Interim Core Map Documentation for the Tipton Kangaroo Rat

Posted on EPA's GeoPlatform: June 2025
Interim core map developed by the Center for Biological Diversity (CBD)[1]
Documentation and analysis supplemented by EPA's Office of Pesticide Programs

Species Summary

The Tipton kangaroo rat is a subspecies of the San Joaquin kangaroo rat that is endemic to the southern San Joaquin Valley of California. This species is primarily granivorous, but supplements its diet with plants and insects, and is adapted to the arid grasslands and scrub lands of the San Joaquin Valley. They dig burrows in areas that are high enough not to be flooded. The grassland and scrubland of the San Joaquin Valley have been almost entirely converted to agriculture, and they occupy fragments of natural habitat in the Valley. The most recent surveys in 2014-2015 recorded 15 occupied locations for the species. The 2020 5-year review describes the species as continuing to decline due to habitat loss and other threats. Rodenticides are mentioned in the listing documents and the 2020 5-year review as a threat to the species.

Description of Interim Core Map

The core map is based on known locations of the Tipton kangaroo rat. The most recent known locations are depicted in Figure 1 from the 2020 5-year review.[2] Data from Figure 1 were taken from surveys published in Cypher et al. (2016).[3] Occupied points from Cypher et al. (2016) were mapped and nearby areas of potential habitat were included if they were within 1.6 miles of the point and were not currently considered agricultural lands.

[1] CBD sent EPA the core map for this species before EPA released its mapping process document and example documentation. EPA supplemented the documentation and supporting analysis for consistency with EPA's most recent documentation examples made available after CBD developed this core map.
[2] FWS. 2020. 5-YEAR REVIEW Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*). Page 3. Available at https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2987.pdf.

[3] Cypher BL, Phillips SE, Westall TL, Tennant EN, Saslaw LR, Kelly EC, Van Horn Job CL. 2016. Conservation of Endangered Tipton Kangaroo Rats (Dipodomys Nitratoides Nitratoides): Status Surveys, Habitat Suitability, and Conservation Strategies. California State University, Stanislaus.

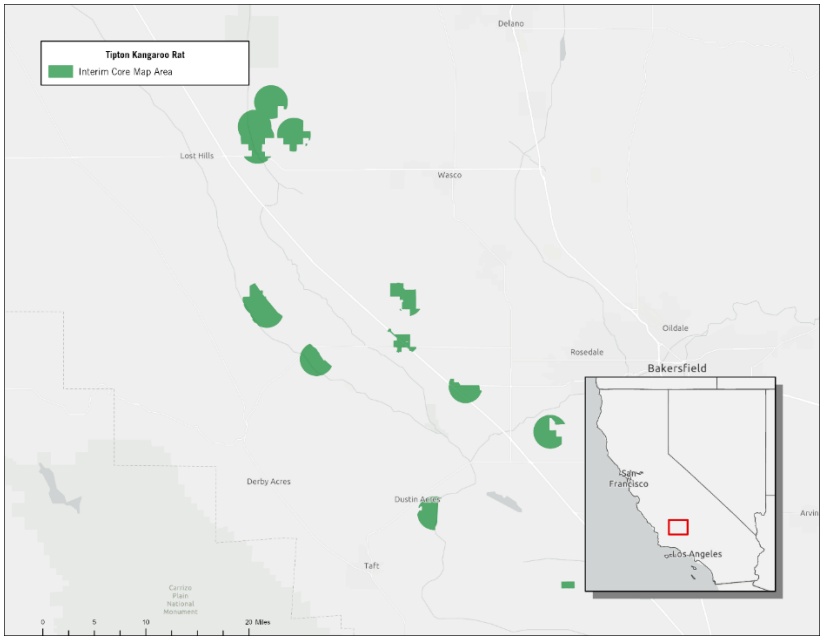

Figure 1. Tipton kangaroo rat interim core map (25,792 acres)

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)	0	0
	Evergreen Forest (42)	0	
	Mixed Forest (43)	0	
Agriculture	Pasture/Hay (81)	.5	14
	Cultivated Crops (82)	13.5	
Mosquito adulticide, residential	Open space, developed (21)	7.6	11
	Developed, Low intensity (22)	2.8	
	Developed, Medium intensity (23)	.5	
	Developed, High intensity (24)	0	

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover	% of core map represented by example pesticide use
Invasive species control	Woody Wetlands (90)	.1	74.9
	Emergent Herbaceous Wetlands (95)	.6	
	Open water (11)	2.3	
	Grassland/herbaceous (71)	64.8	
	Scrub/shrub (52)	6.9	
	Barren land (rock/sand/clay; 31)	.2	

Evaluation of Known Location Information

Five sources of known location information were evaluated.

- Occurrence and survey map in the 2020 5-year review
- Cypher et al 2016
- California Natural Diversity Database
- Global Biodiversity Information Facility including iNaturalist
- NatureServe

The 2020 5-year review presents the best available, primary location information for the species because it identifies the locations that are considered currently occupied. No source of known location information was available for any time after 2020. The 2020 5-year review Figure 1 was based on the most recent survey of the species from 2014-2015 published in Cypher et al. (2016).

The survey report by Cypher et al. (2016)[4] was also evaluated. This survey was conducted for the California Department of Fish and Wildlife and is referenced as the basis for the present occurrences in the 2020 5-year review. Observations from this study are considered reliable as a primary source of location information.

The California Natural Diversity Database (CNDDB) contains 81 element occurrences of the species that were collected between 1903 and 2018. Of these occurrences, seven are newer than 15 years (2010). The CNDDB data was considered useful to inform the core maps for this species because they are collected and vetted by the California state wildlife agency. Sites ranged in size from <10 acres to >1000 acres in size.

The Global Biodiversity Information Facility (GBIF) included seven occurrences that were dated from 2011-2019. This data source included observations from iNaturalist as well as NatureServe collections. The spatial resolution of the data are such that it does not allow for the developer to identify species locations with precision.

NatureServe data described the species as present across 12 hexagons of 343sq.mi. each. This data source was more narrowly defined than the ECOS range map but was not considered to be of fine enough spatial resolution on which to base a core map.

Approach Used to Create Interim Core Map

The core map for Tipton's kangaroo rat is based on recent known locations because sufficient location information was available.

Evaluation of available location data showed that the 2020 5-year review and underlying Cypher et al. (2016) report presents the best and most complete set of known, current locations.

Cypher et al. (2016) presented coordinates for sites with verified presence of the Tipton's kangaroo rat in Appendix B and C of that reference document. These points are highly likely what are depicted as occupied sites (blue hexagons) in Figure 1 from the 2020 5-year review map. Comparing the Appendix B and C points with a georeferenced Figure 1 showed that the points were found to be within an acceptable margin of error compared to the blue hexagons in Figure 1.

We used coordinates from Cypher et al. (2016) Appendix B and C as point locations as the basis for the core map. To determine an appropriate area of occupancy we included surrounding non-agricultural habitat area from GIS within 1.6 miles from these points. Within these 1.6 mile

[4] Cypher BL, Phillips SE, Westall TL, Tennant EN, Saslaw LR, Kelly EC, Van Horn Job CL. 2016. Conservation of Endangered Tipton Kangaroo Rats (Dipodomys Nitratoides Nitratoides): Status Surveys, Habitat Suitability, and Conservation Strategies. California State University, Stanislaus.

circular areas, current agricultural fields were then removed as non-habitat to produce the final core map. Habitat within a 1.6 mile radius was selected as the area of occupancy based on the habitat needs of the species. The 1998 Recovery Plan indicates that to provide enough habitat to ensure the conservation of the species protected blocks of habitat should be a minimum of 2000 ha (about 5000 ac) in size.[5] A circle of 5000 acres has a radius of approximately 1.6 miles and was therefore selected as the basis for selecting the occupied area.

Current agricultural habitat was removed because neither the Recovery Plan nor the listing documents indicate that Tipton's kangaroo rats inhabit or use active agricultural areas. They strongly prefer natural habitat. Current agricultural habitat was identified based on land cover layers of a GIS dataset containing a map of vegetation within the Great Valley Ecoregion produced by the Geographical Information Center (GIC) at California State University--Chico. This land cover layer was used rather than EPA's cultivated land layer because a visual inspection revealed that EPA's cultivated land layer was incorrectly classifying areas of habitat as cultivated. We assume that part of the incorrect classification of cultivated land was caused by inclusion of now fallow lands. Even though there is an apparent negative correlation between Tipton kangaroo rat persistence and agricultural development, there is evidence of rats recolonizing abandoned agricultural fields. Germano and Rhodehamel (1995) excavated 15 Tipton and Hermann's kangaroo rat burrows on agricultural land that had been fallow for more than eight years.[6] Longland and Dimitri (2021) note in their review of kangaroo rat ecology that the San Quintin kangaroo rat—once thought extinct—had been rediscovered in fallowed agricultural fields.[7] Therefore, the most current and region-specific land cover layers are necessary to include all areas of potential habitat since abandoned fields may be habitat.

Considering the data available for this core map is based on reliable occurrence data that represents all known locations and that minimal assumptions were required about the species habitat, we assign an uncertainty score of 2 "limited" to this core map.

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[5] FWS. 1998. Recovery Plan for Upland Species of the San Joaquin Valley, California. Page 112. Available at https://ecos.fws.gov/docs/recovery_plan/980930a.pdf.

[6] Germano DJ, Rhodehamel WM. 1995. Characteristics of Kangaroo Rat Burrows in Fallow Fields of the Southern San Joaquin Valley. Transactions of the western section of the wildlife society **31**:40–44.

