

Interim Core Map Documentation for the Purple Amole

Version 1

Review Completed: August 2025

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

Species Summary

The purple amole (*Chlorogalum purpureum*; Entity ID 58) is a threatened terrestrial flowering plant. The designated critical habitat for the purple amole is out of date. This species occurs in open, well drained clay soils with few competitors in San Luis Obispo and Monterey counties in California. Additional information is provided in **Appendix 1**.

Description of Core Map

The core map for the purple amole is based on biological information, which includes known locations and habitat locations. Since there is no up to date designated critical habitat for this species, critical habitat was not used in the development of this core map. Known locations used for this core map include information provided by FWS in the 2022 Recovery Plan and occurrences reported in iNaturalist. **Figure 1** depicts the interim core map for the purple amole. The core map represents approximately 237,114 Acres.

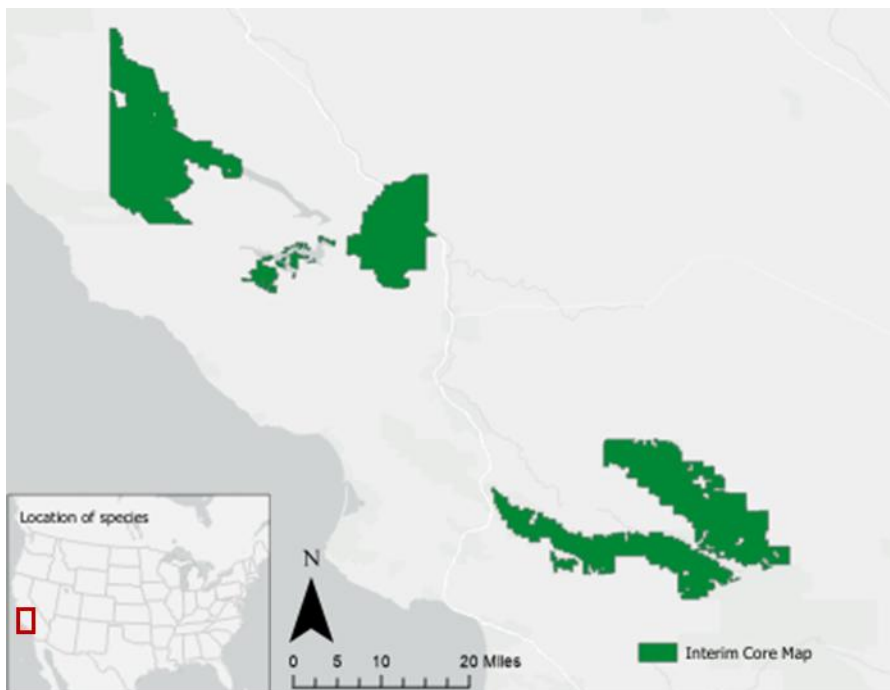


Figure 1. Interim core map for the purple amole.

Land cover categories within the core map area are included in **Table 1**. The predominant land covers are shrubs and grasslands, followed by mixed forest and evergreen forest.

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

Example pesticide use sites/types	NLCD Class/Value	% Area
Forestry	Deciduous Forest (41)	0%
Forestry	Evergreen Forest (42)	5%
Forestry	Mixed Forest (43)	10%
Agriculture	Pasture/Hay (81)	0%
Agriculture	Cultivated Crops (82)	0%
Mosquito adulticide, residential	Open space, developed (21)	2%
Mosquito adulticide, residential	Developed, Low intensity (22)	0%
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)	0%
Invasive species control	Grassland/herbaceous (71)	39%
Invasive species control	Scrub/shrub (52)	41%
Invasive species control	Barren land (rock/sand/clay; 31)	0%
Total Acres	Interim Core Map Acres	~237,114 acres

The core map developed for the purple amole is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the purple amole. This core map incorporates information developed by the U.S. Fish and Wildlife Service (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 expert feedback from FWS. This interim core map has an “average” best professional classification to describe uncertainties and data interpretation. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

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 habitats² (referred to as “the process”). This core map was developed by EPA using the 4 steps described in the process document:

1. Compile available information for a species
2. Identify core map type

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

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

3. Develop the core map for the species
4. Document the core map

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

- The available occurrence data, including FWS named locations
- The critical habitat has been confirmed to be outdated.
- The species occurs in grasslands, shrublands, and woodlands that are open, with specific characteristics explained in FWS documentation.

For step 2, EPA used the compiled information to identify the core map type. EPA compared the known location and habitat data to the range and found that there were hotspots of suitable habitat and species observations outside of the range. Specifically, locations outside of the range included areas adjacent to highway 58 north of the Los Padres National Forest boundary and areas south/southeast of the town of Shandon California (See **Appendix 1**). EPA also found that the range likely captures areas where the species is not expected to occur. The range map follows geo-political boundaries (townships) and includes areas that do not likely represent the habitat of this species. The species has specific habitat requirements, though the critical habitat is outdated. When weighing that information together, EPA selected the biological information core map type. EPA used known locations and suitable habitat data to derive this 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 known locations from FWS and public sources as well as land cover data. **Appendix 2** provides more details on the GIS analysis and data used to generate the core map.

Evaluation of Known Location Information

There are four datasets with known location information:

- Descriptions of locations provided by FWS, including a link to a collective database on research-grade herbarium observations
- Occurrences in iNaturalist
- Occurrences in the Global Biodiversity Information Facility (GBIF)
- Occurrences in NatureServe

EPA evaluated these sets of data in developing the core map. The 2022 Recovery Plan showed that this species is known to occur in Jolon, Fort Hunter Liggett, Camp Roberts, Nacimiento River Noth/South, and Los padres National Forest. It documented a detailed list of these sites. iNaturalist (67 research grade observations), GBIF (14 georeferenced records), and NatureServe observations were generally consistent with the species range except for some hotspots near highway 58 and the town of Shandon California. Therefore, the known location information supports using the range refined by habitat type and known locations as the core map. **Appendix 1** includes more information on the available known location information.

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

EPA considered various data sets and approaches to generate this core map. When reviewing the interim core map, it may be possible to improve the confidence of this core map or bring in data from species experts that confirms more specific known locations or habitats for the species.

One data set EPA considered for refining the core map was the SSURGO database, given that the species prefers well drained clay soils. However, these data did not refine the core map to any meaningful extent since the known locations and suitable land cover types matched with suitable soil requirements.

EPA also considered various datasets (such as the [2020 Global Canopy Height](#) dataset or the [USA NLCD Tree Canopy Cover](#) dataset) for canopy cover in order to refine the core map, given that the species prefers open areas. However, it was not clear from FWS documentation what quantitative metric (such as percent canopy cover) was appropriate for the species. Instead, qualitative characteristics were described that allowed EPA to determine that suitable habitat for the species matched with about half a dozen land cover categories clearly defined in the “Landfire” land cover database. Since all the identified suitable land cover types from Landfire are “open” in nature, refining the core map area based on those was deemed sufficient to capture the “open” habitat requirement for the purple amole. It seemed unlikely that adding an additional dataset for capturing “open” habitat would have removed area from the core map.

