

Core Map Documentation for the Vernal Pool Tadpole Shrimp

Date Uploaded to EPA's GeoPlatform: July 2025

Draft Interim Core Map Developer: Center for Biological Diversity

Species Summary

Vernal pool tadpole shrimp are freshwater crustaceans found in California. As of 2024 there are 329 recorded occurrences of the vernal pool tadpole shrimp spread across 11 distinct regions. Vernal pool tadpole shrimp inhabit a wide variety of vernal pools and other ephemeral wetlands in California's Central Valley and surrounding areas. They spend most of their life as eggs or cysts in the dry sediment at the bottom of the vernal pools. They emerge and become active during wet periods when their vernal pools become inundated and feed mostly on detritus or other small animals in the pool. Their vernal pools historically existed throughout the Central Valley and in surrounding areas, but most have been lost to agricultural development and disruptions to natural flooding in the Valley and elsewhere. Vernal pool tadpole shrimp are vulnerable to pesticides that runoff from agricultural fields and urban areas.

EPA Review Notes

The developers created this core map using EPA's process available at: <https://www.epa.gov/endangered-species/process-epa-uses-develop-core-maps-pesticide-use-limitation-areas>. EPA reviewed the draft interim map and documentation and evaluated if: (1) the map and documentation are consistent with the agency's process; (2) areas included or excluded from the interim core map are consistent with the biology, habitat, and/or recovery needs of the species; (3) data sources are documented and appropriate; and (4) the GIS data and mapping process are consistent with the stated intention of the developer. EPA agrees that this map is a reasonable depiction of core areas for this species and was consistent with the agency's mapping process. This documentation was not prepared by EPA, but EPA may have edited this documentation for clarity or other purposes.

The core map developed for this species is considered interim and can be used to develop pesticide use limitation areas (PULAs). 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 core map does not replace or revise any range or designated critical habitat developed by FWS.

Description of Core Map

The core map is biological information type based on a combination of critical habitat and suitable habitat for the species. Known locations were used to ensure areas of suitable habitat were included in the core map, but were not added independently. There are 11 geographically isolated areas that are considered occupied with a total of 329 presumed extant occurrences (see **Figure A1-4**). This species relies on vernal pools in California that have a distribution that is reasonably well understood and mapped. The combination of critical habitat and generalized locations of vernal pools that are considered occupied by the vernal pool tadpole shrimp constitute the basis for the core map.

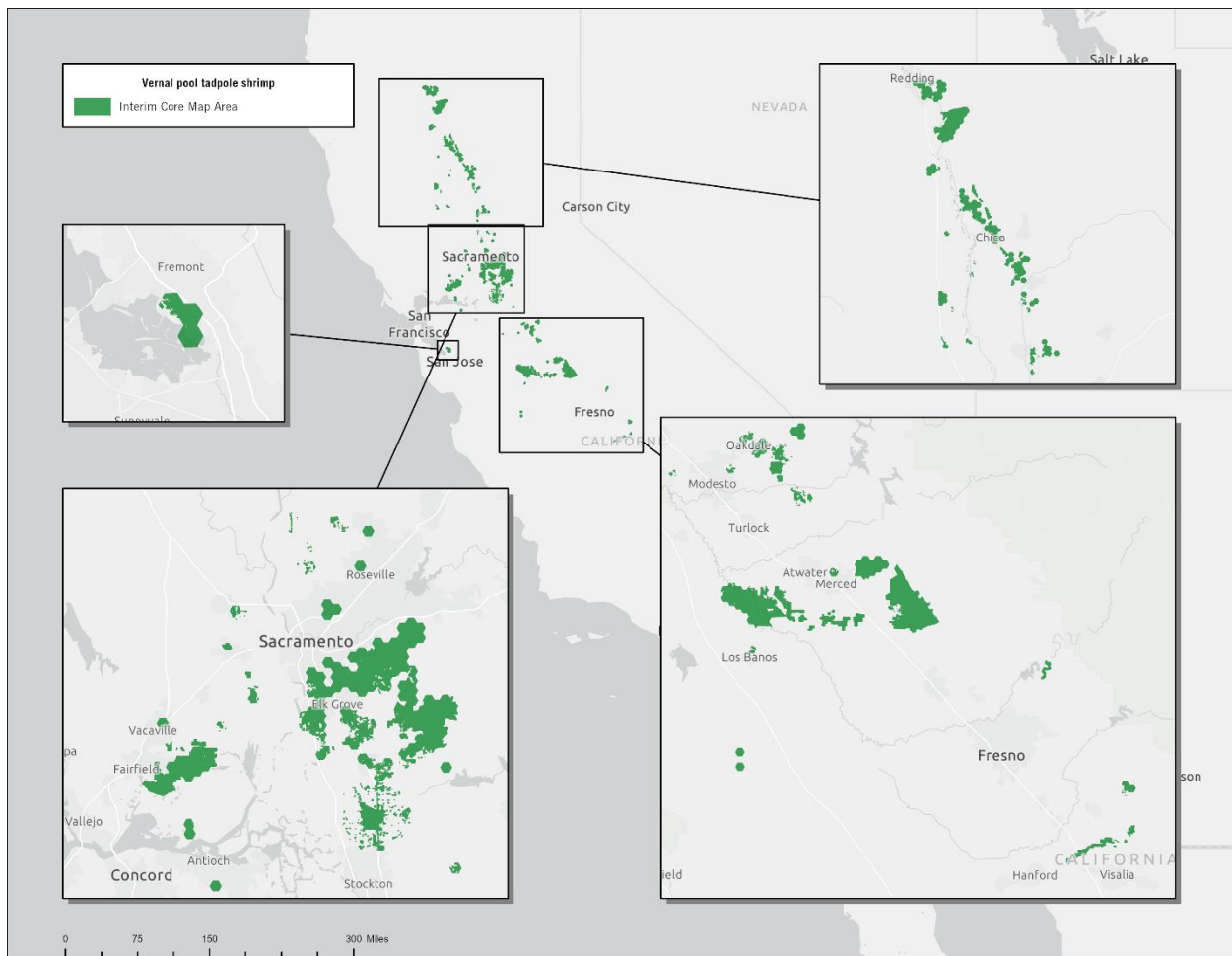


Figure 1. Vernal pool tadpole shrimp interim core map.

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 Landcover (Value)	% Area	% area for landcover type
Forestry	Deciduous Forest (41)	0	0
Forestry	Evergreen Forest (42)	0	0
Forestry	Mixed Forest (43)	0	0
Agriculture	Pasture/Hay (81)	.3	10.1
Agriculture	Cultivated Crops (82)	9.8	10.1
Mosquito adulticide, residential	Open space, developed (21)	4.3	17.9
Mosquito adulticide, residential	Developed, Low intensity (22)	4.9	17.9
Mosquito adulticide, residential	Developed, Medium intensity (23)	7.2	17.9
Mosquito adulticide, residential	Developed, High intensity (24)	1.5	17.9
Invasive species control	Woody Wetlands (90)	.4	71.9
Invasive species control	Emergent Herbaceous Wetlands (95)	8.5	71.9
Invasive species control	Open water (11)	.8	71.9

Example pesticide use sites/types	NLCD Landcover (Value)	% Area	% area for landcover type
Invasive species control	Grassland/herbaceous (71)	61	71.9
Invasive species control	Scrub/shrub (52)	.4	71.9
Invasive species control	Barren land (rock/sand/clay; 31)	.8	71.9
Total Acres	Interim Core Map Acres	572,398	

Evaluation of Known Location Information

Three sources of known location information were evaluated.

- General occurrence information and survey results presented in the FWS 2024 5-year review
Comment: FWS (2024) presents a table summary of the number of presumed extant occurrences and a map of those occurrences (**Figure A1-4**). The occupied areas are not identified by name because there are too many occurrences to name in the species review. The review presents location information as points (**Figure A1-4**). This location information presents the most up to date data on the species and is much more refined than the ECOS range map for the species.
- California Department of Fish and Wildlife (CDFW) vernal pools geodatabase
Comment: Vernal pools are an Area of Conservation Emphasis for the CDFW and have received special attention that has resulted in a statewide geodatabase¹ of the known locations of vernal pools that can be filtered for the presence of the vernal pool fairy shrimp. The geodatabase presents hexagonal regions with occupied vernal pool(s) located somewhere within the hexagonal area. This dataset was produced and verified by the CDFW and presents a reliable source of location information for the vernal pool fairy shrimp.
- California Natural Diversity Database (CNDDDB)
Comment: The CNDDDB presents 336 records for the vernal pool tadpole shrimp dated from 1966 to 2023. Of these, 100 could be considered recent (newer than 2010). This dataset presents spatial information for occupied pools at various spatial scales. This dataset contains presumably all of the locations that were described in the FWS (2024). This source of information is referenced in FWS documents and is considered very reliable.

¹ <https://gis.data.ca.gov/search?q=vernal%20pool>

Approach Used to Create Core Map

The core map for the vernal pool tadpole shrimp was based on critical habitat and occupied hexagonal areas identified by the CDFW in their vernal pool geodatabase.

Critical habitat areas are all considered currently occupied and were added to the core map.

The core map was further expanded to include hexagonal areas from the CDFW vernal pool data layer.

The vernal pool data layer was filtered to only include hexagonal areas with current known locations based on a query of the CNDDDB. If a hexagonal area had an occurrence of the vernal pool tadpole shrimp then the entire hexagonal area was included.

Using the EPA's cultivated lands layer, we then removed areas that were considered cultivated. Neither the Recovery Plan nor the 5-year review indicate that the vernal pool tadpole shrimp can survive in cultivated fields once they are established (FWS, 2005; FWS, 2024).

Considering the available location information includes critical habitat and other occupied areas of varying precisions we judge the uncertainty score of this core map to be 3 (average). Substantial additional areas were added to the core map outside of the critical habitat to expand the core map.

Locations of occupied pools was available through the CDFW's vernal pool geodatabase, but with limited precision. No habitat modeling was required.