[7] Longland WS, Dimitri LA. 2021. Kangaroo rats: Ecosystem engineers on western rangelands. Rangelands 43:72–80.

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

A core map based on the species range was not used because the ECOS range map was overly broad based on this species habitat requirements. A core map based on species critical habitat was not used because the species does not have designated critical habitat.

A core map based on modeled habitat was not used because sufficient location information was available to describe the known locations. A habitat model was presented in Cypher et al. (2016) but is out of date, and no current habitat model for the species was available.

Other sources of known location information were evaluated but not included in the core map.

- Figure 1 from the 2020 5-year review
    - The core map relies on location information presented in Figure 1 of the 2020 5-year review. We considered georeferencing this map and extracting locations, but we did not rely on this method in the final map. Figure 1 of the 2020 5-year review relied primarily on occurrence information presented in Cypher et al. (2016). Appendix B and C of this study included approximate coordinates (accurate to three decimal places) of locations that had verified the presence of the species. Comparing these coordinates with a georeferenced Figure 1, showed that these coordinates matched up with locations in Figure 1 within an acceptable margin of error. The Appendix B and C coordinates were used rather than coordinates extracted from a georeferenced Figure 1 map.
- CNDDB
    - CNDDB had 81 element occurrences of the species. The occurrence records contained both historic and recent records at a variety of spatial scales. Seven records could be considered recent (less than 15 years old). These seven records largely agree with known locations from the 2020 5-year review. FWS noted that they considered the CNDDB records in their most recent 5-year review from 2020, and CNDDB did not have any more recent records than the 2020 five-year review. EPA did not further consider the CNDDB data for this core map.
- Cypher et al. (2016) Appendix D
    - Cypher et al 2016 also presented “presumed occupied” locations in Appendix D of their report. These locations had lat/long values associated with locations that were presumed occupied in 2016 based on other survey effort, but without confirmation in the study itself. FWS relied heavily on the results of this study and appear to have already considered this information when describing occupied areas/occurrences for this species. Since locations from Appendix D do

not appear on Figure 1 from the 2020 5-year review, which map occupied/extant areas, EPA did not include these particular occurrences in the interim core map. These locations were not considered further.

- GBIF and iNaturalist
    - GBIF has eight records of Tipton's kangaroo rat from 2011-2019. These records either provided no coordinates or the coordinates were provided with an uncertainty of 28,000m. These records were considered too imprecise for inclusion in the core map.
- NatureServe
    - NatureServe has location data, but the locations were provided with limited precision. NatureServe Explorer Pro, shows that there are recorded observations of the Tipton kangaroo rat in 12 hexagonal areas within Kern and Tulare counties. This occupied area is not further refined to determine which areas have been occupied recently.

Appendix 1. Information compiled for species during Step 1

1. Recent FWS documents

FWS. 1998. Recovery Plan for Upland Species of the San Joaquin Valley, California. Available at https://ecos.fws.gov/docs/recovery_plan/980930a.pdf.

FWS. 2020. 5-YEAR REVIEW Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*). Available at https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2987.pdf.

2. Background information

Status: ENDANGERED

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

Resiliency – No recent FWS documents describe the species resiliency.

Redundancy – No recent FWS documents describe the species redundancy.

Representation – No recent FWS documents describe the species representation.

Habitat, Life History, and Ecology

Habitat:

The Tipton kangaroo rats are adapted to the arid environment of the southern San Joaquin Vally and the floodplains of the Tulare Lake basin. They forage for seeds of grasses and sedges within grassland and scrub brush plant communities. Remnant grasslands and scrublands are highly fragmented in the areas and host a mix of native and introduced grasses and woody plants such as spiny and common saltbushes, arrow scale, quail bush, iodine bush, pale-leaf goldenbush, honey mesquite, and seepweed.

They burrow in sandy soils that are not subject to flooding.[8]

Diet:

Tipton kangaroo rats are primarily granivorous (seed eating), but they supplement their diet with vegetation and insects.[9]

Taxonomy:

[8] FWS 2020 pp. 109-110
[9] FWS 1999 p. 107

The San Joaquin kanagroo rat (*Dipodomys nitratoides*) is a small mammal in the family Heteromyidae that was described in Best (1991). Best (1991) divided the species into three subspecies include the Tipton (*Dipodomys nitratoides nitratoides*), Fresno (*Dipodomys nitratoides exilis*), and the short-nosed kangaroo rat (*Dipodomys nitratoides brevinasus*) (Best 1991). The Tipon kangaroo rat can be distinguished from the other two subspecies based on morphological differences.[10]

The Tipton kangaroo rat (Dipodomys nitratoides nitratoides) is a valid taxon under the Integrated Taxonomic Information System (ITIS).

Taxonomic Hierarchy

Kingdom	Animalia – Animal, animaux, animals
Subkingdom	Bilateria – triploblasts
Infrakingdom	Deuterostomia
Phylum	Chordata – cordés, cordado, chordates
Subphylum	Vertebrata – vertebrado, vertébrés, vertebrates
Infraphylum	Gnathostomata
Superclass	Tetrapoda
Class	Mammalia Linnaeus, 1758 – mammifères, mamífero, mammals
Subclass	Theria Parker and Haswell, 1897
Infraclass	Eutheria Gill, 1872
Order	Rodentia Bowdich, 1821 – esquilo, preá, rato, roedor, rongeurs, rodents
Suborder	Castorimorpha A. E. Wood, 1955
Family	Heteromyidae Gray, 1868 – heteromyid rodents, Kangaroo Mice, Kangaroo Rats, Pocket Mice
Subfamily	Dipodomyinae Gervais, 1853
Genus	Dipodomys Gray, 1841 – Kangaroo Rats
Species	Dipodomys nitratoides Merriam, 1894 – San Joaquin Valley Kangaroo Rat, San Joaquin kangaroo rat, Fresno Kangaroo Rat
Subspecies	Dipodomys nitratoides nitratoides Merriam, 1894 – Tipton kangaroo rat

Relevant Pesticide Use Sites:

- Row crop margins
- Rangeland/pastureland
- Near built structures (rodenticides)

Relevant Recovery Criteria and Actions:

Objective:

The 1998 Recovery Plan states that the two most important elements of the recovery strategy are:

1. Determining how to manage natural lands to enhance habitat for Tipton kangaroo rats that lessens the frequency and severity of population crashes and negative impact of competition with Heermann's kangaroo rats.
2. Consolidating and protecting blocks of suitable habitat for Tipton kangaroo rats to minimize the effects of random catastrophic events (e.g., drought, flooding, fire) on their populations.[11]

[10] FWS 2020 p. 2
[11] FWS 2020 p. 112

Criteria:

Downlisting

1. Protection of occupied habitat:
    a. Three or more distinct areas with 2,000 hectares (4,940 acres) or more of contiguous, occupied habitat, and
    b. 30% each or more of the minimum acreage in public or conservation ownership.
2. A management plan that includes the survival of the Tipton kangaroo rat as an objective has been approved and implemented for all protected areas identified as important to continued survival.
3. The populations are stable or increasing through a precipitation cycle.

Delisting will be considered when, in addition to the criteria for downlisting, all of the following conditions have been met:

1. A total of 9,000 hectares (22,230 acres) or more of occupied habitat in public or conservation ownership, and
2. Protected sites have a mean density of 10 kangaroo rats per hectare (4 per acre) during a complete precipitation cycle.[12]

Recovery Actions:

Since federal listing in 1988 several actions have contributed to further protect the species and promote recovery. The Tipton kangaroo rat was listed as endangered under the California Endangered Species Act in 1989.

Since listing the Service has acquired and protected natural lands that contributed to other conservation actions at the Allensworth Ecological Reserve, Semitropic Ridge, Kern Fan areas, and other areas.

In 1991 and 1992, The Service has studied habitat management and population ecology at the Pixley National Wildlife Refuge which has some of the best remaining habitat for Tipton kangaroo rats., were initiated. Additional survey for the species have also been conducted.

The Environmental Protection Agency, California Department of Fish and Game, and California Department of Food and Agriculture have instituted county bulletins regarding the use of rodenticides.[13]

Recommendations for Future Actions:

[12] FWS 2020 p. 11
[13] FWS 1998 p. 111

The Recovery Plan states that the following recovery actions are needed:

I. Expand, coordinate, and continue habitat management studies of Tipton kangaroo rats at sites representing the range of existing habitat conditions for the species.

2. Initiate studies of competition between Tipton and Heermann's kangaroo rats, focusing primarily on how different habitat management prescriptions affect the population dynamics of the two species at sites of coexistence.

3. Design and implement a range-wide population monitoring program that measures population and environmental fluctuations at sites representative of the range of natural land sizes and habitat conditions for the species.

4. Inventory and assess existing natural land and drainage-problem parcels contiguous to and near existing protected natural lands and develop a protection plan that ranks parcels that may' be available according to their size and potential for supporting Tipton kangaroo rats, with the objective of connecting and expanding:

a. Pixey National Wildlife Refuge and the scattered parcels of the Allensworth Ecological Reserve;

b. Kern National Wildlife Refuge and the scattered parcels of the Semitropic Ridge conservation lands;

c. Kern River alluvial fan area including the Kern Fan Element, Cole's Levee Ecosystem Preserve, and other mitigation parcels.

d. Additional lands which after inventory and assessment are identified as important to the two key elements of the recovery strategy for Tipton kangaroo rats.