Finally, EPA considered the explicit removal of cultivated lands from the interim core map as an extra step at the end of the refinement, but this was not necessary since the NLCD overlap analysis (Table 1) revealed that agriculture comprised 0% of the total core map area.

Appendix 1. Information compiled for species

1. Recent FWS documents

- ECOS species page <https://ecos.fws.gov/ecp/species/5531>
- Purple Amole (*Hooveria purpurea* | *Chlorogalum pupureum*) Recovery Plan (2022) ([https://ecos.fws.gov/docs/recovery_plan/Purple%20Amole%20Recovery%20Plan_FINAL\(1\).pdf](https://ecos.fws.gov/docs/recovery_plan/Purple%20Amole%20Recovery%20Plan_FINAL(1).pdf))
- Species Status Assessment for Purple Amole (2020) (<https://ecos.fws.gov/ServCat/DownloadFile/181977>)
- 5-Year Review: Purple Amole (*Hooveria purpurea*) (2020) (https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3395.pdf)
- Endangered and Threatened Wildlife and Plants; Final Designation of Critical Habitat for *Chlorogalum purpureum*, a Plant From the South Coast Ranges of California (2002) (<https://www.govinfo.gov/link/fr/67/65414?link-type=pdf>)

2. Background information

- Status
 - Federally listed as threatened in 2020
- Resiliency, redundancy, and representation (the 3Rs)
 - There are two varieties of purple amole; Santa Lucia purple amole (*Hooveria purpurea* var. *purpurea* | *Chlorogalum purpureum* var. *purpureum*) and Camatta Canyon amole (*Hooveria purpurea* var. *reducta* | *Chlorogalum purpureum* var. *reductum*) (p. 1; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)
 - Resiliency was evaluated on two future scenarios:
 - Scenario 1: Representative Concentration Pathway 8.5 (RCP 8.5) – No policy to curb greenhouse gas emissions for the next 50 years
 - Scenario 2: RCP 4.5 – Includes the effects of the RCP 4.5 Stabilization scenario (<https://sos.noaa.gov/catalog/datasets/climate-model-temperature-change-rcp-45-2006-2100/>) for the next 50 years, mixed with management actions
 - For Santa Lucia purple amole (SLPA), “the resiliency analysis under current conditions shows that three of the four populations have moderate resiliency and one is low. Under Future Scenario 1, resiliency does not change. Under Future Scenario 2, with increased management, resiliency increases from low to moderate in one population [...]” (p. 4; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)
 - For Camatta Canyon Amole (CCA), “the resiliency analysis under current conditions shows that one occurrence has moderate resiliency and two occurrences have low resiliency; there is insufficient information to calculate a resiliency score for occurrence 4. Under Future Scenario 1, one occurrence remains in moderate condition and the two in low current condition become extirpated. Under Future scenario 2, with increased management, one occurrence remains in moderate condition, the two in low current condition become extirpated, and occurrence 4 moves from unknown to moderate condition.” (p. 4; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)
 - The “[...] declining numbers of individuals may affect genetic diversity, and the spatial extent and associated ecological representation of both [SLPA] and [CCA] are inherently low.” (p. 42; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)

- “[...] purple amole has inherently low redundancy due to being composed of two narrow endemic varieties, but having two spatially separated varieties does provide some protection for the species as a whole from extinction due to less expansive catastrophic events.” (p. 42; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)

3. Habitat, Life History, and Ecology

- Well drained clay soils mixed with gravel in open ground; relatively free of competition, in San Luis Obispo and Monterey counties in California (see ‘Critical Habitat’ section; pp. 12-13 <https://ecos.fws.gov/ServCat/DownloadFile/181977>)
- “The known populations primarily exist within an open grassland community, with a smaller number of individuals found within scattered oak woodland communities and open areas within shrubland communities” (Critical Habitat Designation 2002).
- “Of the known sites surveyed in 1999, approximately 42 percent were found in grassland communities, 29 percent were found between tree canopies in oak savanna or woodland communities, 13 percent were found to occur along ecotones between grassland and either oak woodland or shrubland communities, and the remaining were located within open areas between shrub species, most commonly *Eriogonum fasciculatum* (California buckwheat) and *Adenostoma fasciculatum* (chamise) (Wilken 2000). Within the grassland community, the most common grass species (e.g., nonnative *A. caryophylla* and *B. hordeaceus*) did not always dominate in terms of frequency or cover; the most frequent species were native annual forbs such as *Lasthenia californica*, *Linanthus liniflorus*, *Micropus californicus*, and *Navarretia* spp. (*Navarretia*) (Wilken 2000). Insect species, which may contribute to *C. p. var. purpureum* pollination, were observed during recent surveys and include unidentified native bees and an unidentified, small blue butterfly (L. Clark, Fort Hunter Liggett, pers. comm., 2002). Detailed studies of pollinators need to be conducted” (Critical Habitat Designation 2002).
- “*Chlorogalum purpureum* is a summer dormant perennial herb that forms a bulb. The inflorescence develops during early spring, followed by flowering and fruit development during May and June. By the time the fruit has matured, the leaves wither and the inflorescence dries and turns light brown in color. Reproduction is primarily by seed, and the seed set apparently increases with insect pollination (D. Wilken, in litt., 1998). Like other members of the lily family, *C. purpureum* is probably in a mycorrhizal relationship with a fungus (a close association between the plant and soil fungus, where the fungus aids in nutrient and water uptake), which can alter growth and competitive interactions between species (Allen 1991)” (Critical Habitat Designation 2002).

Taxonomy

- Flowering terrestrial plant in the family Asparagaceae (https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=42900#null)

4. Relevant Pesticide Use Sites

- Herbicide use in road maintenance is implied by the 2020 Species Status Assessment (SSA), though text did not specify herbicide use.
- Insecticides and fungicides were not specified as explicit threats to the species in any FWS documentation, but FWS did note that the species forms mutualistic relationships with insect pollinators and mycorrhizal fungi.

5. Relevant Recovery Criteria and Actions

- All information below is from 2022 Recovery Plan
- Recovery Criteria/Objectives
 - “At least four resilient populations display evidence of recruitment of new individuals and stable or increasing population trends averaged over 10 consecutive years;”
 - “Each of the four resilient populations is being managed in a way, currently and into the future, that will support continued existence of Santa Lucia purple amole and its habitat, including management of non-native, invasive species, and anthropogenic disturbance and feral wildlife;”
 - “Management is effective as shown by monitoring over 10 consecutive years; and
 - An *ex situ* permanent conservation seedbank is established in a Center for Plant Conservation-affiliated botanic garden that reflects the breadth of the taxon’s genetic diversity.”
 - “At least four resilient occurrences or occupied area of 250 hectares (617 acres), across the single population, display evidence of recruitment of new individuals and stable or increasing population trend averaged over 10 consecutive years;
 - Each of the four resilient occurrences, or occupied area of 250 hectares (617 acres), is protected from habitat loss, including development activities;
 - Each of the four resilient occurrences, or occupied area of 250 hectares (617 acres), is being managed in a way, currently and into the future, that will support continued existence of Camatta Canyon amole and its habitat, including management of non-native invasive species, and protection from off-highway vehicles;
 - Management is effective as shown by monitoring over 10 consecutive years; and
 - An *ex situ* permanent conservation seedbank is established in a Center for Plant Conservation-affiliated botanic garden that reflects the breadth of the taxon’s genetic diversity.”
- Recovery Actions
 - Application of frequent fire to both clusters and foraging habitat
 - “Recovery actions for Santa Lucia purple amole
 - 1. Manage habitat that supports the taxon to reduce or eliminate threats (Priority 1)
 - 2. Conduct annual census monitoring (Priority 2)
 - 3. Collect seed and deposit accessions into the permanent conservation seedbank (Priority 3)
 - 4. Conduct experimental research projects (Priority 3)”
 - “Recovery actions for Camatta Canyon amole
 - 1. Protect all currently unprotected habitat where the taxon occurs (Priority 1)
 - 2. Manage habitat that supports the taxon to reduce or eliminate threats (Priority 1)
 - 3. Conduct annual census monitoring (Priority 2)
 - 4. Collect seed and deposit accessions into the permanent conservation seedbank (Priority 3)
 - 5. Conduct experimental research projects (Priority 3)”