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

Range Map Approach for Core Map:

A core map based on the species range was rejected because the ECOS range map is overly broad and contains large areas of unoccupied habitat. The 2024 5-year review shows that the extant range does not include any areas of northern California north of Redding and a much smaller area of the Central Valley.

Critical Habitat Approach for Core Map:

A core map based on critical habitat was rejected because, of the known populations, only a subset is within the designated critical habitat.

Habitat Modeling Approach for Core Map:

A core map based on modeled habitat was rejected because sufficient location information was available to describe the known locations. The 2024 5-year review notes that a predictive habitat model was created for the vernal pool tadpole shrimp in 2013, but only included a subset of extant counties. This modeling is insufficient and outdated to be used as the basis for a core map.

Other sources of information reviewed but not included:

Location information from the CNDDDB was evaluated, but these locations were not used solely as the basis for the core map. The CNDDDB data include presumably all the occurrences assessed in the 2024 5-year review. The CNDDDB data was used as a filter step to select occupied hexagonal

areas within the vernal pool data layer. The vernal pool dataset was judged to be of adequate resolution to form the basis of the core map.

References

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, 2024. *Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Conservancy Fairy Shrimp 5-Year Review: Summary and Evaluation*. Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service.

Vollmar, J. E. 2002. *Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grasslands*: Vollmar Consulting.

Appendix 1. Information Compiled for the Vernal Pool Tadpole Shrimp

1. Recent FWS documents

FWS. 2005. Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon. Available from: https://ecos.fws.gov/docs/recovery_plan/Vernal%20Pool%20Ecosystem%20Final%20Recovery%20Plan.pdf.

FWS. 2024. Vernal Pool Fairy Shrimp (*Branchinecta lynchi*) Vernal Pool Tadpole Shrimp (*Lepidurus packardii*) Conservancy Fairy Shrimp (*Branchinecta conservatio*) 5-Year Review: Summary and Evaluation. Available from: https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/13113.pdf

2. Background information

Status: *ENDANGERED*

Resiliency, redundancy, and representation (the 3Rs):

FWS has not formally assessed resiliency, redundancy, or representation in the 2005 Recovery Plan or 2024 5-year review (FWS, 2005; FWS, 2024).

Habitat, Life History, and Ecology

Habitat:

The vernal pool tadpole shrimp lives in ephemeral, freshwater wetlands often called vernal pools. Vernal pools and other ephemeral wetlands vary depending on topology, soil type, and climate. Vernal pool fairy shrimp can inhabit pools that range in size from 2 to 356,253 square meters. The exact habitat requirements of the species are not known (FWS, 2005). Vernal pool habitats are part of complex, ephemeral drainage systems that develop and change during times of heavy precipitation in the winter and spring. Upland habitat also plays an important role in the ecological function of the pools. The vernal pools are dynamic and harsh ecosystems with highly variable amounts of water followed by drying and long periods of desiccation. The vernal pool fairy shrimp is adapted to this harsh environment by being active and reproduces when water levels are high and lay eggs, or cysts, that remain dormant in the soil at the bottom of the pool or wetland until wet conditions return (FWS, 2005).

Diet:

When active, their diet consists mostly of detritus, but they will opportunistically consume algae, bacteria, protozoa, rotifers, aquatic earthworms, aquatic insects, other fairy shrimp, frog eggs, and tadpoles (Vollmar, 2002).

Taxonomy:

The vernal pool tadpole shrimp (*Lepidurus packardii*) is classified as a crustacean in the Triopsidae family (Order:Notostraca). Recent genetic analysis confirmed *L. parckardi* as a valid species (FWS, 2005).

Kingdom	Animalia – Animal, animaux, animals
Subkingdom	Bilateria – triploblasts
Infrakingdom	Protostomia
Superphylum	Ecdysozoa
Phylum	Arthropoda – artrópode, arthropods, arthropods
Subphylum	Crustacea Brunnich, 1772 – curtacés, crustáceo, crustaceans
Superclass	Altocrustacea
Class	Branchiopoda Latreille, 1817 – branchiopods, branchiopodes
Order	Notostraca G. O. Sars, 1867 – tadpole shrimp
Family	Triopsidae Keilhack, 1909
Genus	Lepidurus Leach, 1819
Species	<i>Lepidurus packardii</i> Simon, 1886 – vernal pool tadpole shrimp

Figure A1-1. Taxonomy from ITIS.

Relevant Pesticide Use Sites:

Agricultural fields
Urban/residential areas

Relevant Recover Criteria and Actions:

Objective:

FWS (2005) states that the overall goals of this recovery plan are to:

- Achieve and protect in perpetuity self-sustaining populations of each species.
- Delist the 20 federally listed plant and animal species.
- Ensure the long-term conservation of the 13 species of special concern.

Interim goals of this recovery plan are to:

- Stabilize and protect populations to prevent further decline of each species.
- Conduct research necessary to refine reclassification and recovery criteria.
- Reclassify to threatened status those species listed as endangered

The overall objectives of this recovery plan are to:

- Ameliorate or eliminate the threats that caused the species to be listed as federally endangered or threatened, and to ameliorate any newly identified threats, to be able to delist or downlist these species.
- Ameliorate or eliminate the threats that affect the species of concern and ameliorate any newly identified threats to conserve these species.
- Confirm the status of *Plagiobothrys hystriculus*, a species of concern that is currently presumed extinct. If extant populations are discovered, the ultimate goal would be to ensure the long-term conservation of this species.
- Promote natural ecosystem processes and functions by protecting and conserving intact vernal pools and vernal pool complexes.

Criteria:

FWS (2024) states that the recovery criteria for the three shrimp species are as follows:

1. Habitat protection: Accomplish habitat protection that promotes vernal pool ecosystem function sufficient to contribute to population viability of the covered species.

1A. Suitable vernal pool habitats within each prioritized core area for the species is protected. Downlisting criteria 1A.

1B. Species occurrences distributed across the species geographic and genetic range are protected. Protection of extreme edges of populations protects the genetic differences that occur there.

1C. This is a general criteria for reintroductions and introductions that must be carried out and meet success criteria. However, for downlisting the longhorn fairy shrimp, no reintroductions or introductions are described. Reintroductions and introductions are described for delisting the species.

1D. Additional occurrences (i.e., localities) identified through future site assessments, GIS and other analyses, and status surveys that are determined essential to recovery are permanently protected.

1E. Habitat protection results in protection of hydrology essential to vernal pool ecosystem function, and monitoring indicates that hydrology that contributes to population viability has been maintained through at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of five years of post-drought monitoring.

2. Adaptive habitat management and monitoring:

2A. Habitat management and monitoring plans that facilitate maintenance of vernal pool ecosystem function and population viability have been developed and implemented for all habitat protected in 1A–E above.

2B. Mechanisms are in place to provide for management in perpetuity and long-term monitoring of 1A–E above (i.e., funding, personnel, etc.).

2C. Monitoring indicates that ecosystem function has been maintained in the areas protected under 1A–D for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of five years of post-drought monitoring.

3. Status surveys:

3A. Status surveys, 5-year status reviews, and population monitoring show populations within each vernal pool region where the species occur are viable (e.g., evidence of reproduction and recruitment) and have been maintained (stable or increasing) for at least one multi-year period that includes above average, average, and below average local rainfall, a multi-year drought, and a minimum of five years of post-drought monitoring.

3B. Status surveys, status reviews, and habitat monitoring show that threats identified during and since the listing process have been ameliorated or eliminated. Site-specific threats identified through standardized site assessments and habitat management planning also must be ameliorated or eliminated.

4. Research:

4A. Research actions necessary for recovery and conservation have been identified (these are research actions that have not been specifically identified in the recovery actions but for which a process to develop them has been identified). Research actions (both specifically identified in the recovery actions and determined through the process) on species biology and ecology, habitat management and restoration, and methods to eliminate or ameliorate threats that have been completed and incorporated into habitat protection, habitat management and monitoring, and species monitoring plans, and refinement of recovery criteria and actions.

4B. Research on genetic structure has been completed for reintroduction and introduction efforts and results incorporated into habitat protection plans to ensure that within and among population genetic variation is fully represented by populations in 1A–E above.

4C. Research necessary to determine appropriate parameters to measure population viability for each species have been completed.

5. Participation and outreach:

5A. Recovery Implementation Team is established and functioning to oversee rangewide recovery efforts.

5B. Vernal pool regional working groups are established and functioning to oversee regional recovery efforts.

5C. Participation plans for each vernal pool region have been completed and implemented.

5D. Vernal pool region working groups have developed and implemented outreach and incentive programs that develop partnerships contributing to achieving recovery criteria 1–4.

Recovery Actions:

A variety of recovery actions have taken place since the species' listing in 1994 and cannot be described adequately here. An accounting of recovery actions and progress toward recovery criteria can be found in the FWS (2024).

Recommendations for Future Actions:

1. FWS (2024) lists the following recommendations: Conduct large-scale mapping studies outside of the Central Valley to catalog all vernal pool complexes that were present in 2005 and how much still exists today.
2. Create a comprehensive database of all protected lands outside of the Central Valley and update the Central Valley database with newly protected lands since 2017.
3. Establish a Recovery Implementation Team and regional Vernal Pool Working Groups.
4. Assess how many occurrences of each species are still extant and how many are sufficiently protected to contribute to recovery criterion 1B.
5. Conduct genetics studies for the Conservancy fairy shrimp to assess the rangewide phylogeography of all known populations of the species.
6. Establish monitoring and management protocols on all protected lands to collect data that are necessary to assess if vernal pool hydrology, ecosystem function, and population viability of the three shrimp species are being maintained in perpetuity. Research may be needed to determine what data is needed to assess population viability for the three shrimp species.

3. Description of Species Range:

The vernal pool tadpole shrimp historically inhabited vernal pools, also known as playas, and other ephemeral wetlands throughout California's Central Valley and north in the Klamath River watershed of northern California.



Figure A1-2. FWS range for the vernal pool tadpole shrimp from last updated on March 19, 2018.