5. Develop and implement research on restoration of habitat for Tipton kangaroo rats, including cost-effective mechanisms to protect both natural and restored habitat from flooding.

6. Restore habitat on retired agricultural lands as Needed.[14]

3. Description of Species Range:

The Tipton kangaroo rat is found in the southern San Joaquin Valley of California. The ECOS range map is included here.

[14] FWS 1999 pp. 112-113

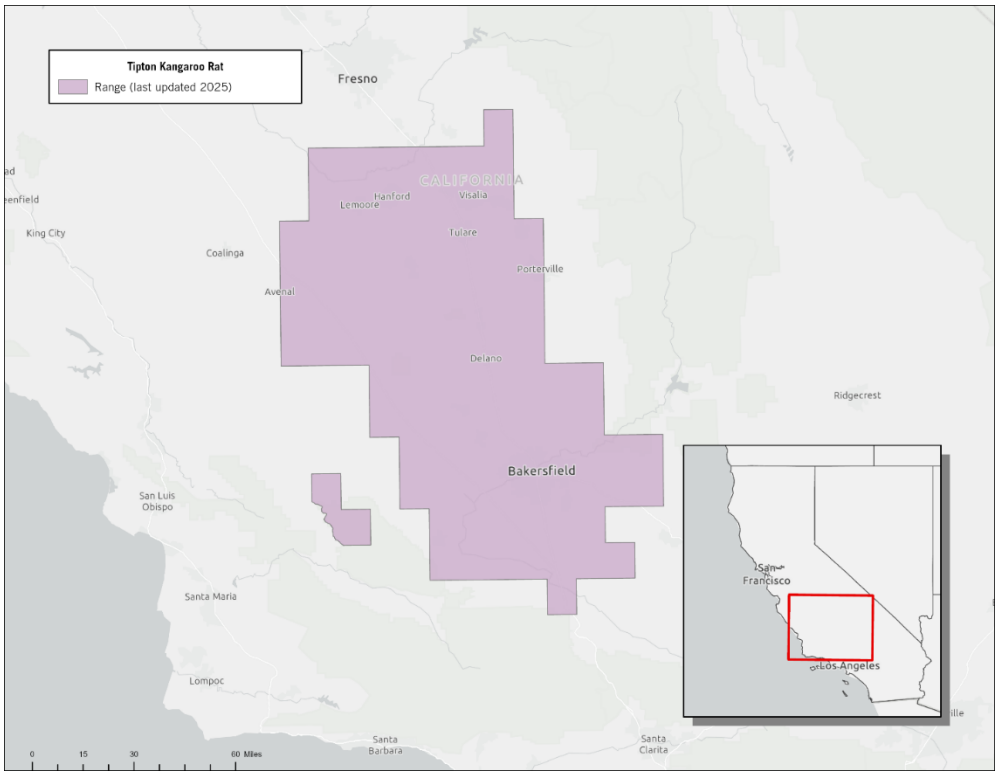


Figure A1-1. FWS range from ECOS last updated on 10/30/2025 (3,926,181 acres). (https://ecos.fws.gov/ecp/species/7247)

4. Critical Habitat:

There is no designated critical habitat for this species.

5. Known Locations

The 2020 5-year review indicates that the most recent trapping efforts to survey the population occurred in 2014 and 2015 and the results were published in Cypher et al (2016).[15] This trapping survey was done at 44 locations within the species range and detected Tipton kangaroo rats at 15 locations.[16] The survey results are depicted in Figure A1-3 below.

[15] Cypher BL, Phillips SE, Westall TL, Tennant EN, Saslaw LR, Kelly EC, Van Horn Job CL. 2016. Conservation of Endangered Tipton Kangaroo Rats (Dipodomys Nitratoides Nitratoides): Status Surveys, Habitat Suitability, and Conservation Strategies. California State University, Stanislaus.
[16] FWS 2020 p. 2

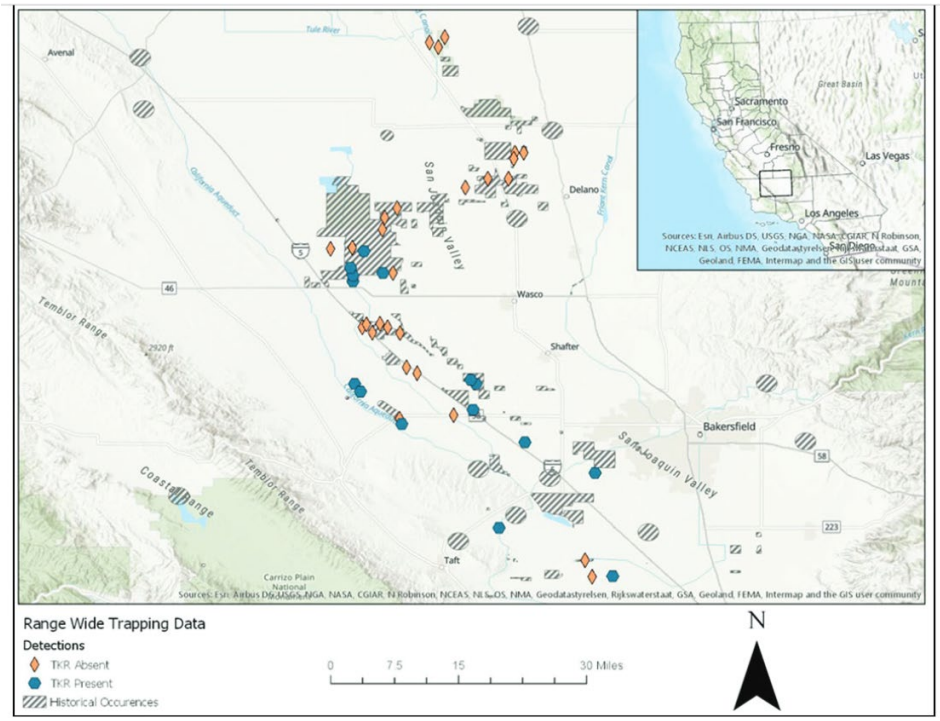


Figure A1-3. Figure 1 from the 2020 5-year review.

Some locations have declined including at Pixley National Wildlife Refuge where no kangaroo rats were detected by 2019.[17]

The best remaining locations include Lokern Ecological Reserve (and adjacent lands) and Semi Tropic Ecological Reserve.[18]

Overall, the 2020 5-year review concludes that the Tipton kangaroo rats have declined across their range.[19]

The California Natural Diversity Database also contains occurrence information that was considered, but provided no additional areas that are considered occupied outside of what is reported in the 2020 5-year review.

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

[17] FWS 2020 p. 2
[18] FWS 2020 p. 3
[19] FWS 2020 p. 3

The biological information core map for this species is based on recent known locations depicted in Figure 1 from the 2020 5-year review (15 sites with coordinates; survey results from Cypher et al. (2016)).

The CNDDB data for the Tipton Kangaroo Rat has no records site records newer than 2018 and the 2020 five-year review map differed from the CNDDB records; therefore, we did not consider CNDDB records to represent the most current and best available location data. CNDDB data was therefore not included in the creation of the core map. After reviewing additional sources of occurrence data from available Nature Service, GBIF and iNaturalist, these data had no coordinates and were imprecise or with limited accuracy.

The Core map was developed by utilizing the coordinates and data from Appendixes B and C from Cypher et al. (2016), then buffered by 1.6 miles to account for the habitat needs of the species. A geodatabase feature class containing a map of vegetation within the Great Valley Ecoregion produced by the Geographical Information Center (GIC) at CSU Chico, was used with the agricultural map class filtered and was clipped by the buffered 1.6-mile points. A visual examination of small floating island vegetation areas was done to determine if they satisfy the criteria of habitable size and vegetation type to be kept in the final core map area.

This section details the data and steps used to create the core map for the Tipton Kangaroo based on this known location information.

1.1. References and Software

1. Census 2024 TIGER/Line Shapefiles downloaded 1/14/2025: https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.html
2. Vegetation – Great Valley Ecoregion_ds2632 feature class https://filelib.wildlife.ca.gov/Public/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip
3. World UTM Grid: https://services.arcgis.com/P3ePLMYs2RVChkJx/arcgis/rest/services/World_UTM_Grid/FeatureServer
4. Modified Cultivated Layer (Downloaded 01/27/2025) https://cdn.arcgis.com/home/item.html?id=159e70ce4c284f5b972c687037f8a668
5. USA NLCD Land Cover https://www.arcgis.com/home/item.html?id=3ccf118ed80748909eb85c6d262b426f https://landscape10.arcgis.com/arcgis/rest/services/USA_NLCD_Land_Cover/ImageServer
6. Cypher et al. (2016) Table named, “APPENDIX B. LIVE-TRAPPING RESULTS AND HABITAT ATTRIBUTES FOR SITES SURVEYED FOR TIPTON KANGAROO RATS.”
7. Cypher et al. (2016) Table named, “APPENDIX C. LOCATION COORDINATES FOR THE APPROXIMATE CENTER OF SITES SURVEYED FOR TIPTON KANGAROO RATS IN THIS STUDY.”
8. Software used: ArcGIS Pro version 3.2

9. Data Interoperability – FME® 2024.1.2.1 (20240920 - Build 24626
10. MS 365 Excel Version 2412

1. Datasets and Procedures Used in Core Map Development

2.1. Take all four records Clipped Vegetation – Great Valley Ecoregion_ds2632 feature class to Tulare and Kern County, CA