6. Range (Figure A1-1)

- Two varieties within the Santa Lucia Range or southwestern Monterey County and San Luis Obispo County California (2022 Recovery Plan).
- Totals 931,266 Acres in the state of California, last updated 5/22/18, downloadable at <https://ecos.fws.gov/ecp/species/5531#rangeInfo>

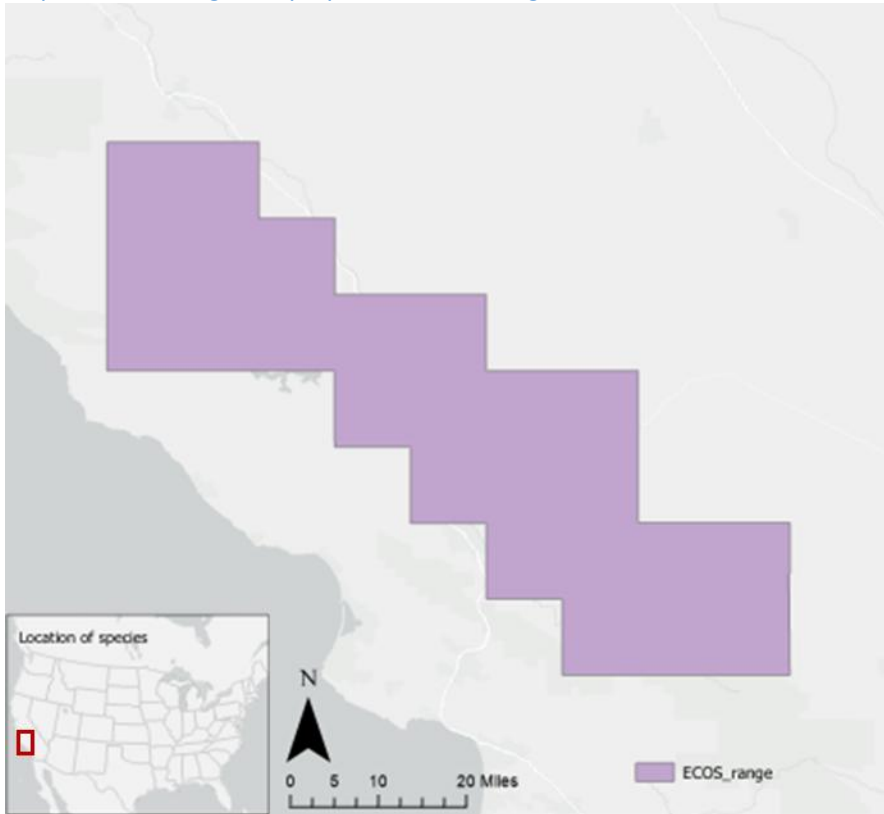


Figure A1-1. FWS range for the purple amole.

7. Critical Habitat (Figure A1-2)

- Approximately 2,443 ha in clay soils along the south coast ranges of San Luis Obispo and Monterey counties in California is designated critical habitat. This was last updated 10/14/2002 (<https://www.govinfo.gov/link/fr/67/65414?link-type=pdf>).
- **Shapefile:** https://ecos.fws.gov/docs/crithab/zip/FCH_Chlorogalum_purpureum_20021024.zip
 - For SLPA, critical habitat elements include well-drained sandy clay to loamy clay soils with an overlay of final gravel. Prefer “blue oak woodland or oak savannahs, and open areas within shrubland communities” where there is little cover from competing species (p. 12; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)
 - For CCA, critical habitat elements include well-drained soils with a lot of gravel at the surface. Prefer “grassland or the pine bluegrass grassland, nonnative grassland and wildflower field[s ...], blue oak woodland or oak savannahs[...], oak woodland, and open areas within shrubland communities [...] where there is little cover of other species which potentially compete for resources[...]” (pp. 12-13; <https://ecos.fws.gov/ServCat/DownloadFile/181977>)
- Designated critical habitat for this species is downloadable at <https://ecos.fws.gov/ecp/species/5531#crithab>

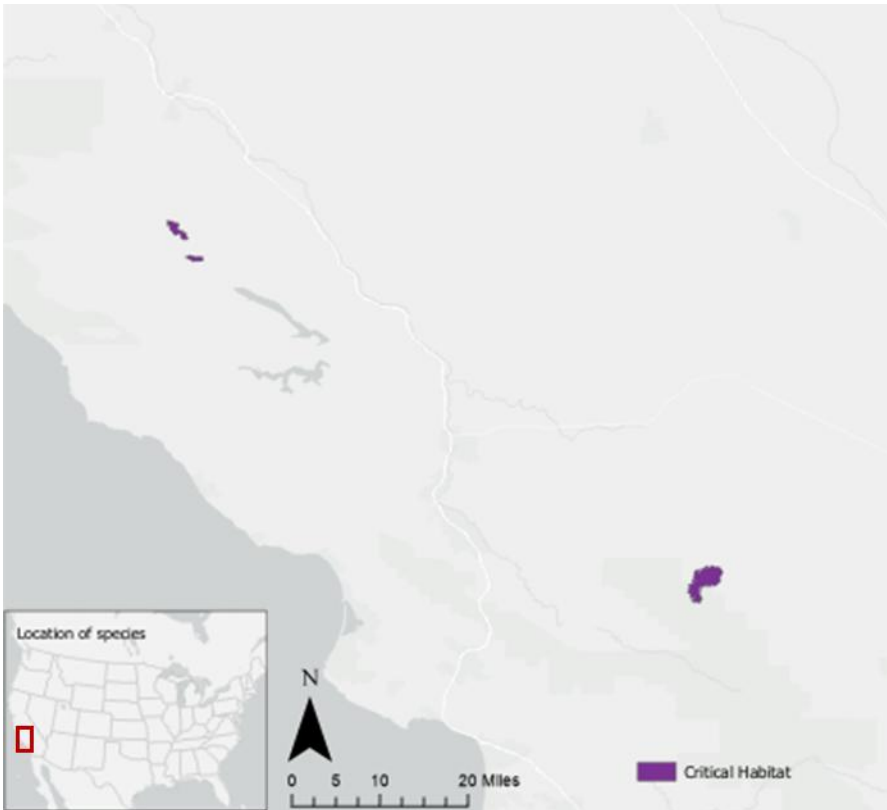


Figure A1-2. FWS critical habitat for the purple amole.