4. Critical Habitat:

FWS designated critical habitat for the species in 2006.

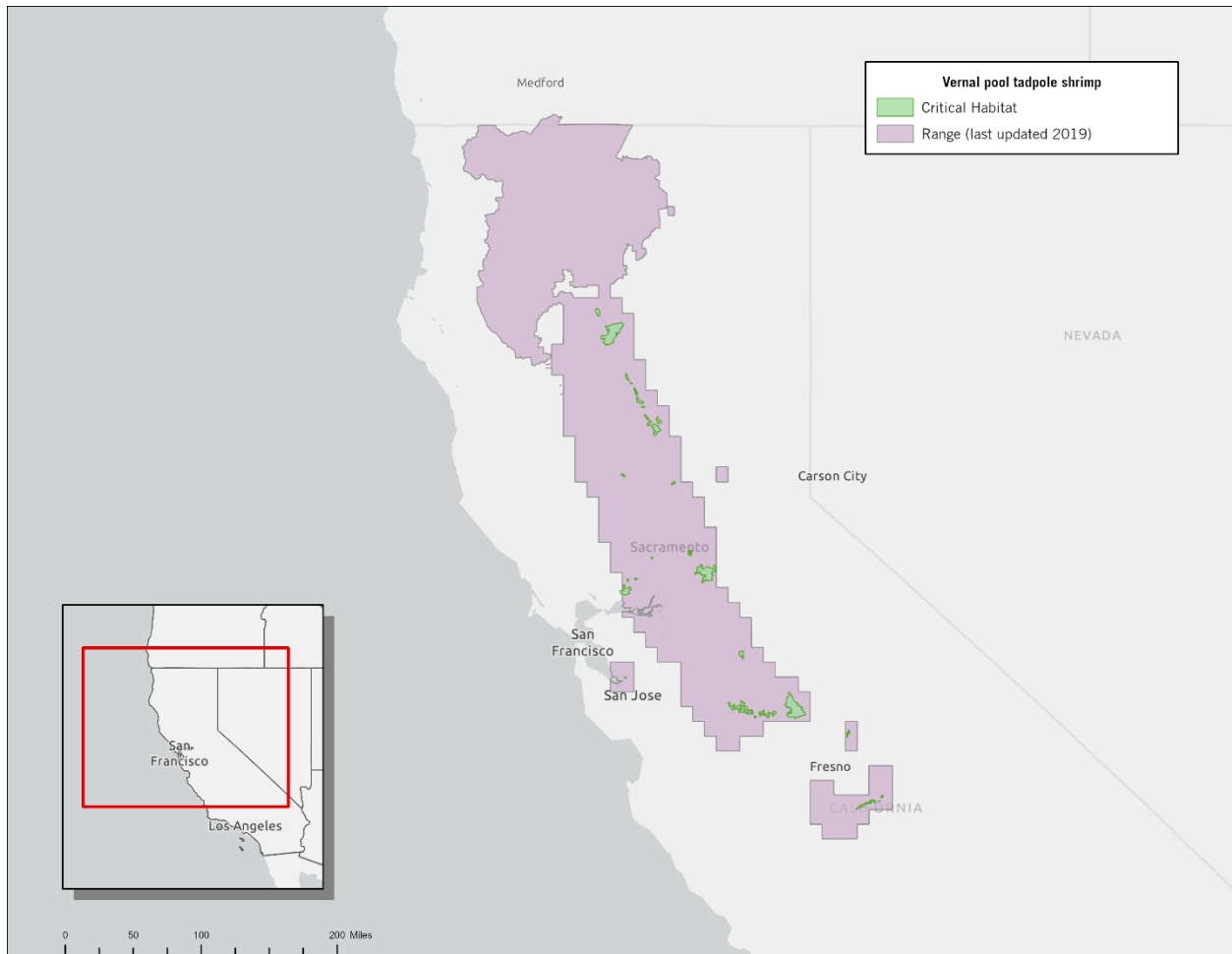


Figure A1-3. Critical Habitat for the vernal pool tadpole shrimp. The total acreage of the critical habitat is approximately 228,785 acres.

5. Known Locations

FWS (2024) indicates that based on CNDDDB data there are 329 total occurrences across 11 distinct vernal pool regions. FWS provide only general information regarding the locations of these occurrences beyond what is depicted in **Figure 3** from the 2024 5-year review {FWS, 2024 #436}. **Figure A1-4** represents the best available source of location for the species because it incorporates multiples sources of data and is more comprehensive than CNDDDB and has been verified by the FWS. CBD did not search iNaturalist, GBIF, and NatureServe because the data available from CNDDDB was very robust, as were the occurrence data provided by FWS.

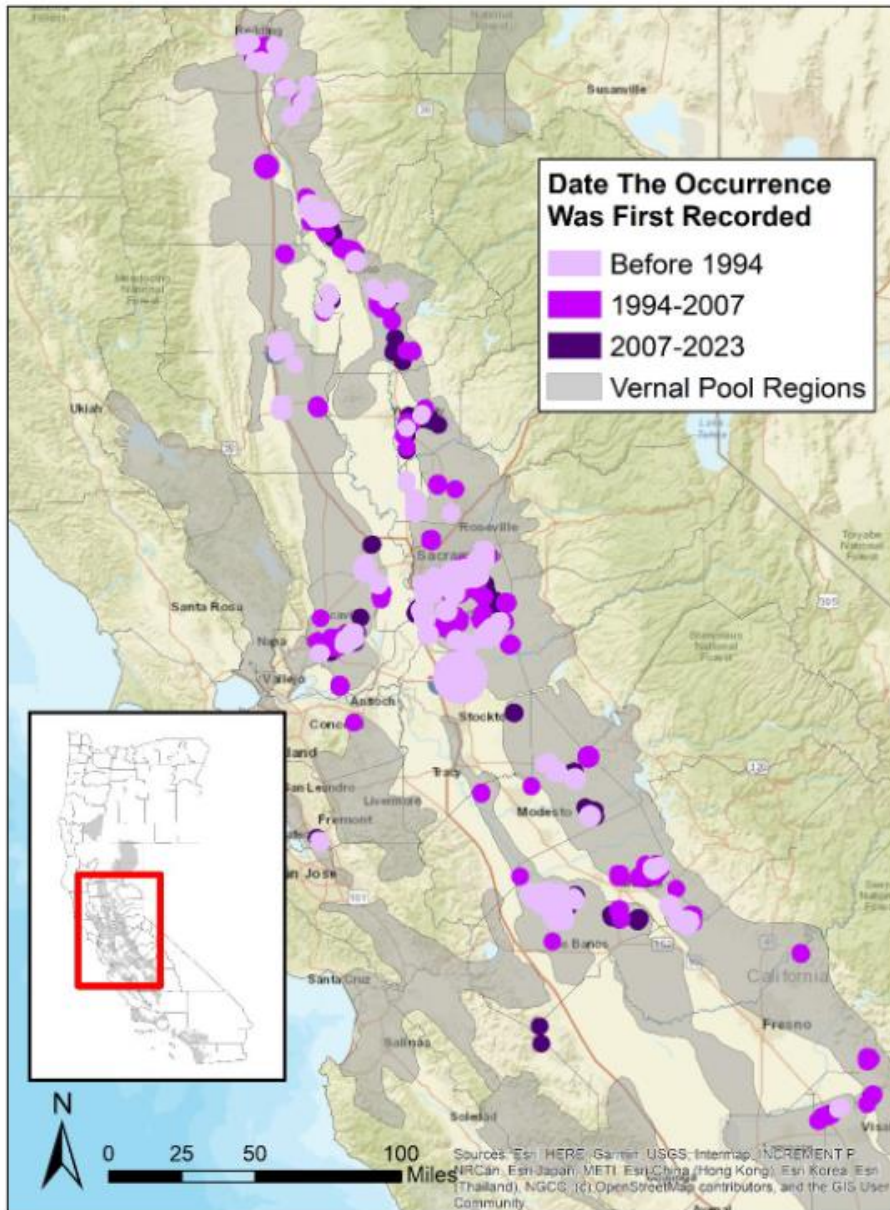


Figure A1-4. Vernal pool fairy shrimp occurrences in California as presented in Figure 3 from the 2024 5-year review.

As of March 2025, the CNDDDB has 336 records for the vernal pool tadpole shrimp dated from 1966 to 2023. Of these, 100 could be considered recent (newer than 2010). CNDDDB data has some precise species locations presented as polygons or points that appear to be nearly the same as the data used to create the map in **Figure A1-4**.

Appendix 2. GIS Data and Method to Develop Core Map

The core map type for this species is based on known locations from the California Natural Diversity Database (CNDDDB) and the critical habitat for this species.

CBD developed the interim core map by refining the species critical habitat based on where vernal pools with known occurrences of the vernal pool tadpole shrimp occur. Any CNDDDB polygons not already covered by either the critical habitat, yet spatially coincident vernal pool hexagons were added to core map. Some CNDDDB polygons that extend outside the critical habitat polygon less than 100 meters were not included in the core map, as these areas will be covered by the PULA for vernal pools. Any CNDDDB polygons that extend greater than 100 meters from a vernal pool was used in the core map.

The Cultivated Layer was used to remove any areas within the core map that are cultivated agriculture. The map was then buffered and smoothed using EPA's QA/QC process.

This section details the data and steps used to create the core map for the vernal pool tadpole shrimp based on this biological information.