1. In ArcPro, go the properties of "tl_2024_us_county", select the Definition Query tab. 1.1.2 Create definition query (NAME = 'Tulare' Or NAME = 'Kern') (**Figure A2-1**)

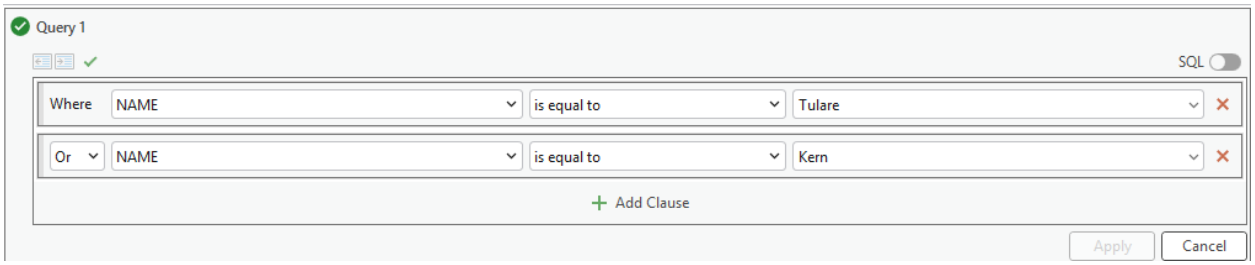


Figure A2-1. Screenshot of County Layer Definition Query

2. Use "Pairwise Clip" tool to clip "Vegetation – Great Valley Ecoregion_ds2632 feature class" to the filtered extent of the "tl_2024_us_county". (**Figure A2-2**) (**Figure A2-3**)

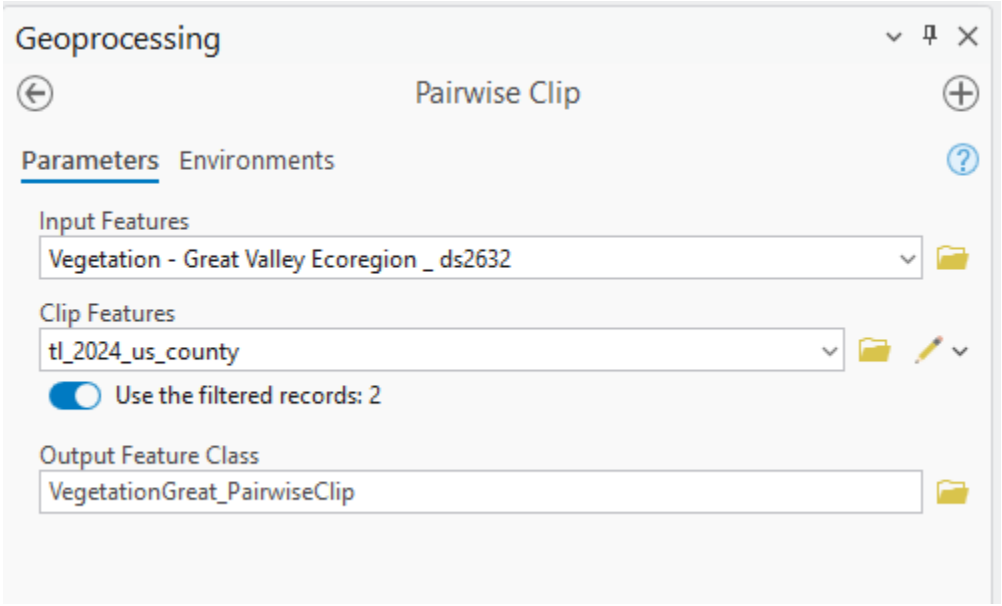


Figure A2-2. Screenshot of Pairwise Clip

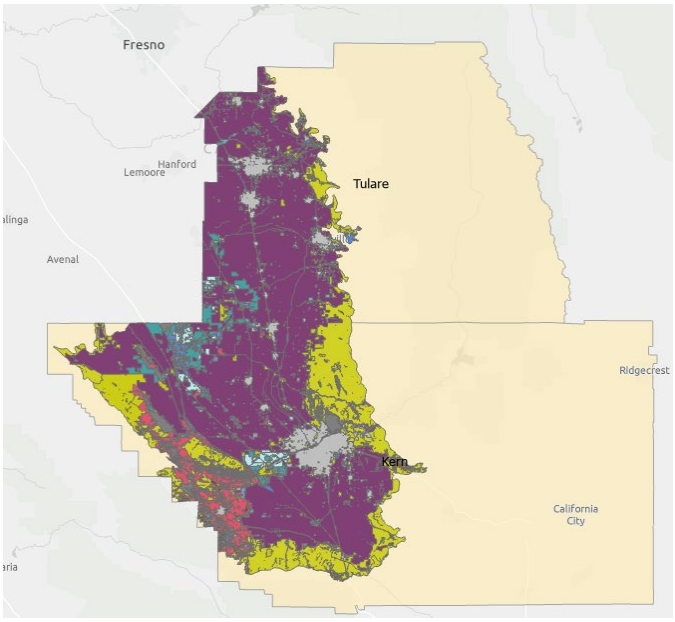


Figure A2-3. Screenshot of Clipped Vegetation FC and Filtered Counties

2.2. Extract data from Appendix B and C from Cypher et al. (2016) to excel

1. The Center for Biological Diversity (CBD) extracted data from Appendix B and C from Cypher et al. (2016) into two worksheets, "A9RD3FC" and" A9RD404". (**Figure A2-4**) (**Figure A2-5**)

Site	Dates trapped	No. traps	No. TN	TKR prese	No. TKR	No. HKR	Dist. to Ag	Scalds pre	Scald size	Shrubs pr	Shrub den	Iodine bus	Seepweed	Dominant	GC densit	Grazing	Tilling	Micro-topography
1	10/30-10/31/13	40	80	yes	2	6	0.37	no	n/a	yes	medium	no	yes	small-lea	sparse	no	no	undulations < 12"
2	10/30-10/31/13	30	60	no	0	5	0.24	no	n/a	yes	medium	no	yes	Isocoma	dense	no	yes	generally flat
4	10/30-10/31/13	30	60	no	0	3	0.24	no	n/a	yes	n/a	yes	no	Allenrolfe	sparse	no	yes	undulations < 12"
5	11/26-11/27/13	40	80	yes	7	1	0.45	yes	large	yes	medium	no	yes	Suaeda	sparse	no	no	undulations <12" and mounds or ridges >12"
6	11/26-11/27/13	40	80	yes	1	1	0.6	yes	large	yes	medium	no	yes	Suaeda a	medium a	no	no	undulations <12" and mounds or ridges >12"
7	11/6-11/7/13	40	80	no	0	3	0.28	yes	large, med	yes	medium	yes	yes	small-lea	medium	no	no	mounds or ridges >12"
8	11/6-11/7/13	40	80	no	0	8	0.27	yes	large and	yes	dense	no	yes	small-lea	medium	no	yes	undulations < 12"
9	11/14-11/15/13	39	78	no	0	3	0.7	yes	large and	yes	medium	yes	yes	Allenrolfe	sparse	no	no	undulations < 12"
10	11/14-11/15/13	40	80	no	0	0	0.38	yes	large	yes	medium	yes	no	Allenrolfe	sparse	yes	no	mounds or ridges >12"

Figure A2-4. Screenshot of Worksheet "A9RD3FC"

	A	B	C
1	Site	Longitude*	Latitude*
2	1	-119.167	35.127
3	2	-119.202	35.126
4	4	-119.214	35.154
5	5	-119.399	35.453
6	6	-119.408	35.46
7	7	-119.499	35.471
8	8	-119.517	35.481
9	9	-119.592	35.549
10	10	-119.585	35.554

Figure A2-5. Screenshot of Worksheet "A9RD3FC"

2.3. Create 1.6 mile buffer around known locations. Data Interoperability—FME Process overview shown in Figure A2-6.

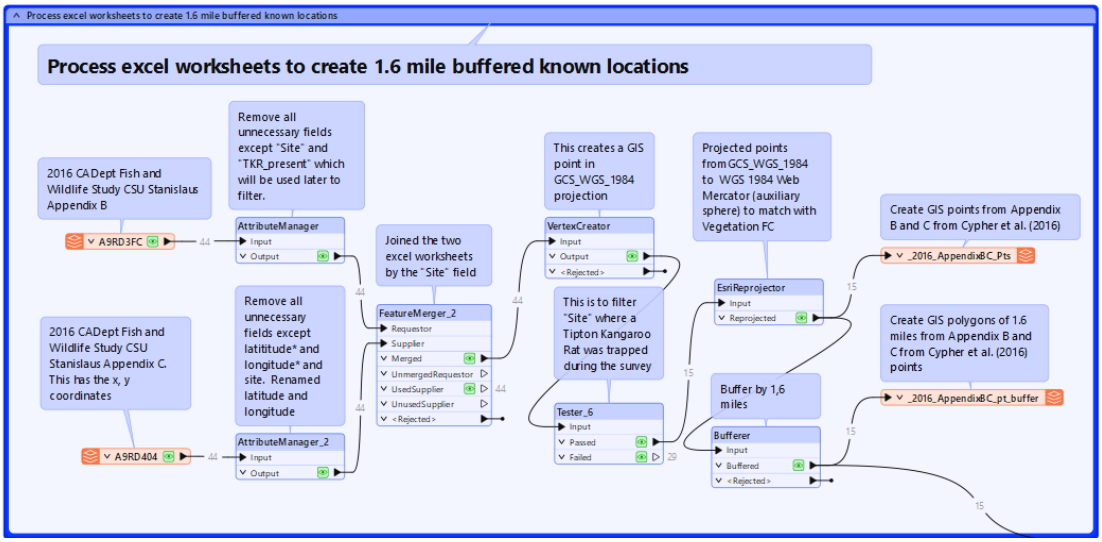


Figure A2-6. Screenshot of FME bookmark group to process excel worksheets

1. Used Data Interoperability – FME to add two excel worksheets from step 1.2 as "readers" into FME workbench. (**Figure A2-7**)