8. Known Locations

- The known locations referenced in the recovery plan focused on several areas in California, USA (plotted in **Appendix 2 Figure A2-3**):
 - **Jolon/Fort Hunter Liggett/Camp Roberts** – these areas were further described in the recovery plan multiple times *“Purple amole is endemic to Monterey and San Luis Obispo counties in central coastal California. Santa Lucia purple amole is known from 17 occurrences in four populations in the Santa Lucia Range in southwestern Monterey County (Fort Hunter Liggett) and north central San Luis Obispo County (Camp Roberts) (CNDDDB 2020, website)”* and again *“In the 5-year review in 2008, habitat loss and alteration resulting 5 from military activities was thought to have been considerably lessened with implementation of completed or draft Integrated Natural Resources Management Plans (INRMPs) and monitoring programs at Fort Hunter Liggett and Camp Roberts”* These named places are military bases, which explains why there are known locations referenced by the California Natural Diversity Database but these are not reflected in the iNaturalist observations. Even though these observations are research grade they are produced via citizen science and volunteer organizations that would likely not have direct access to military bases, which may be the reason for the difference.
 - **Nacimiento River North/South** – Referenced in FWS maps from the recovery plan.
 - **Los Padres National Forest** – *“Camatta Canyon amole is known from four occurrences in the La Panza Range and adjacent hills in central San Luis Obispo County (Kofron et al. 2021, p. 26). The Camatta Canyon amole has a known distribution of approximately 36*

hectares (90 acres) (Figure 3), but is expected to occupy more land on nearby private property.”

1. Carissa Highway
 2. Camatta Creek
 3. La Panza
- iNaturalist: 75 research grade observations

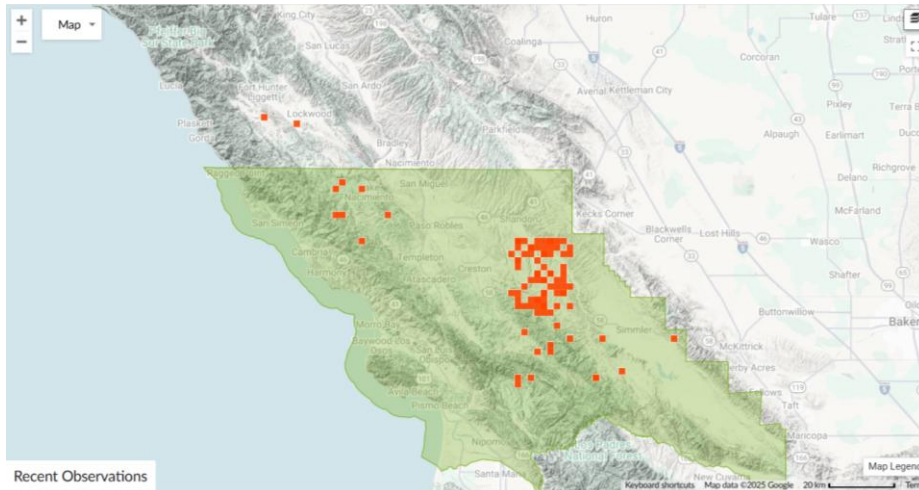


Figure A1-3. Occurrence data of Camatta Canyon from iNaturalist (67 research grade observations; <https://www.inaturalist.org/taxa/1362971-Hooveria-purpurea>; accessed April 29, 2025).

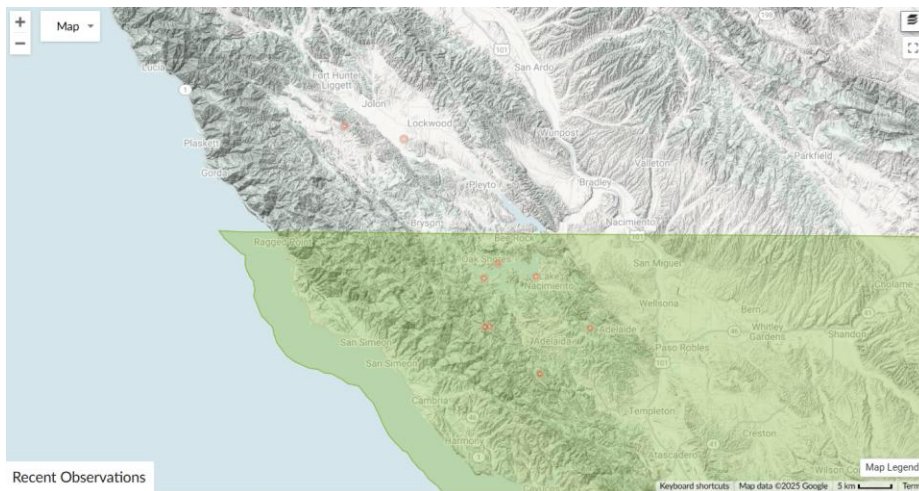


Figure A1-4. Occurrence data of Santa Lucia Purple Amole (8 research grade observations; https://www.inaturalist.org/observations?subview=map&taxon_id=1362972; accessed April 29, 2025).

- Global Biodiversity Information Facility (GBIF) (15 georeferenced records) https://www.gbif.org/occurrence/map?q=Hooveria%20purpurea&taxon_key=2772632&occurrence_status=present
GBIF element occurrences were consistent with the other occurrence data given the scale and resolution of the data.

- NatureServe Data (https://explorer.natureserve.org/pro/Map/?taxonUniqueid=ELEMENT_GLOBAL.2.129360; accessed April 29, 2025).

Publicly available NatureServe element occurrences were consistent with the other occurrence data and core map given the scale and resolution of the data.

9. Identify core map type

- The core map is based on biological information because
 - The critical habitat is outdated for the species
 - The range is too widespread, potentially including habitats not required by the species.
 - Known location data are robust and are consistent across sources.

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

EPA developed the interim core map by combining the species named locations and iNaturalist research grade observations with the species range, then identifying areas within that combined range and known location layer that satisfied the species habitat requirements. GBIF and NatureServe data were considered and visually compared to the range and other location data, but not used to refine the interim core map since they were consistent with the data obtained from iNaturalist and the Consortium of California Herbaria.