1. References and Software

- World UTM Grid:
https://services.arcgis.com/P3ePLMYs2RVChkXj/arcgis/rest/services/World_UTM_Grid/FeatureServer
- Modified Cultivated Layer (Downloaded Jan. 27, 2025)
<https://cdn.arcgis.com/home/item.html?id=159e70ce4c284f5b972c687037f8a668>
- BIOS California Natural Diversity Database (CNDDDB) Government [ds45]
cnddb.shp
- BIOS Vernal Pools - ACE [ds2732]
ds2732.shp
- FWS Species critical habitat:
https://ecos.fws.gov/docs/crithab/zip/FCH_Lepidurus_packardi_20060210.zip
- FWS Species range:
https://ecos.fws.gov/docs/species/shapefiles/usfws_K048_I01_Lepidurus_packardi_current_range.zip
- Software used: ArcGIS Pro version 3.2

2. Datasets Used in Core Map Development

2.1. Create copy of template EPA polygon and project USFWS Critical Habitat shapefile

- a. In ArcPro, create a copy of the template EPA polygon shapefile for Vernal Pool Fairy Shrimp, named "Vernal_Pool_Fairy_Shrimp_Poly" (core map shapefile).
- b. Select all the records from the "FCH_Lepidurus_packardi_20060210" (Critical Habitat) shapefile. Copy and paste them into the newly created "Vernal_Pool_Fairy_Shrimp_Poly" shapefile from step 1. **(Figure A2-1)**

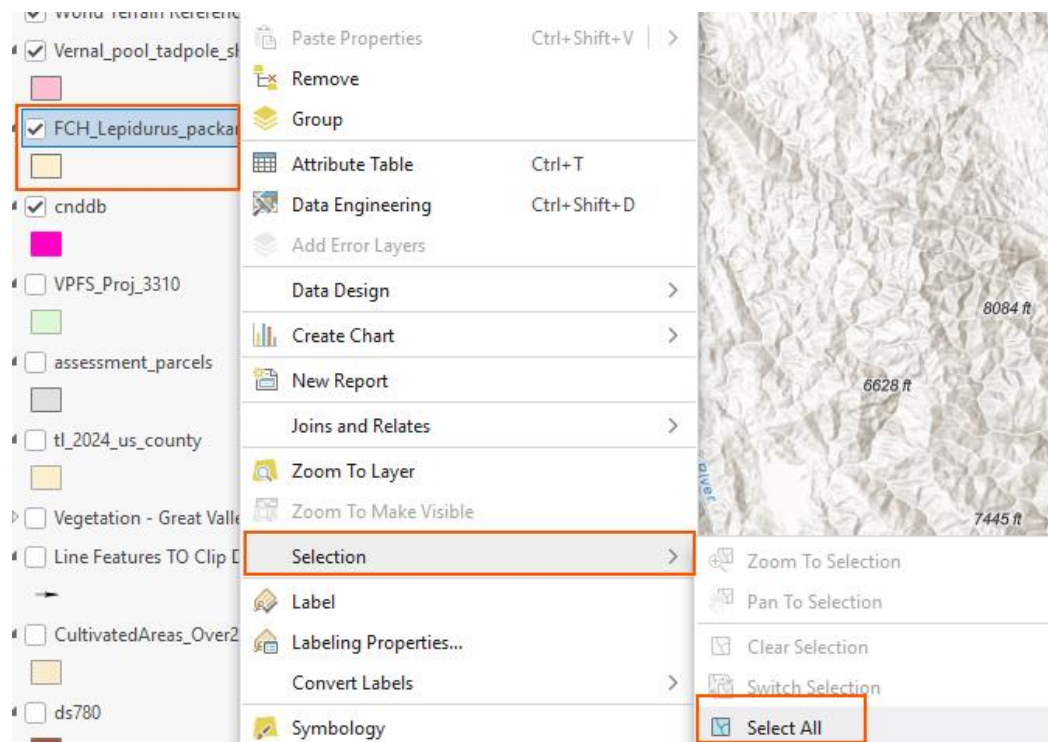


Figure A2-1. Screenshot of steps to select all records in a shapefile

- c. Set the definition query in the BIOS California Natural Diversity Database (CNDDDB) Government [ds45] shapefile where "SNAME" = "Lepidurus packardi". This filter will show only polygons for vernal pool tadpole shrimp and can be used to identify known locations. **(Figure A2-2)**

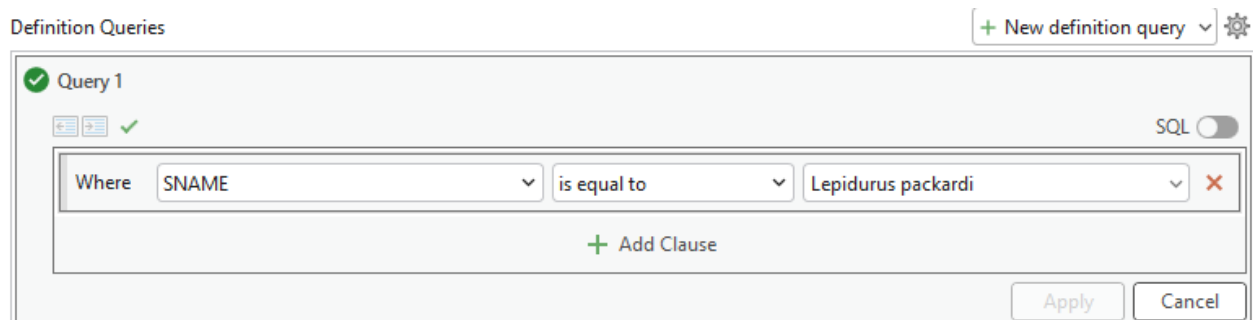


Figure A2-2. Screenshot of definition query

- d. A definition query was assigned in the BIOS Vernal Pools - ACE [ds2732] shapefile to show only hexagons that are assigned to contain a vernal pool. **(Figure A2-3)**

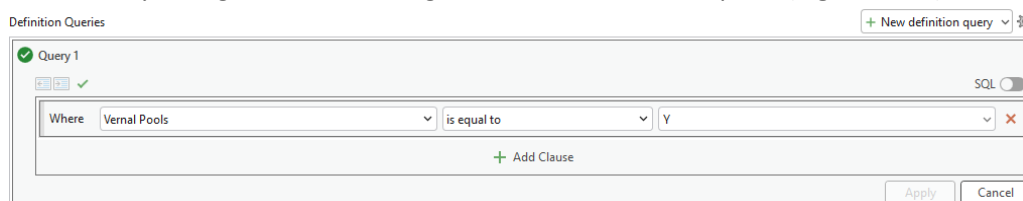


Figure A2-3. Screenshot of definition query

- e. Pan and zoomed to remaining delta CNDDDB polygons (CNDDDB polygons minus any areas where they do not intersect with vernal pools). Because there are sources that indicate presence and suitable habitat for the vernal pool tadpole shrimp, the vernal pools were copied and pasted into the core map shapefile.
- f. For CNDDDB polygons that were partially inside and outside critical habitat, the “Measure” tool was used to determine how far the polygon existed outside these areas. If the measurement was 100 meters or greater and a vernal pool existed in the area, then that vernal pool was added to the core map. If it was less than 100 meters, the core map was left as is.
- g. To confirm that all CNDDDB polygons intersects with the core map, use the “Select by Location” tool, with CNDDDB as the input feature, “Intersect” as the relationship, “Vernal_pool_tadpole_Poly” and the selecting feature, search distance is blank, and the “Invert Spatial Relationship” box is checked. If no CNDDDB polygons are selected, then all CNDDDB polygons have a “Vernal_pool_tadpole_Poly” that covers it. One CNDDDB polygon was selected. The observation was in 2006, and the note says no eggs masses observed. The imagery doesn’t show a vernal pool. **(Figure A2-4) (Figure A2-5)**