Figure A2-7. Screenshot of Worksheet "A9RD3FC" and "A9RD3FC" FME "readers"

2. Used "Attribute Manager" FME transformers to remove unnecessary fields. Fields "Site" and "TKR_present" are kept for filtering later. Fields "latitude" and "longitude" are kept to create GIS points later. (**Figure A2-8**) (**Figure A2-9**)

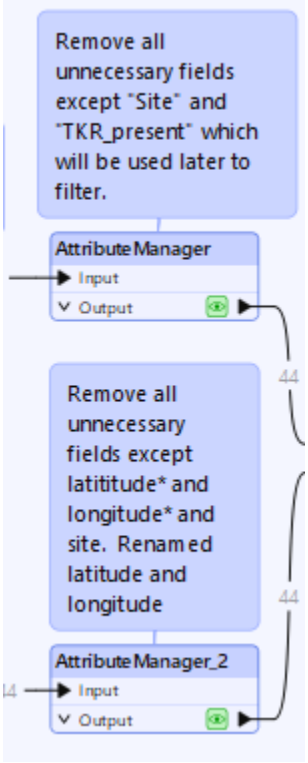


Figure A2-8. Screenshot of FME "Attribute Manager"

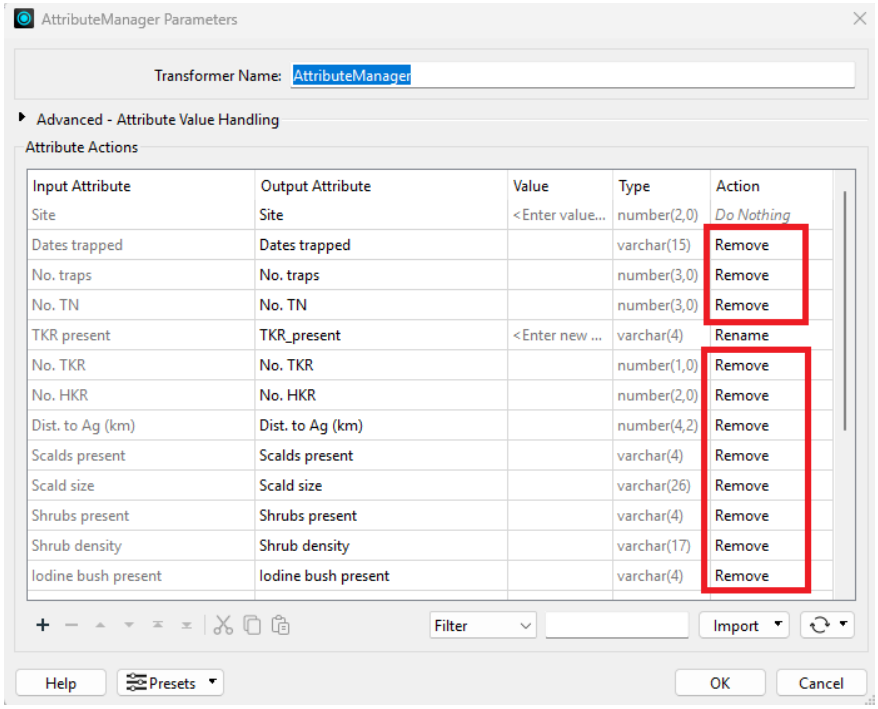


Figure A2-9. Screenshot of FME "Attribute Manager" parameters and remove action of fields

3. Use “VertexCreator” transformer to create GIS points in “GCS_WGS_1984” projection. (**Figure A2-10**)

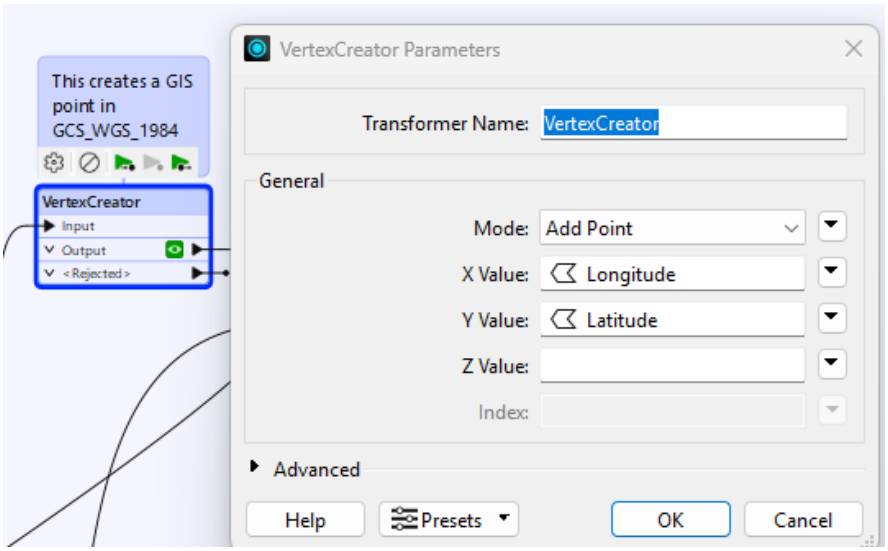


Figure A2-10. Screenshot of FME “VertexCreator” transformer and parameters

4. Use “Tester” transformer to filter records where “TKR_present = “yes”. (**Figure A2-11**)

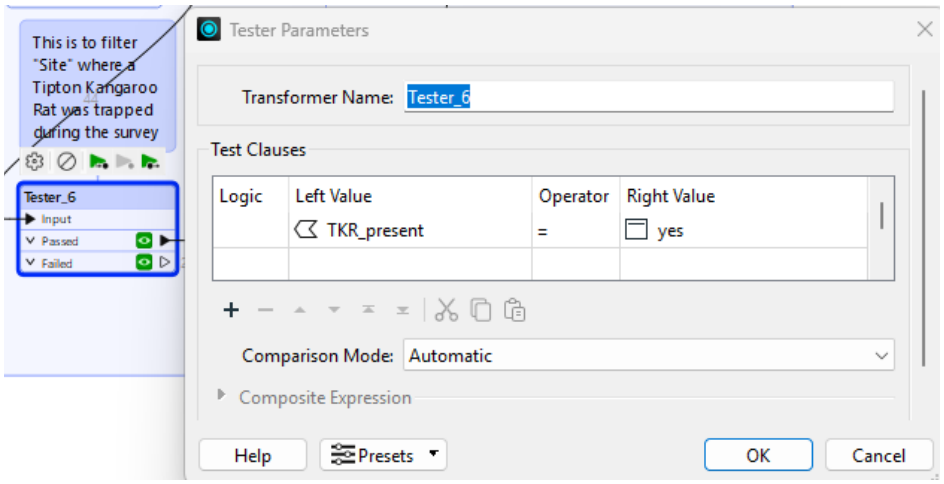


Figure A2-11. Screenshot of FME “tester” transformer and parameters

5. Use “EsriReprojector” transformer to project the new created points from “GCS_WGS_1984” to “WGS_1984_Web_Mercator_Auxiliary_Sphere” to match with the projection in the “Vegetation – Great Valley Ecoregion_ds2632 feature class” to make sure that the clipping process done later is correct. **(Figure A2-12)**