1. References and Software

- FWS Species Range: <https://ecos.fws.gov/ecp/species/5531#rangeInfo>
- FWS Species Critical Habitat: <https://ecos.fws.gov/ecp/species/5531#crithab>
- iNaturalist: <https://www.inaturalist.org/taxa/1362971-Hooveria-purpurea> and https://www.inaturalist.org/observations?subview=map&taxon_id=1362972
- Consortium of California Herbaria: www.cch2.org/portal/collections/map/index.php?gridSizeSetting=60&minClusterSetting=10&clusterSwitch=y&taxa=Chlorogalum%20purpureum&usethe=1&taxontype=2&reclimit=15000
- PAD-US Protection Status by GAP Status Code layer ([PAD-US Protection Status by GAP Status Code - Overview \(arcgis.com\)](#))
- ESRI Living Atlas – National Land Cover Database (NLCD): <https://www.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f>
- USGS Landfire: https://lfps.usgs.gov/arcgis/rest/services/Landfire_LF230/US_230EVT/ImageServer
- Purple Amole (*Hooveria purpurea* | *Chlorogalum pupureum*) Recovery Plan (2022) ([https://ecos.fws.gov/docs/recovery_plan/Purple%20Amole%20Recovery%20Plan_FINAL\(1\).pdf](https://ecos.fws.gov/docs/recovery_plan/Purple%20Amole%20Recovery%20Plan_FINAL(1).pdf))
- Software used: ArcGIS Pro version 3.3

2. Datasets used in Core Map Development

Setting the outer extent of the core map

The named locations in the 2022 Recovery Plan combined with iNaturalist observations and the species range were used to set the outer extent of the core map, especially since there were hotspots of known locations outside of the range in multiple places. First, areas adjacent to highway 58 north of the Los Padres National Forest boundary. Second, areas south/southeast of the town of Shandon California.

2.1 Download the Range, Critical Habitat, and Known Locations:

The range and critical habitat were added to the map in ArcGIS Pro by directly downloading the files from the ECOS database. Next, known locations were downloaded and added to the map. There were two sets of known locations in iNaturalist – for the Santa Lucia canyon purple amole and the camata canyon. However, the known locations for the Santa Lucia populations were sparse with limited positional accuracy. Points plotted from the coordinate data were buffered by the positional accuracy using the ArcGIS Pro “Buffer” tool to assess if the points showing up outside of the species range may fall within the species range. If not, then the known locations outside of the range would be merged and dissolved (using those respective ArcGIS Pro tools) with nearby suitable habitat also outside of the range and plotted as part of the core map. While there were more observations for the camatta canyon populations – many of the research grade observations were outside of the ECOS Species Range (**Figure A2-1**).

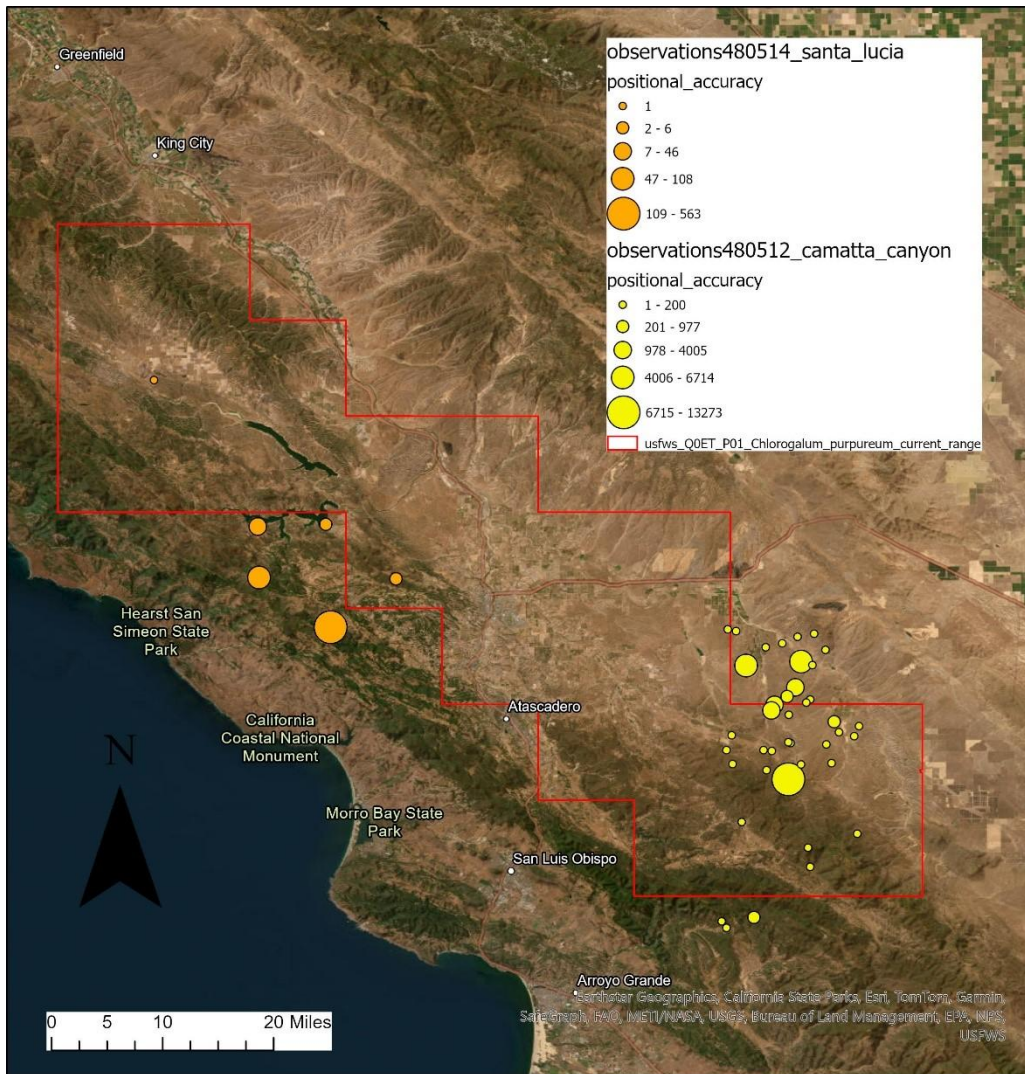


Figure A2-1. iNaturalist research-grade observations from the last 15 years plotted for the purple amole, with points buffered to reflect the positional accuracy.

b. Additional observations were downloaded from the source referenced by the FWS in their recovery plan (**Figure A2-1**). The Consortium of California Herbaria is the organization that supports all herbaria in California. In 2003, the Consortium initially included only herbaria in the University of California system. It now includes records from 48 California institutions. Herbaria in California are encouraged to apply for membership. Herbaria located outside California are occasionally accepted as members as well. Data providers need to meet this set of minimum requirements. Current members of CCH are listed at ucjeps.berkeley.edu/consortium/participants.html. These observations are derived from California vascular plant specimens housed in herbaria. They are not as recent as the iNaturalist observations, however they add important historical context for the range of the species and to identify typical habitat and relevant protected areas.

