies

3. **Description of Species Range**
   - **Figure A1-1** depicts the FWS range.

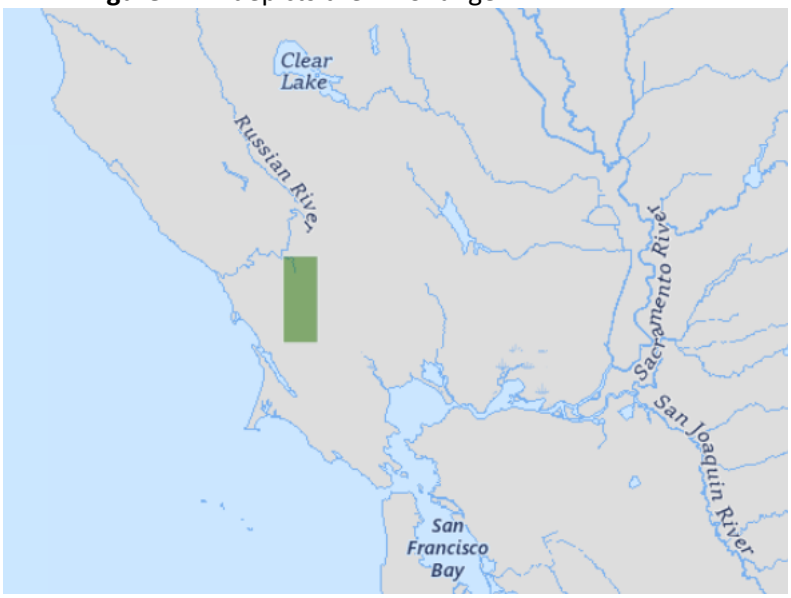

Figure A1-1. FWS range for the Pitkin Marsh lily.

4. **Critical Habitat**
   - FWS has not designated a critical habitat for this species (Species Profile for Pitkin Marsh lily(Lilium pardalinum ssp. pitkinense))

5. **Known Locations**
   - Known Locations Described in FWS Recovery Documents
     - Currently found in only two areas: Pitkin Marsh and Cunningham Marsh.
   - **Occurrences Included in Public Databases** (Searched June 18, 2025, by EPA)
     - California Natural Diversity Database, 2025 (California Department of Fish and Wildlife, available here) had three presumed extant occurrences within the species range and interim core map area.
     - iNaturalist (available here) had 17 research grade observations for this species between 2017-2024. Only five occurrences are within the species range, and none occur within the interim core map. When accounting positional obscuring, these occurrences overlap with the Pitkin and Cunnigham Marshes.

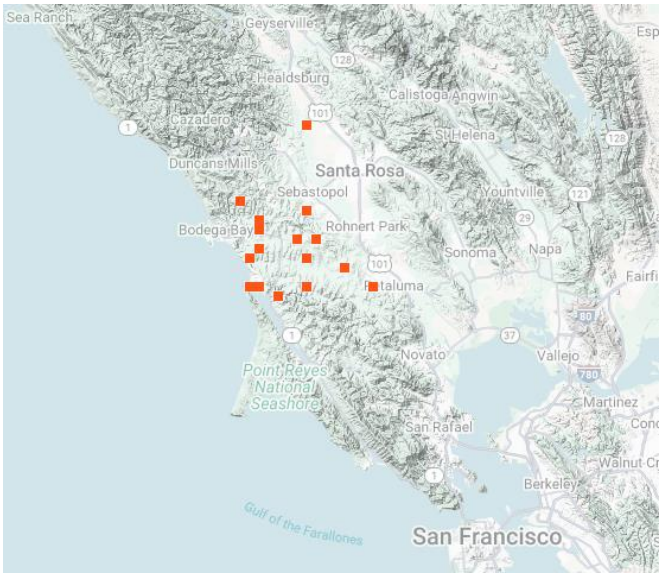

Figure A1-2. Occurrences of the Pitkin Marsh lily available on iNaturalist.

- GBIF (available here; filtered for present occurrences in the U.S.) included eight human observations (from 1977-2023) with all observations also in iNaturalist or NatureServe. Five of the eight data points are outside or on the edge of the species range, and none occur within the interim core map. The remaining three data points do not report coordinate locations.
- Occurrences in NatureServe were consistent with other occurrence data (linked here).

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

1. Dataset References and Software

- Begin with all GIS data layer hosted by Sonoma county-Permit Sonoma (sc_prmdgisin ArcGIS online; available here).
- NLCD Land Cover Database (available here)
- EPA's modified cultivated layer (available here)

2. Datasets Used in Core Map Development

GIS data layer hosted by Sonoma county-Permit Sonoma (sc_prmdgisin ArcGIS online).

3. Core Map Development

1. Added the Marshes and Wetland layer from ArcGIS online.
2. Created a new layer using selected features to create a layer consisting of the two named known locations, Cunningham Marsh and Pitkin Marsh.
3. Clip function used to clip just Cunningham Marsh and Pitkin Marsh.
4. Export NLCD landcover to raster for core map extant.
5. Raster to polygon by classname.
6. Pairwise dissolve by classname to get sum of each landcover category.
7. Clip to Cunningham Marsh and Pitkin Marsh.
8. Erase EPA's modified cultivated layer from the core map after adding the modified cultivated layer to the map project.
9. Calculate acres for each landcover category.