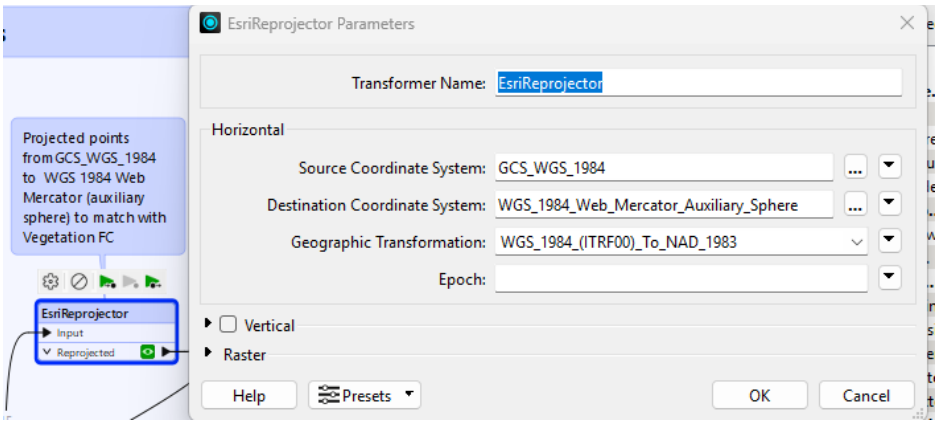


Figure A2-12. Screenshot of FME "EsriReprojector" parameters

6. Use "Bufferer" transformer to buffer the new created points with a buffer distance of 1.6 miles. (Figure A2-13)

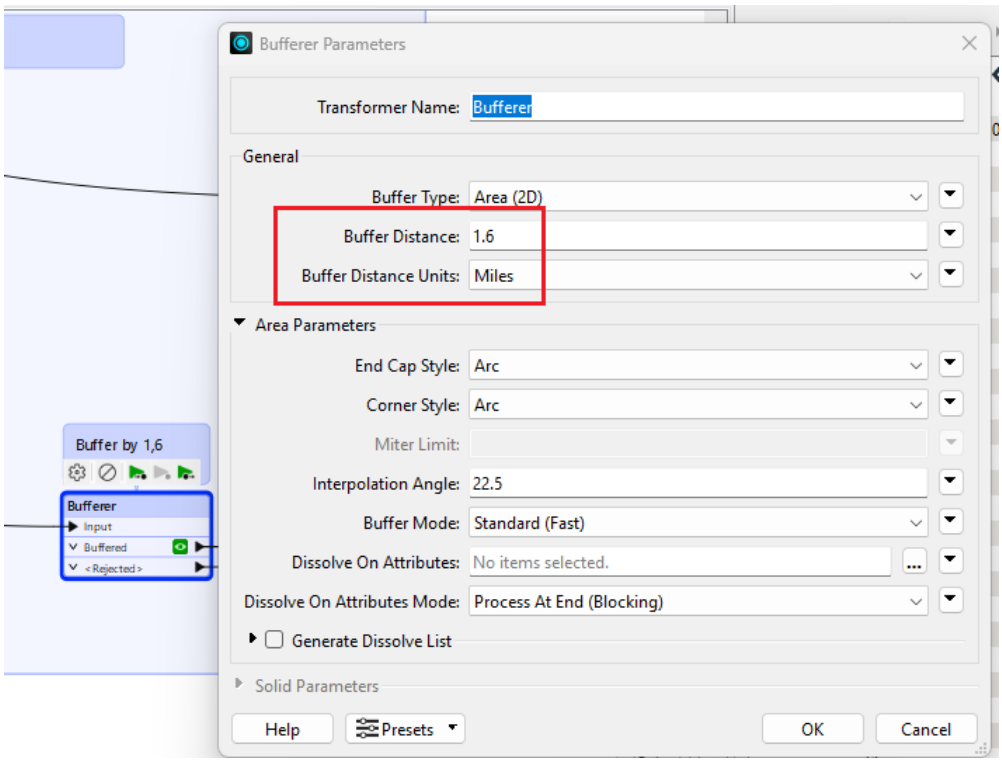


Figure A2-13. Screenshot of FME "Bufferer" transformer and parameters

7. One point feature class, named "_2016_AppendixBC_Pts", and one polygon feature class "_2016_AppendixBC_pt_buffer" are created. These outputs are created so that they can be viewed in an ArcPro project to visualize and confirm the clipping boundaries. (**Figure A2-14**)

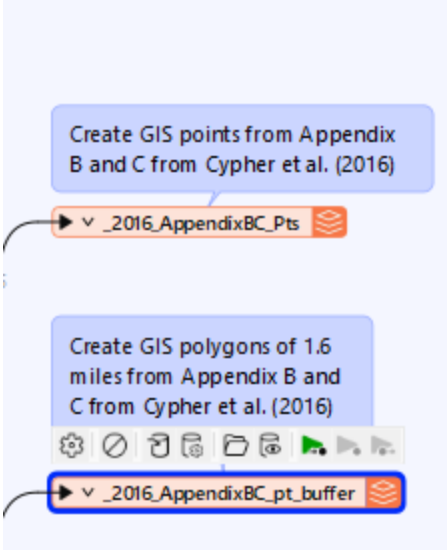


Figure A2-14. Screenshot of two FME "Writers" for a point and polygon FC

2.4 Process the Great Valley Ecoregion clipped feature class without "AGR- Agriculture" Map Class. Data Interoperability – FME overview shown in Figure A2-15.

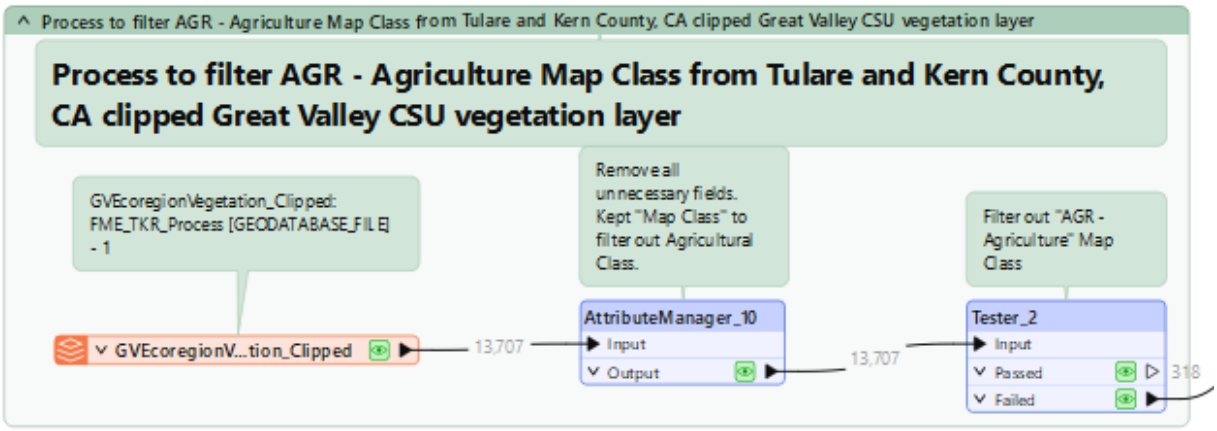


Figure A2-15. Screenshot of FME bookmark group to filter "AGR-Agriculture" Map Class

1. Within Data Interoperability – FME, in another parallel branch process, add from step 1.1, "VegetationGreat_PairwiseClip" FC, as a reader. (**Figure A2-16**)

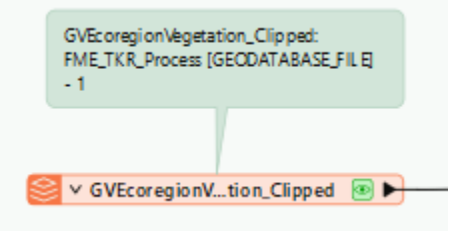


Figure A2-16. Screenshot of FME reader "VegetationGreat_PairwiseClip"

2. Remove all unnecessary fields, except “Map Class” to filter out “AGR-Agriculture” Map Class later. (**Figure A2-17**)

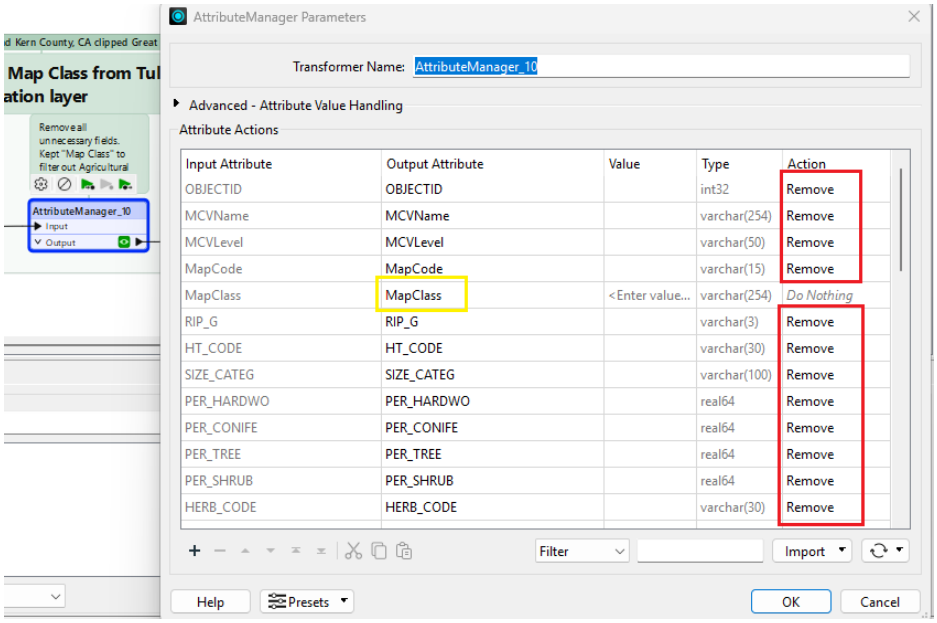


Figure A2-17. Screenshot of FME “Attribute Manager” transformer and parameters

3. Use “Tester” transformer to filter out “AGR-Agriculture” Map Class. What passes out of the “Failed” port will be used in the next bookmark group. (**Figure A2-18**)