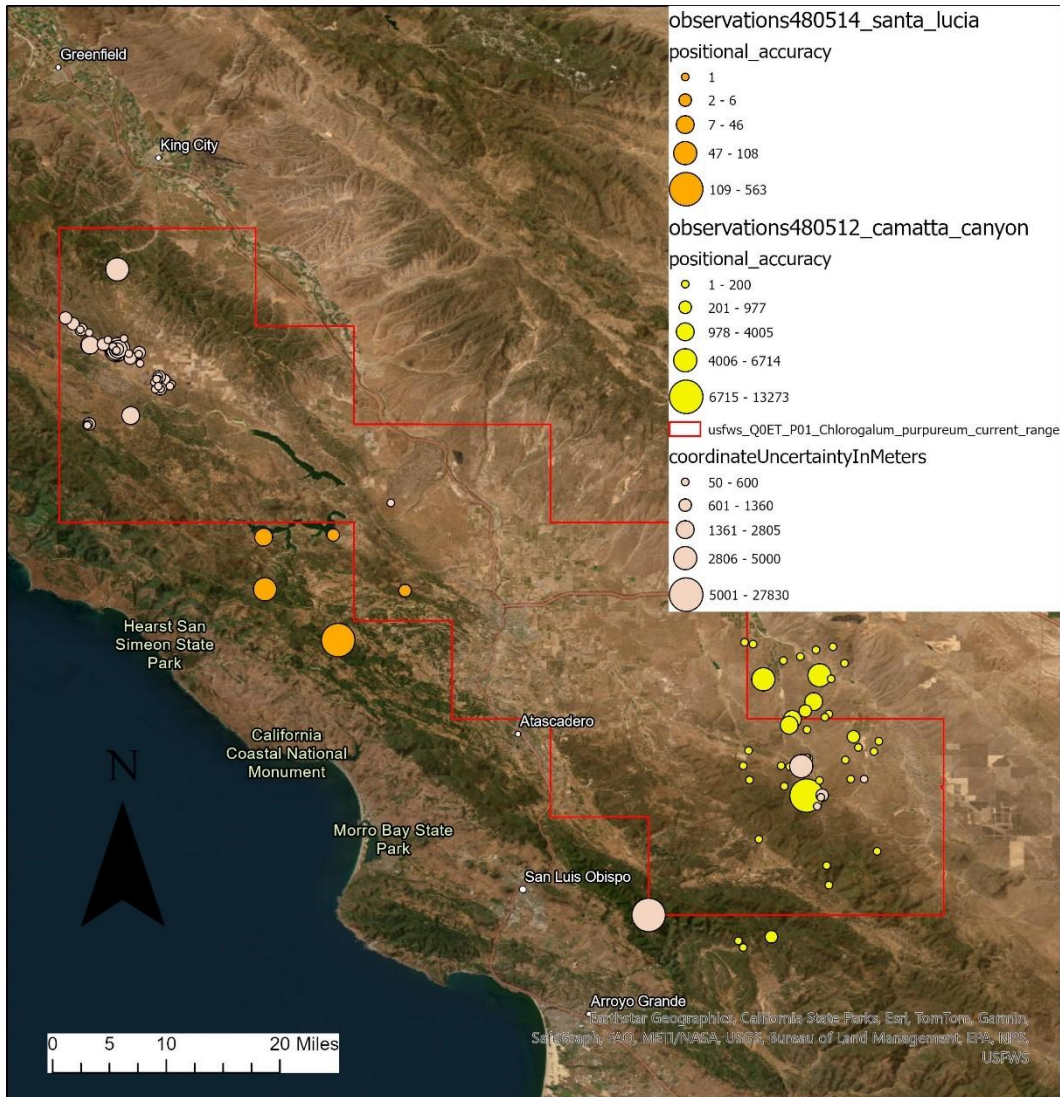


Figure A2-2. Consortium of California Herbaria points plotted in addition to iNaturalist, with the points buffered by the coordinate uncertainty.

2.2 Plot the named areas listed in the final recovery plan.

Named locations from the recovery plan were located using a “Select by Attributes” AcrGIS Pro query of the Protected Area Database US (PADUS) and were a mix of DoD, BLM, National Forest, and local government land (**Figure A2-3**). Fort Hunter Liggett was clipped using the ArcGIS Pro “Pairwise Clip” tool to the FWS provided ECOS Range based on the descriptions of the FWS recovery plan in which the populations of the purple amole were concentrated in southwestern Monterey County. Similarly, Camp Robert was limited to the extent of the FWS ECOS range using the “Pairwise Clip” tool. The populations within the areas of the Nacimiento River were less well-defined in the recovery plan. The Nacimiento River Recreation area covered some of the known locations (within the margin of their positional accuracy) and similar habitat as the other known location sites.

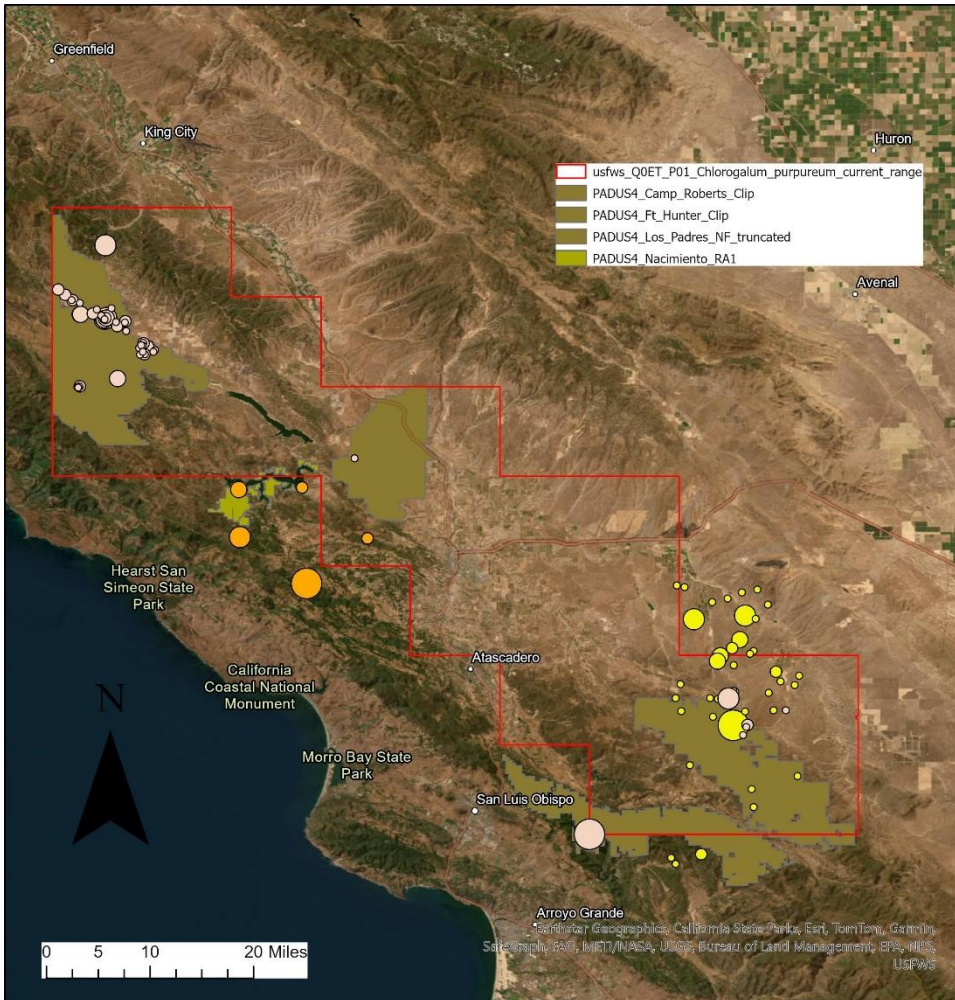


Figure A2-3. Named locations from the recovery plan plotted as polygons using the Protected Area Database (US), compared against other known location data that were points buffered by positional accuracy. The recovery plan locations overlapped many of the iNaturalist and Consortium of California Herbaria points.