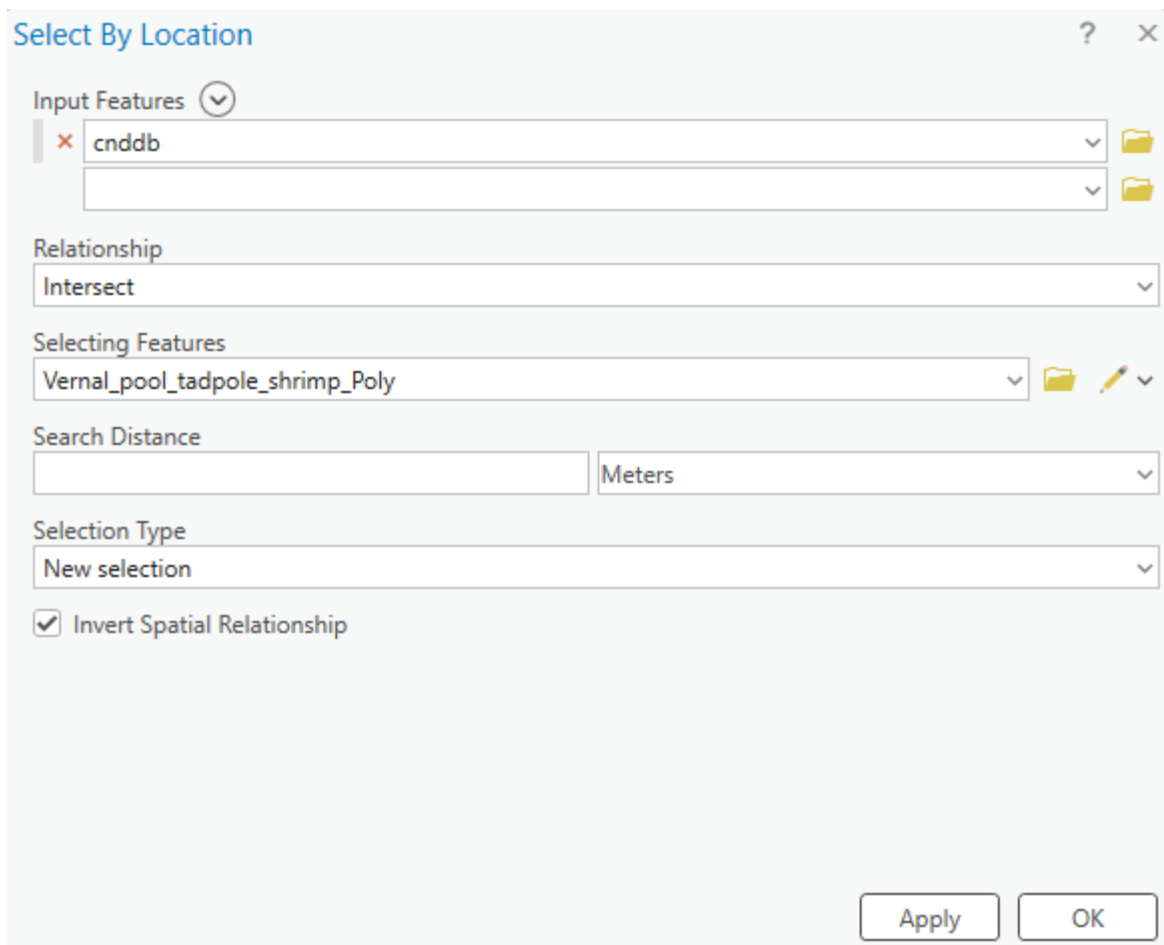


Figure A2-4. Screenshot of “Select by Location” tool

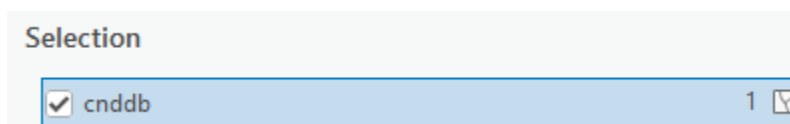


Figure A2-5. Screenshot of Result and “Select by Location tool is applied

2.2. Use EPA’s “CultivatedAreas_Over25acres” to “Pairwise Erase” Conservancy_fairy_shrimp_Poly

- a. When testing “Pairwise Erase” process to refine the core map boundaries, it showed that a unit in the critical habitat was significantly erased. So, to ensure that this does not happen, a definition query on “Vernal_pool_tadpole_shrimp_Poly” was used to exclude them. “Description” does not begin with “Vernal pool tadpole shrimp critical habitat”. (Figure A2-6)

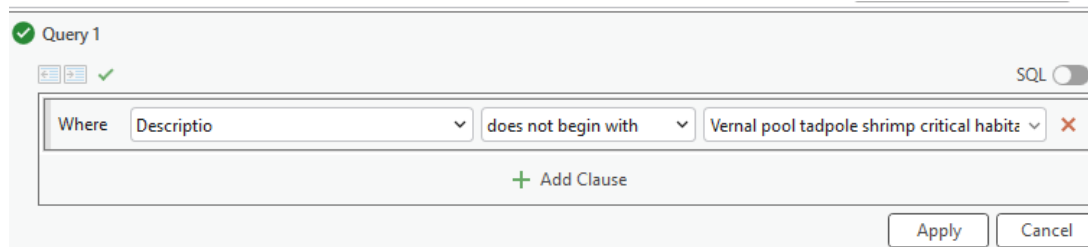


Figure A2-6. Screenshot of Definition Query

- b. As an effort to refine the core map boundaries, use “Pairwise Erase” to erase the core map “Vernal_pool_tadpole_shrimp_Poly” by “CultivatedAreas_Over25acres”. The resulting layer is named, “Vernal_pool_tadpole_shrimp_NoCultLand”. **(Figure A2-7)**

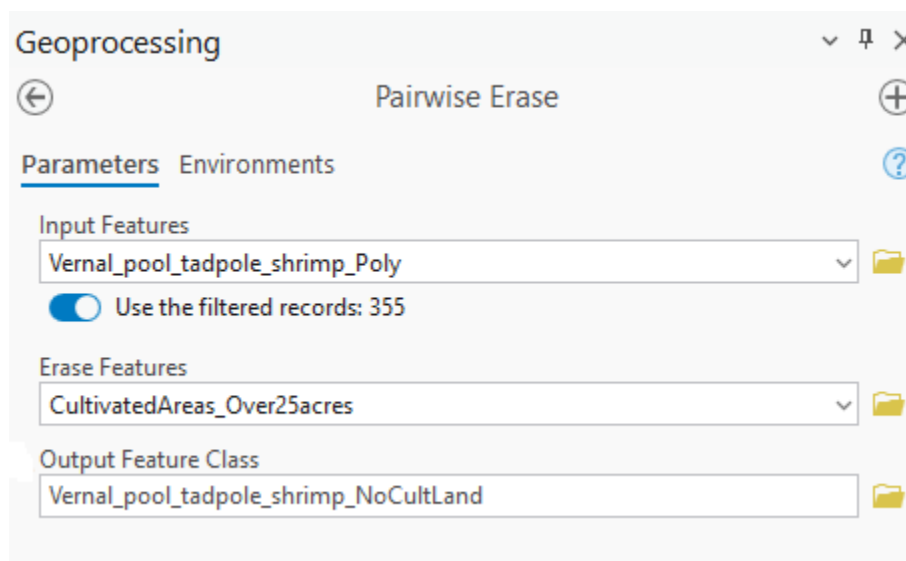


Figure A2-7. Screenshot of “Pairwise Erase” tool

- c. A new definition query was set in the “Vernal_pool_tadpole_shrimp”. “Descriptio” begins with “Vernal pool tadpole shrimp critical habitat”. **(Figure A2-8)** Select all the “Vernal_pool_tadpole_shrimp” records, copy and paste them into “Vernal_pool_tadpole_shrimp_NoCultLand”.

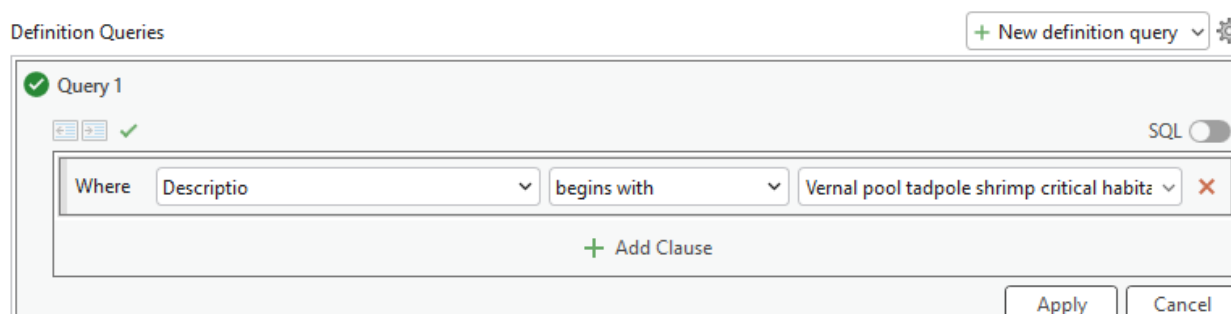


Figure A2-8. Screenshot of Definition Query

- d. Use the “Select by Location” tool with the “Invert Spatial Relationship” to check to see if any CNDDDB polygons were now not covered after the “Pairwise Erase” tool. The result is fourteen CNDDDB polygons were selected. **(Figure A2-9) (Figure A2-10)**

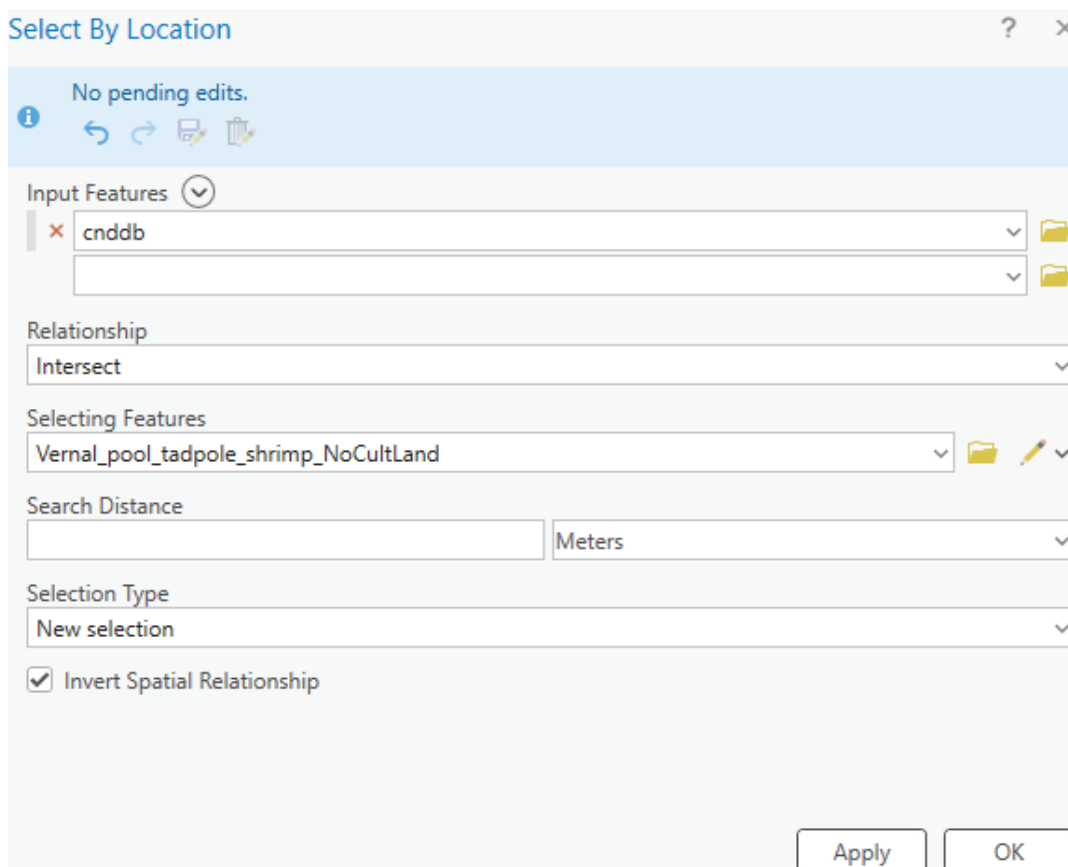


Figure A2-9. Screenshot of “Select by Location” tool

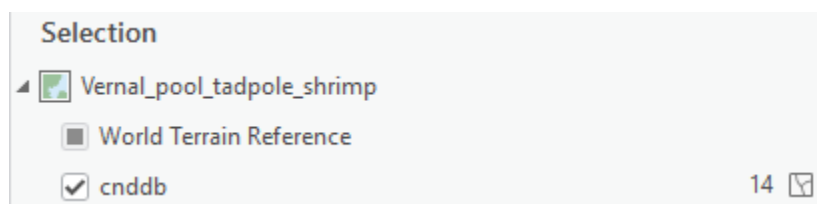


Figure A2-10. Screenshot of Results from “Select by Location” tool

2.3. Use EPA’s QA/QC process to remove small, disconnected patches less than 2 acres

- a. Buffer “Vernal_pool_tadpole_shrimp_NoCultLand” by 1,000 US survey feet, with the option “Dissolve all output features into a single feature” choice. The output feature class is named, “Vernal_pool_tadpole_shrimp_NoCultLand_Buffer”. **(Figure A2-11)**