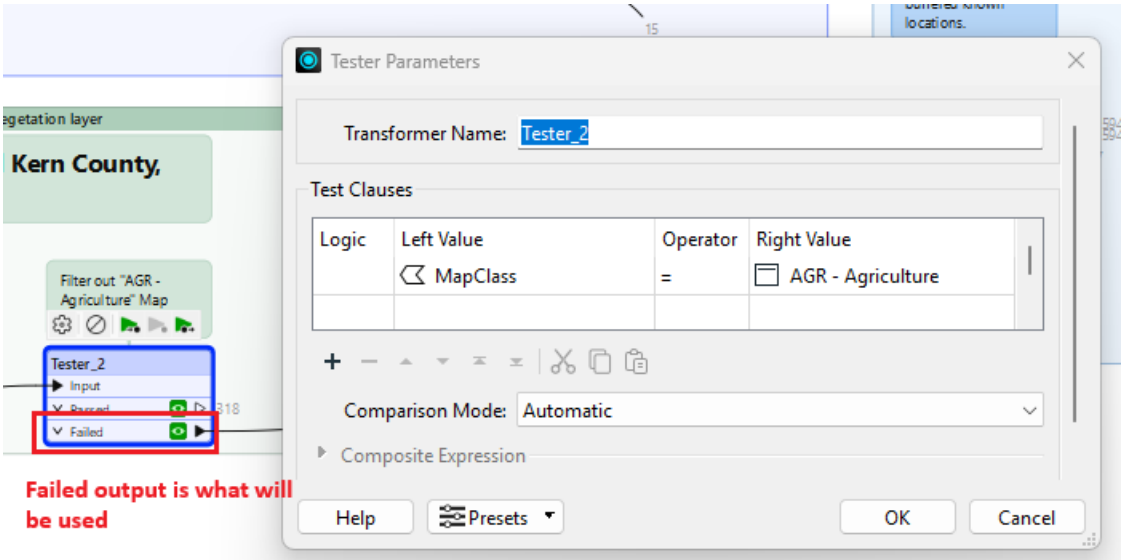


Figure A2-18. Screenshot of FME “Tester” transformer and parameters

5.1. Proceess to clip Vegetation Layer, find floating polygons and create output polygon layer (Figure A2-19)

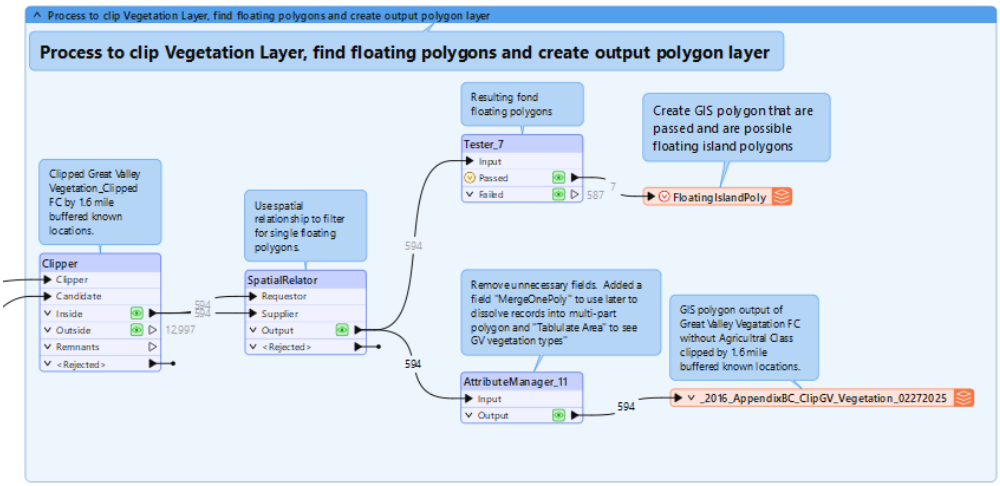


Figure A2-19. Bookmark group to clip Vegetation Layer and Create GIS FC

1. The output from steps 1 and 2 (excel data to buffered polygon) and 3 (Clipped Great Valley Vegetation polygon w/o AGR-agriculture Map Class) group are inputs into the "Clipper" transformer. The "Great Valley Vegetation" layer is clipped by the 1.6 mile buffered points. (**Figure A2-20**)

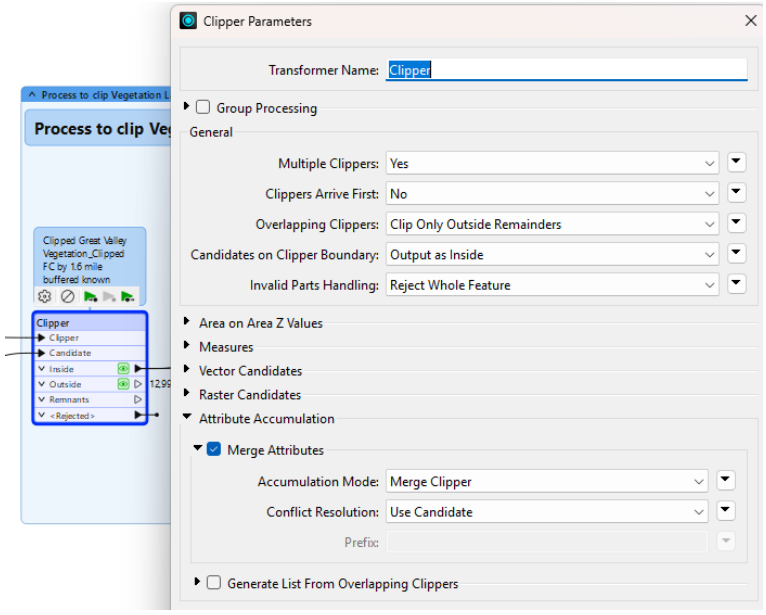


Figure A2-20. Screenshot of FME "Tester" transformer and parameters

2. The "SpatialRelator" transformer is used to compare the clipped output from the previous step against itself to find "floating island polygons". The "Tester"

transformer tests for “_related_suppliers” = “1”. This will be exported as a polygon feature class named, “FloatingIslandPoly”. (**Figure A2-21**) (**Figure A2-22**)

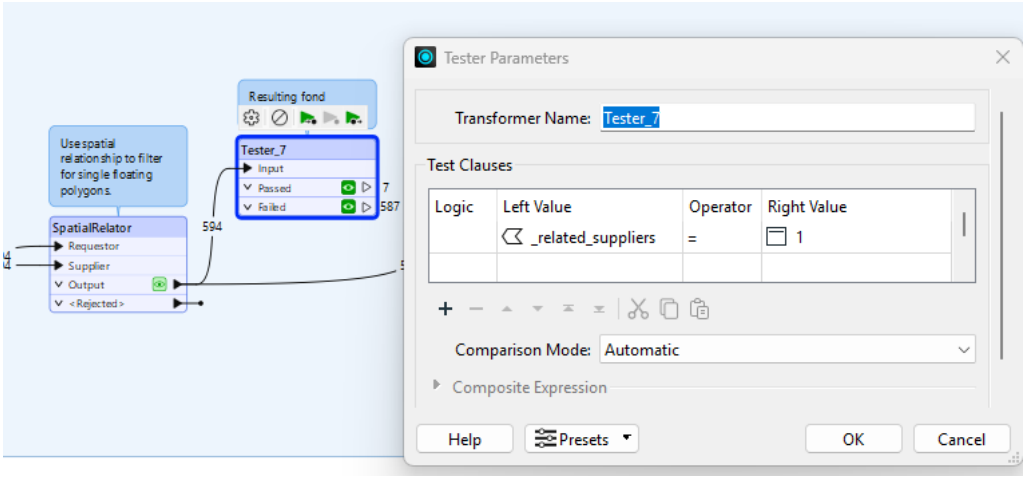


Figure A2-21. Screenshot of FME “SpatialRelator” and “Tester” transformer and parameters

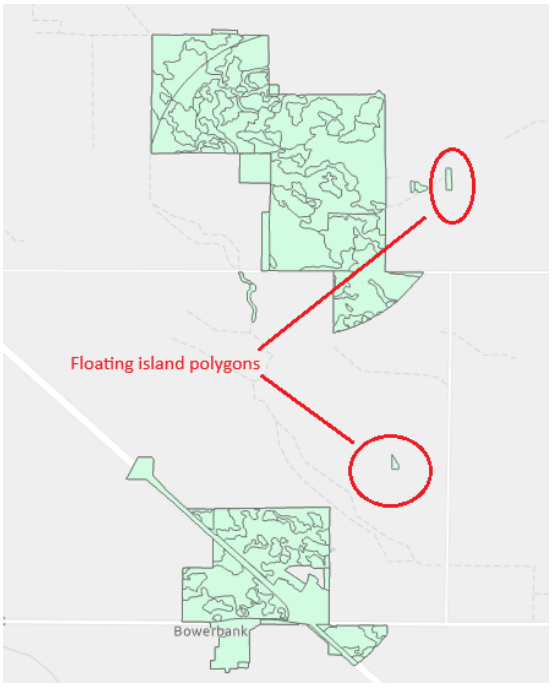


Figure A2-22. Screenshot of example of “Floating island polygons”

3. In a separate branch exiting the port from the “SpatialRelator” transformer is a “AttributeManager” that removes unnecessary fields. Also, added a field named, “MergeOnePoly”. This will be used later in ArcPro project to dissolve into one multi-part polygon and with the “Tabulate Area” tool. The output port from the “AttributeManager” is a writer that will create a polygon feature class named, “_2016_AppendixBC_ClipGV_Vegetation_02272025”. (**Figure A2-23**)