The populations for the Carmatta canyon populations were located using the highways depicted in the FWS recovery plan maps as well as the PADUS areas for the Los Padres National Forest and the La Panza Roadless Area. This area was found by georeferencing the intersection of Red Hill Road and the Carissa Highway (Figure A2-4).

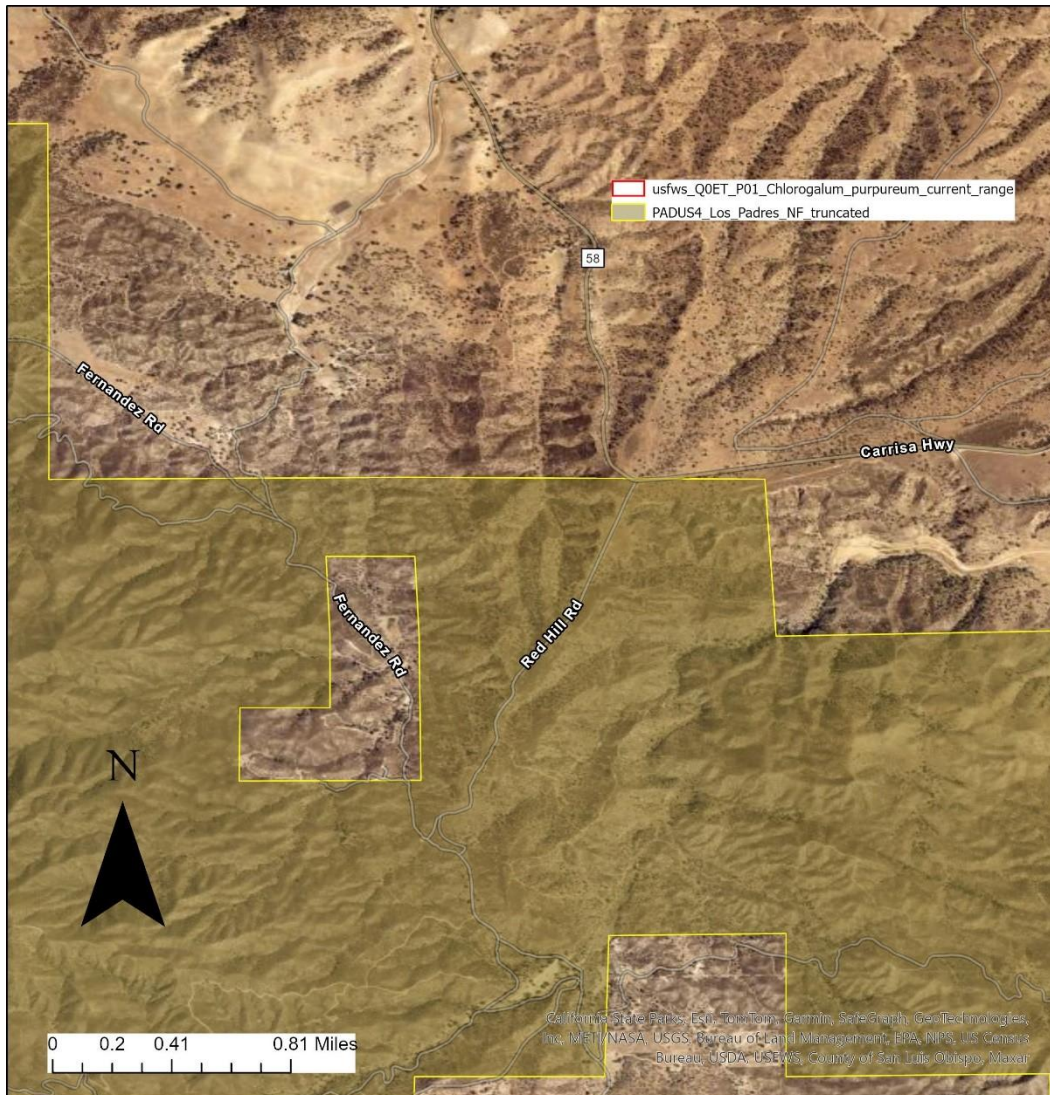


Figure A2-4. Carmatta canyon populations, georeferenced using PADUS and static maps found in FWS recovery plan.

The Los Padres National Forest stretches across southern CA and would have been an overestimation of the range based on the descriptions of the Carmatta canyon populations in the FWS recovery plan. Instead, the areas that were described in the recovery plan and that intersected with known locations were used for this segment.

2.4. Incorporate suitable habitat for the species into the refinement

The recovery plan stated that there were likely additional populations of purple amole north of the Los Padres National Forest. Significant habitat types were identified by querying the Landfire database (detailed steps described below), which involved filtering by the habitat locations on habitat descriptions for the purple amole in FWS documentation (including the 2002 document designating critical habitat and the 2022 recovery plan). The habitats included: California Central Valley Mixed Oak Savanna, California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna, Mediterranean California Mesic Serpentine Woodland and Chaparral, Southern California Dry-Mesic Chaparral,

Southern California Coastal Scrub, and California Central Valley and Southern Coastal Grassland. These habitats were in areas adjacent to highway 58 north of the Los Padres National Forest boundary and in areas outside of the ECOS range boundary south / southeast of the town of Shandon CA.

The iNaturalist dataset had known observations of purple amole in these same regions. Therefore, it made sense to expand the habitat beyond the extent of the FWS range to include suitable habitats and known locations.

The detailed GIS steps to incorporate the suitable habitat are as follows:

- 1) Added the Landfire dataset to the map and limited it to the extent of the iNaturalist known locations outside of the range by using the “Export Raster” tool as shown in **Figure A2-5** (prior to using the “Export Raster” tool, manually drew boxes in ArcGIS Pro around the known location data outside of the range and used the “Merge” and “Dissolve” tools on these boxes to combine them into one layer to use for the extent). This was done to speed up the processing time of the geoprocessing tools applied in subsequent steps.