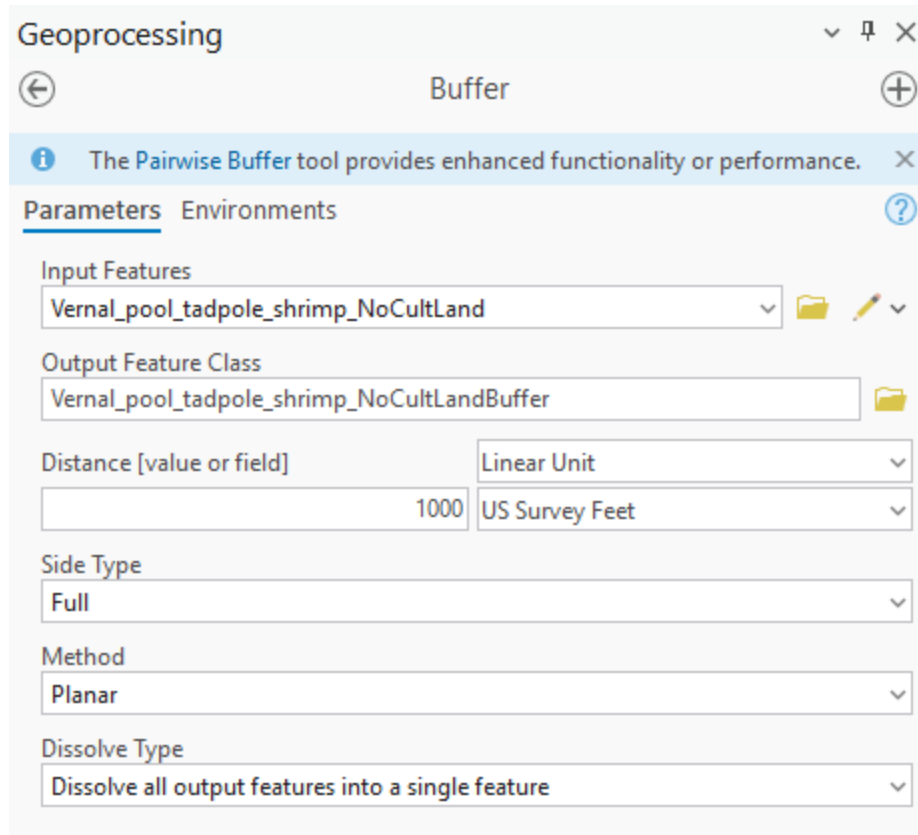


Figure A211. Screenshot of “Buffer” tool

- b. Use the “Eliminate Polygon Part” tool to eliminate polygon parts that are less than 2 acres and more than 1,000 feet away from another polygon. The resulting output is named, “Vernal_pool_tadpole_shrimp_No2Acre”. (Figure A2-12)

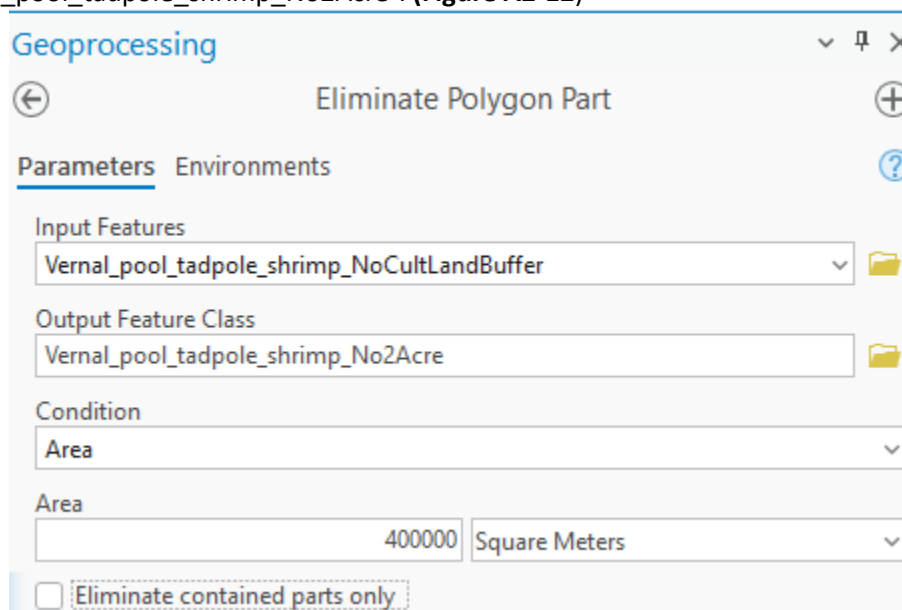


Figure A2-12. Screenshot of “Eliminate Polygon Part” tool

- c. Use “Pairwise Clip” tool to remove any polygon parts that are less than 2 acres and more than 1,000 feet away from another polygon. The resulting output is named, “Vernal_pool_tadpole_shrimp_Clip”. **(Figure A2-13)**

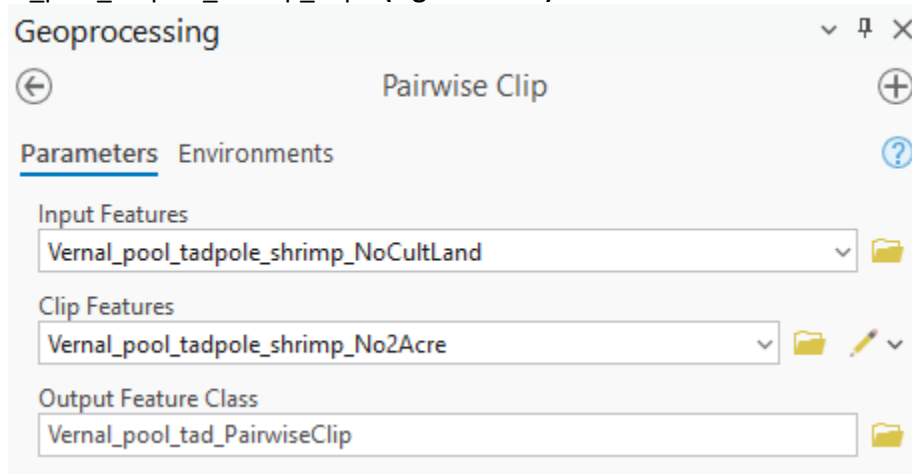


Figure A2-13. Screenshot of “Pairwise Clip” tool

2.4. Use EPA’s QA/QC process to “smooth” by filling gaps or holes and update attributes

- i. Use the “Dissolve” tool to merge polygons from “Vernal_pool_tadpole_shrimp_Clip” into one polygon. The resulting output is named, “Vernal_pool_tadpole_shrimp_Dissolve” **(Figure A2-14)**

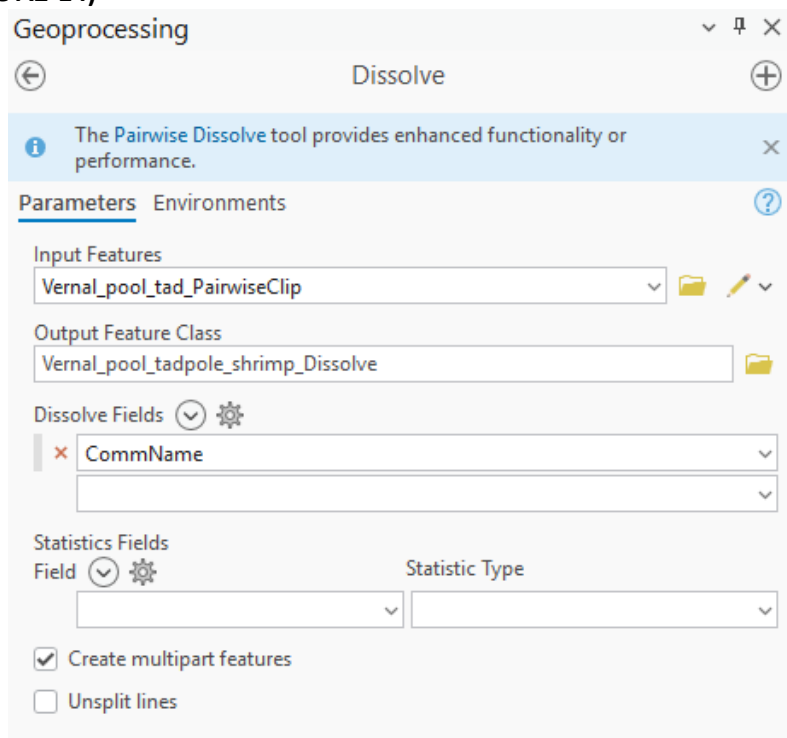


Figure A2-14. Screenshot of “Dissolve” tool

- ii. Use the “Eliminate Polygon Part” tool to fill in gaps and holes less than 25 acres. Resulting output is named, “Vernal_pool_tadpole_shrimp_Smooth”. **(Figure A2-15)**