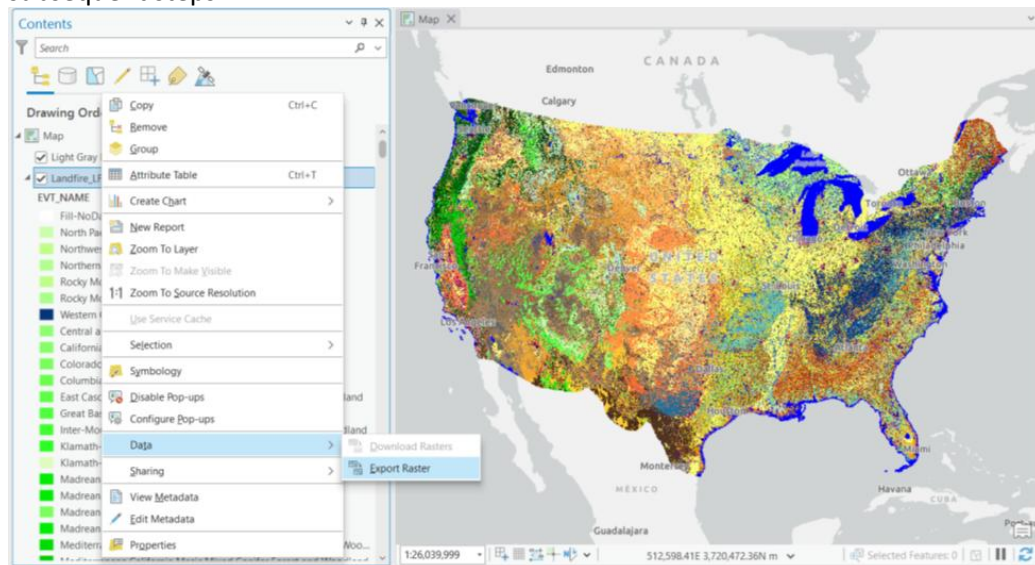


Figure A2-5. Screen shot showing how “Export Raster” tool was accessed to limit the Landfire raster dataset to the extent of the known locations outside of the range, necessary to speed up processing time.

- 2) Converted the isolated section of the Landfire dataset from raster to vector format by applying the following:

Raster to Polygon (tool):

- Input raster: *Landfire_LF230\US_230EVT*
- Field: *EVT_Name*
- Simplify polygons: yes
- Multipart features: no
- Output: *Landfire_polygon*

- 3) Within the new vector dataset, used the “Select by Attribute” function to select the suitable Landfire classes within the attribute table for the purple amole, as follows:

Select by Attribute:

- Input rows: *Landfire_polygon*
 - Selection type: *New Selection*
 - Expression to include areas of suitable habitat for the purple amole:
EVT_Name is equal to...OR: California Central Valley Mixed Oak Savanna, California Lower Montane Blue Oak-Foothill Pine Woodland and Savanna, Mediterranean California Mesic Serpentine Woodland and Chaparral, Southern California Dry-Mesic Chaparral, Southern California Coastal Scrub, and California Central Valley and Southern Coastal Grassland.
 - Output: *CoreMap_habitat*
- 4) Applied the tool “Pairwise Intersection” to combine the known location data and habitat together. This meant points were removed if they did not overlap areas of suitable habitat. The points that were removed because they existed in spaces of unsuitable habitat were examined more closely to confirm that they were less recent than the suitable habitat data from Landfire.
- 5) Confirmed that the critical habitat (**Figure A2-6**) is coincident with the habitat and known location areas produced in the previous step. It sat on top of those areas, adding no additional information. The “Merge” and “Dissolve” tools were applied to the known locations and habitat that had been identified inside and outside of the range. These tools were applied again between that output and the critical habitat, which caused the critical habitat to disappear into the habitat and known location layer. This layer was used as the species core map, which is shown as Figure 1 in the main document.

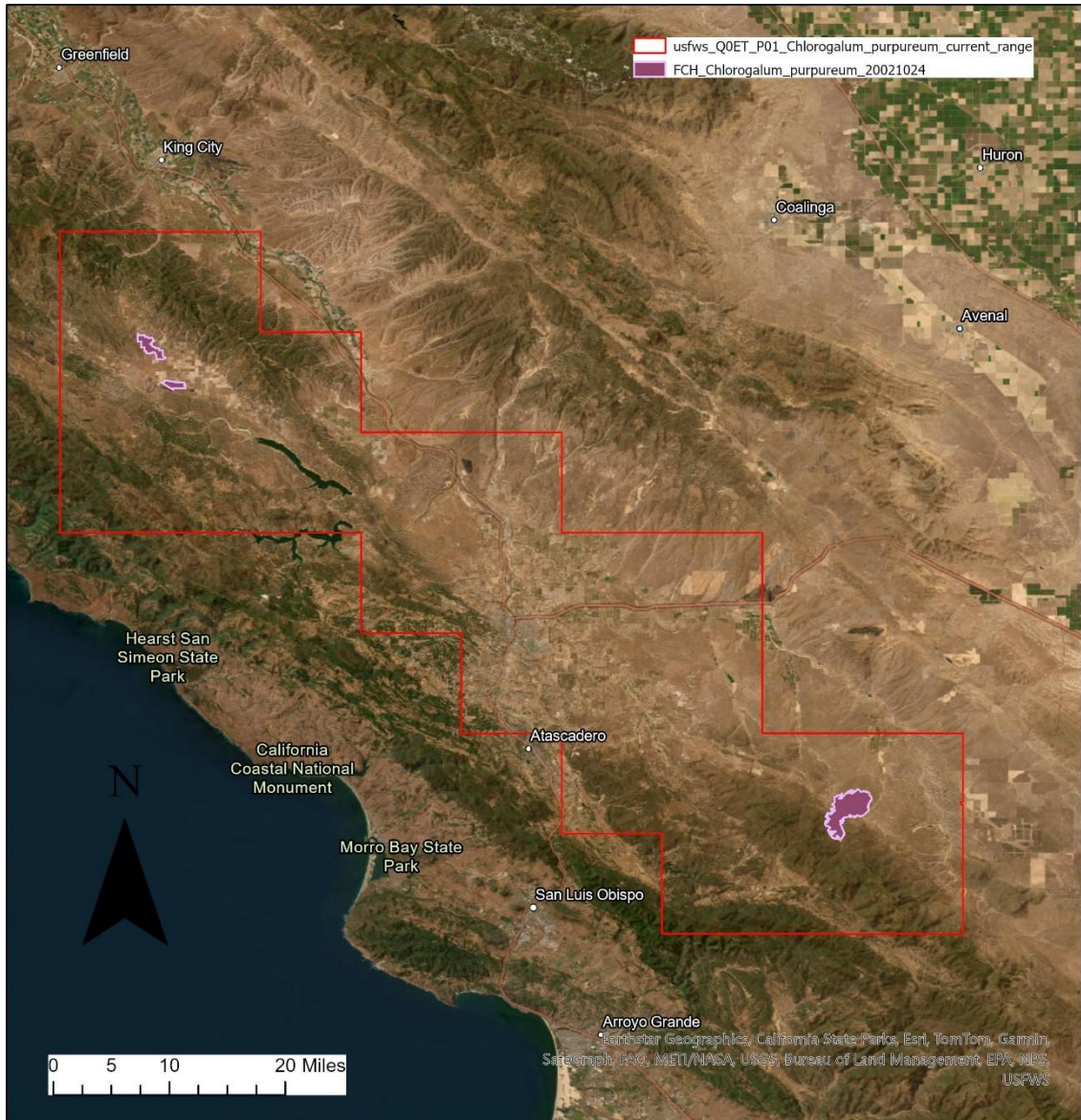


Figure A2-6. The critical habitat data (which is older than 15 years) was considered during the core map refinement to see if it might add additional areas to possibly include in the core map, but when the “Merge” and “Dissolve” tools were applied, it ended up disappearing within the boundaries of the area where known locations and suitable habitats were combined together (so, the known locations and suitable habitats combined formed the core map, which is depicted in Figure 1 of the main document).