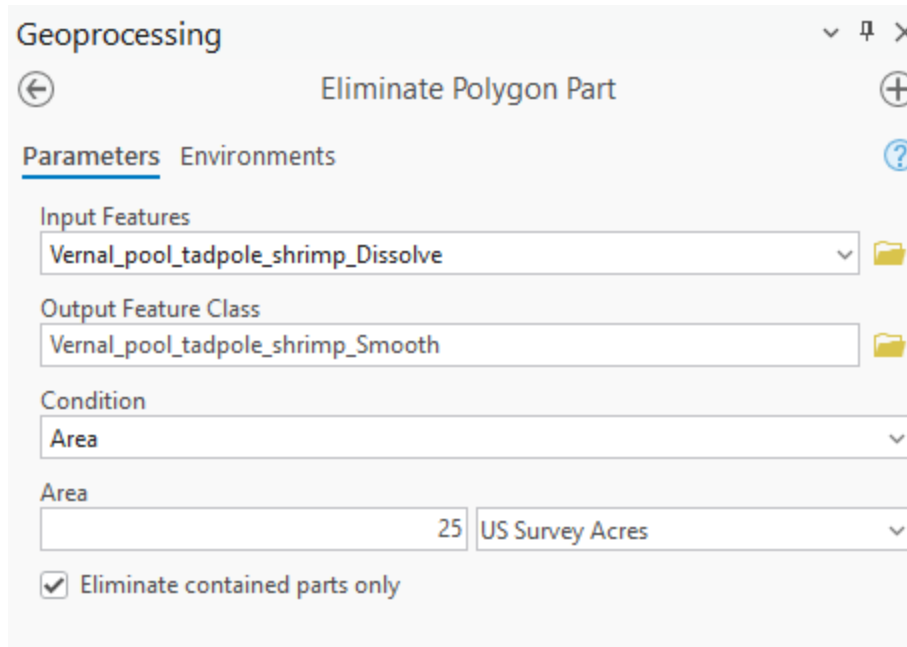


Figure A2-15. Screenshot of “Eliminate Polygon Part” tool

2.5. Update Attributes and “Calculate Geometry”

- Create a copy of the template EPA polygon shapefile for Vernal pool tadpole shrimp, named “Vernal_pool_tadpole_shrimp_Poly_Final” (core map shapefile). Copy and paste from “Vernal_pool_tadpole_shrimp_Smooth” to “Vernal_pool_tadpole_shrimp_Poly_Final”.
 - Since there is only one record in “Conservancy fairy shrimp”, update each field manually with:
 - CommName = " Vernal pool tadpole shrimp"
 - SciName = “Lepidurus packardi”
 - Description = “Area of USFWS Vernal pool tadpole shrimp (VPTS) critical habitat and CDFW Vernal pool hexagons overlapping CNDDDB occurrences outside of critical habitat. All clipped by EPA Cultivated Land.”
 - Category = “Area of occupancy”
 - EPA_Code = “494”
 - FWS_Code = " K048”
 - CBD_Code = " 9813”
 - Heritage = “0”
 - ECOS_WebPg = <https://ecos.fws.gov/ecp/species/2246>
 - Turned on the “World UTM Grid” layer and identified the UTM zone as “10”. Right-clicked on the “Acres” fieldàleft-clicked on “CalculateGeometry”. “Calculate Geometry” dialog box appears. Selected “Area” under “Property”, “US Survey Acres” in “Area Unit” and “NAD_1983_UTM_Zone_10N” in the Coordinate System” boxes. Click Apply. Click OK.
- (Figure A2-16)**

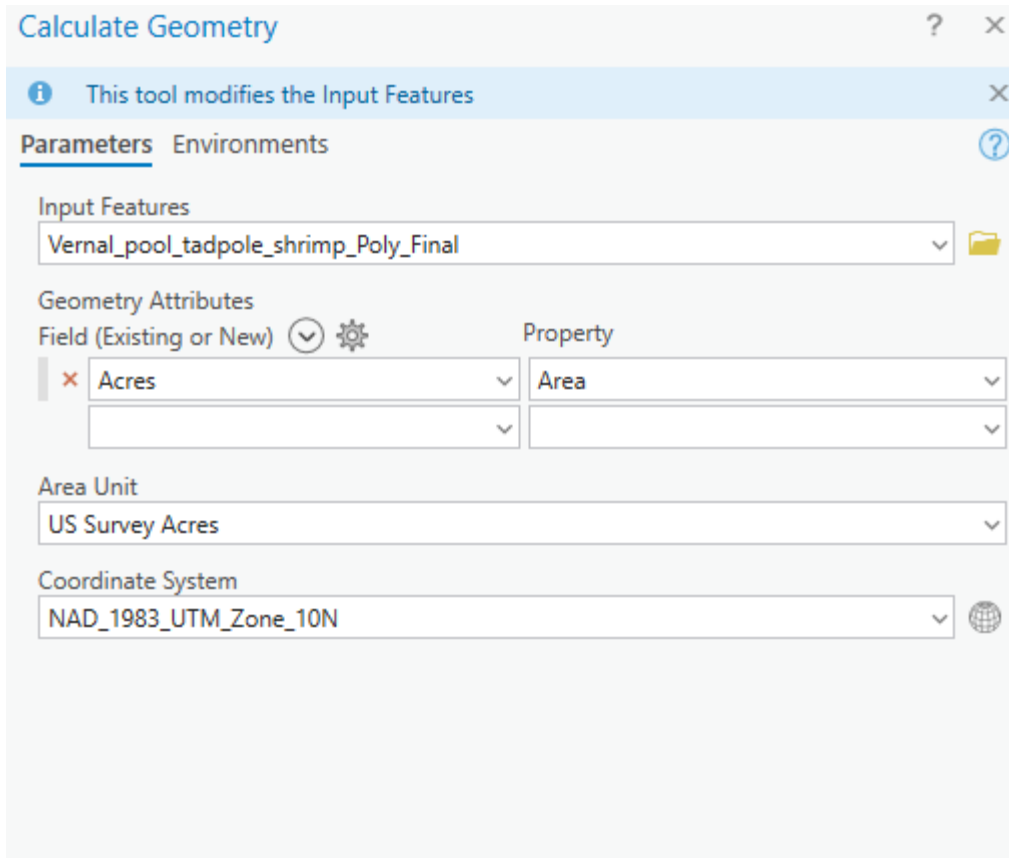


Figure A2-16. Screenshot of “Eliminate Polygon Part” tool

2.6. Use Download USA NLCD Land Cover raster process to determine Percentage of Interim Core Map Represented by NLCD Land Covers

- a. Use the MRLC viewer (<https://www.mrlc.gov/viewer/>) to upload a shapefile of three areas to use as extents to download the NLCD that cover the interim core map areas. **(Figure A2-17)** The file was downloaded and added to ArcPro and renamed, “NLCD_VPTS_Area1.tiff”, “NLCD_VPTS_Area2.tiff”, and “NLCD_VPTS_Area3.tiff”.

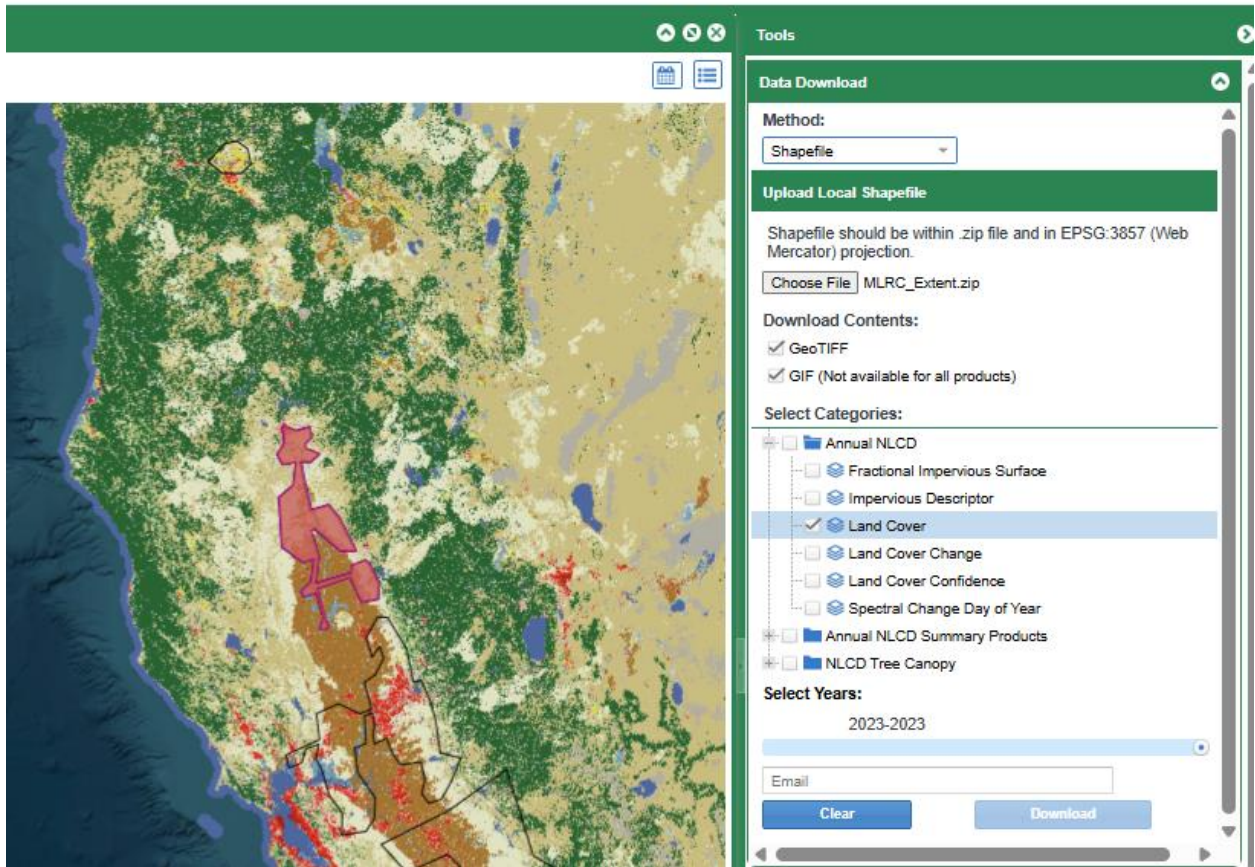


Figure A2-17. Screenshot of MLRC download by shapefile extent

- b. For each of the three areas the “Extract by Mask” tool was used with “NLCD_VPTS_Area1.tiff” filtered by the same area within “Vernal_pool_tadpole_shrimp_Poly_Final” as the extent. **(Figure A2-18)** In the “Environments” tab, changed the output coordinate system to “USA_Contiguous_Albers_Equals_Area_Conic_USGS_version”. **(Figure A2-19)** They were named, “NLCD_MaskArea1”, NLCD_MaskArea2”, etc.

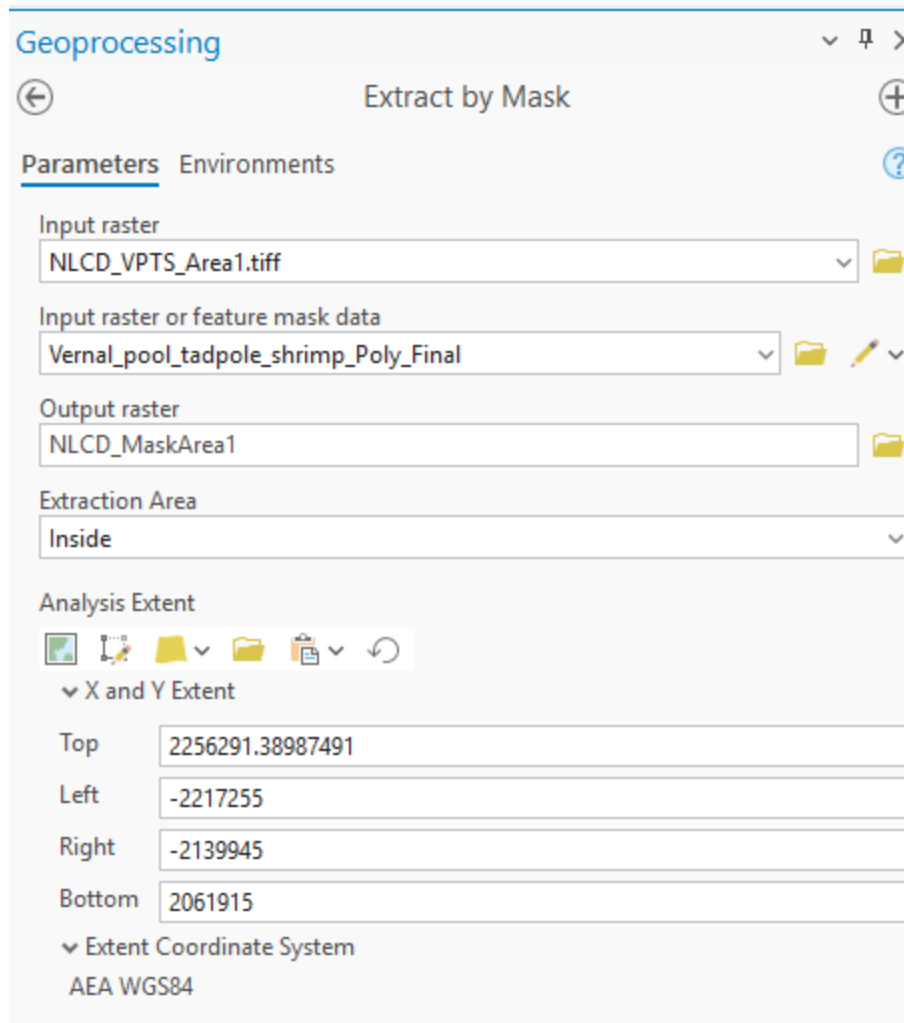


Figure A2-18. Screenshot “Extract by Mask” Parameters Tab

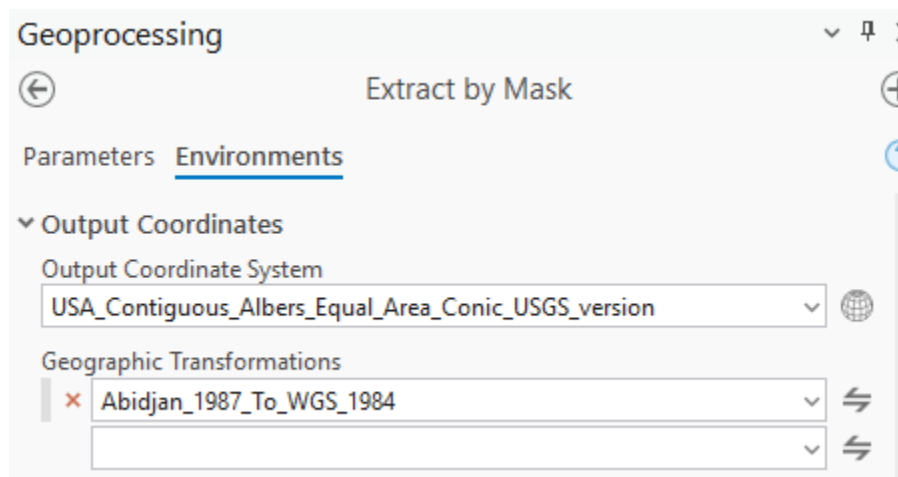


Figure A2-19. Screenshot “Extract by Mask” Environments Tab

- c. Use the “Mosaic To New Raster” tool to gather all three into one output. (**Figure A2-20**)

The screenshot shows the 'Mosaic To New Raster' tool window. The 'Parameters' tab is active. Under 'Input Rasters', three rasters are listed: 'NLCD_MaskArea1', 'NLCD_MaskArea2', and 'NLCD_MaskArea3'. The 'Output Location' is set to 'EPA_Vernal_pool_tadpole_shrimp.gdb'. The 'Raster Dataset Name with Extension' is 'NLCD_1_2_3'. The 'Spatial Reference for Raster' is 'USA_Contiguous_Albers_Equal_Area_Conic_USGS_version'. The 'Pixel Type' is '8 bit unsigned'. The 'Cellsize' is empty. The 'Number of Bands' is '1'. The 'Mosaic Operator' is 'Last'. The 'Mosaic Colormap Mode' is 'First'.

Geoprocessing

Mosaic To New Raster

Parameters Environments

Input Rasters

NLCD_MaskArea1

NLCD_MaskArea2

NLCD_MaskArea3

Output Location

EPA_Vernal_pool_tadpole_shrimp.gdb

Raster Dataset Name with Extension

NLCD_1_2_3

Spatial Reference for Raster

USA_Contiguous_Albers_Equal_Area_Conic_USGS_version

Pixel Type

8 bit unsigned

Cellsize

Number of Bands

1

Mosaic Operator

Last

Mosaic Colormap Mode

First

Figure A2-20. Screenshot “Mosaic To New Raster”

- d. Use the “Tabulate Area” tool to determine the count of area for each NLCD code. (**Figure A2-21**)

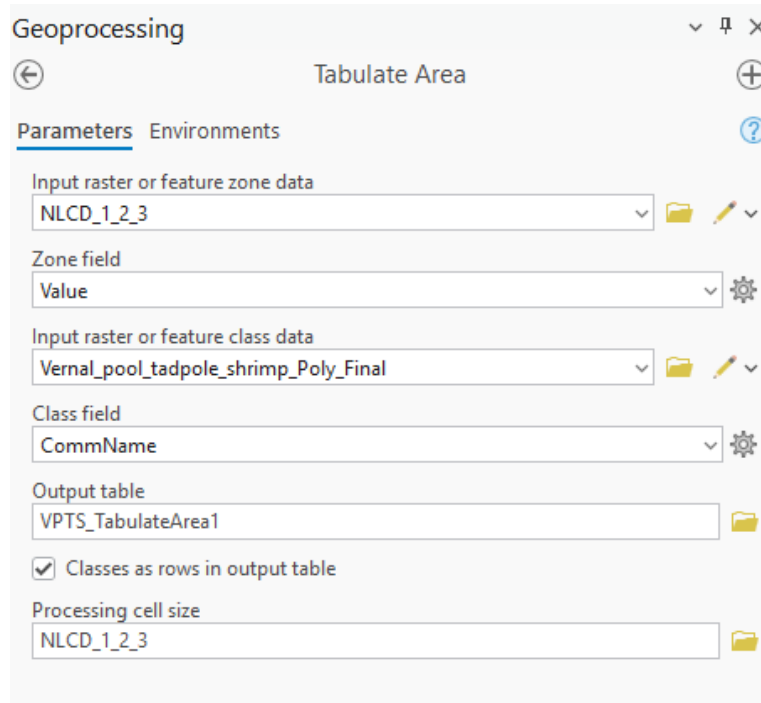


Figure A2-20. Screenshot “Tabulate Area”

- e. Added a double field named, “Per”. Right clicked on field and selected “Calculate Field”. Entered the formula “(!Count!/ 2121374)*100”. This calculated the percentage of NLCD within the core map area. **(Figure A2-21)** Review Results and input into (Table 1. Percentage of Interim Core Map Represented by NLCD Land Covers and Associated Example Pesticide Use Sites/Types.)

This tool modifies the input table

Input Table
VPTS_TabulateArea1

Field Name (Existing or New)
Per

Expression Type
Python

Expression

Fields

- OBJECTID
- Value
- CommName
- CLASS_CODE
- Count
- Area
- Per

Helpers

- .as_integer_ratio()
- .capitalize()
- .center()
- .conjugate()
- .count()
- .decode()
- .denominator()

Insert Values

Per =

(!Count!/2121374)*100

Area	Per
14946300	<Null>
82871100	<Null>
93697200	<Null>
137842200	<Null>

Figure A2-20. Screenshot “Field Calculate”