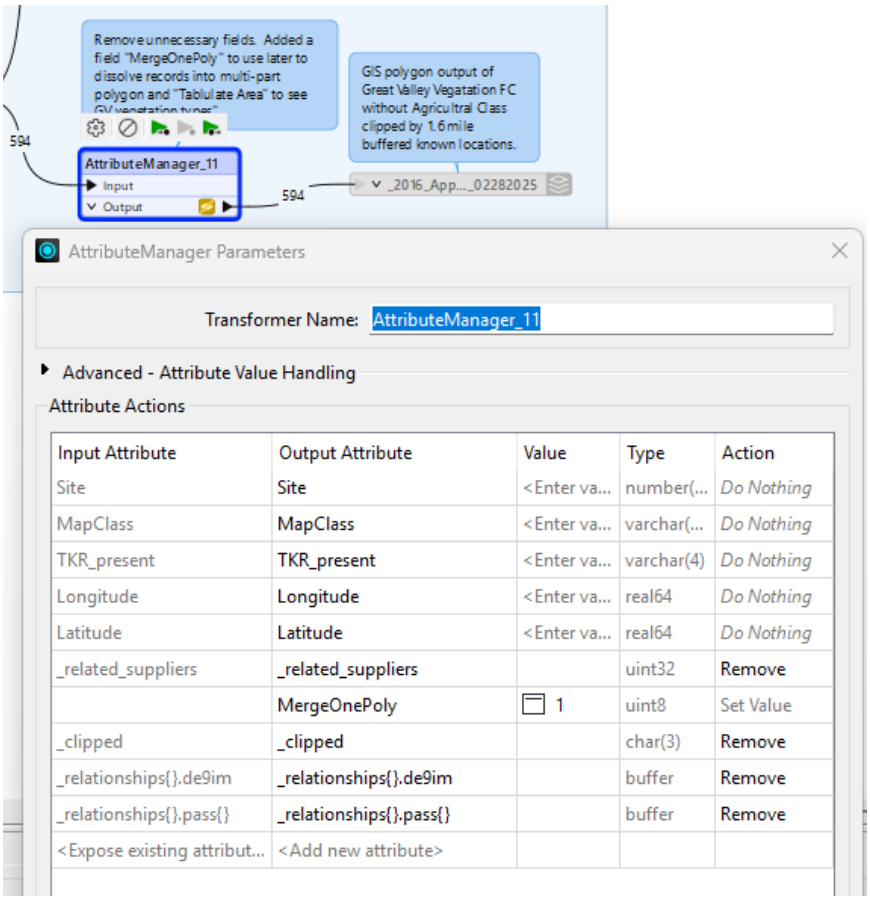
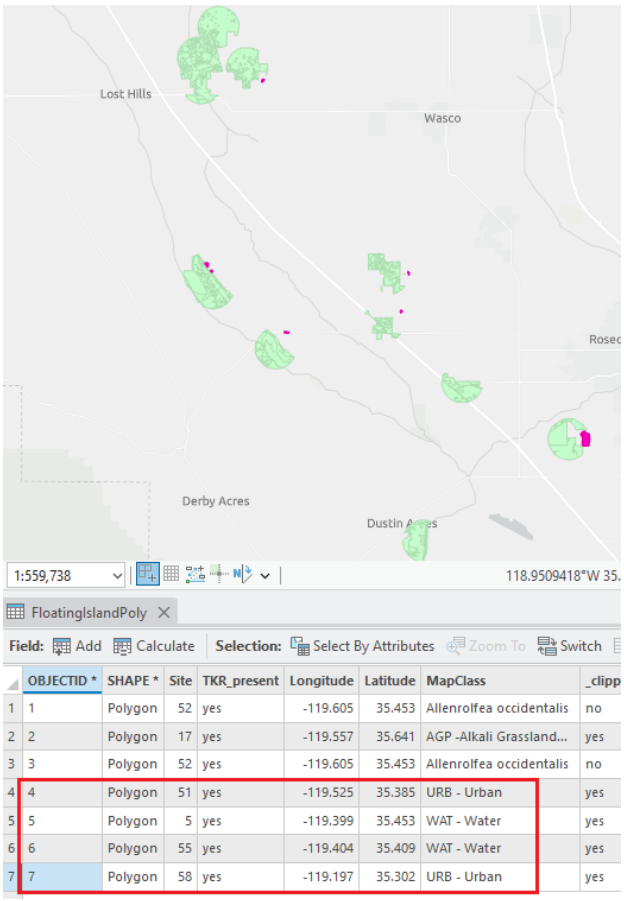


Figure A2-23. Screenshot of "AttributeManager" and "Writer"

2.6. Process to remove "Island Polygons" and Dissolve into one Polygon

1. A visual examination of the seven small floating island polygon areas was done to determine if they satisfy the criteria of habitable size and vegetation type to be kept in the final interim core map area. (**Figure A2-24**) Zoomed into each area and turned on the imagery to confirm that the imagery likely matches the "MapClass" in the feature class. Those with "OBJECTID" 4-7 were removed from the feature class because they were judged too small and too disconnected to sustain a population of Tipton kangaroo rats.



	OBJECTID *	SHAPE *	Site	TKR_present	Longitude	Latitude	MapClass	_clipp
1	1	Polygon	52	yes	-119.605	35.453	Allenrolfea occidentalis	no
2	2	Polygon	17	yes	-119.557	35.641	AGP -Alkali Grassland...	yes
3	3	Polygon	52	yes	-119.605	35.453	Allenrolfea occidentalis	no
4	4	Polygon	51	yes	-119.525	35.385	URB - Urban	yes
5	5	Polygon	5	yes	-119.399	35.453	WAT - Water	yes
6	6	Polygon	55	yes	-119.404	35.409	WAT - Water	yes
7	7	Polygon	58	yes	-119.197	35.302	URB - Urban	yes

Figure A2-24. Screenshot of "Floating Island Polygons" (Pink)

2. A further visual inspection revealed seven other "islands" to determine if they satisfy the criteria of habitable size and vegetation type to be kept in the final interim core map area. Using the same process in the previous step, seven more polygons were identified as "islands" where only two polygons are adjacent to each other. These "island" (OBJECTIDs 444, 443, 442, 318, 451, 445, 560) (**Figure A2-25**) polygons were judged to be non-habitat based on the classification from the Great Valley Ecosystem vegetation dataset.

	OBJECTID	Site	MapClass
1	444	5	WAT - Water
2	443	5	Eucalyptus (globulus, camaldulensis) Semi-natural Stands
3	442	5	Tamarix spp. Semi-natural Stands
4	318	51	URB - Urban
5	451	5	IMF - Introduced North American Mediterranean Forest
6	445	55	WAT - Water
7	560	58	URB - Urban

Figure A2-25. Screenshot of Table with removed polygons OBJECTIDs

3. Use “Dissolve” ArcPro tool to merge all polygons into one multi-part polygon by the “MergeOnePoly” field. (**Figure A2-26**)

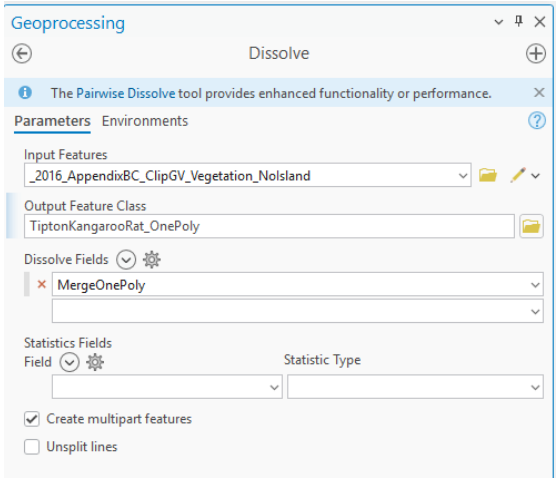


Figure A2-26. Screenshot Dissolve Tool

2.6. Copy and paste step 5 output into polygon template and populate attributes

1. Copy and paste polygon from “TiptonKangarooRat_OnePoly” to new polygon layer called “Tipton_kangaroo_rat_Poly”. (**Figure A2-27**)

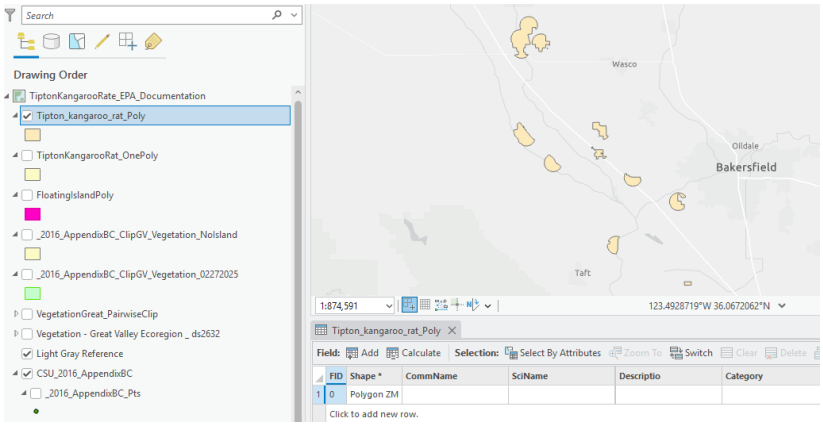


Figure A2-27. Screenshot Resulting records from Copy and Paste

2. Since there is only one record in “Tipton_kangaroo_rat_Poly”, update each field manually with
    a. CommName = "Tipton kangaroo rat”
    b. SciName = “Dipodomys nitratoides nitratoides”

c. Description = “Clip of CSU Chico Great Valley Ecoregion FC (excl. Agr class) by 1.6 mi. buffer of USFWS 2020 5-YR Review fig. 1 Endangered Species Recovery Program at CSU, Stanislaus Tipton kangaroo rats present areas (Cypher et al. 2016 study appx. C coordinates).”
d. Category = “Area of occupancy”
e. EPA_Code = “40”
f. FWS_Code = " A08S”
g. CBD_Code = " 444”
h. Heritage = “0”
i. ECOS_WebPg = https://ecos.fws.gov/ecp/species/7247

3. Turned on the “World UTM Grid” layer and identified the UTM zone as “11”. Right-clicked on the “Acres” field→left-clicked on “CalculateGeometry”. “Calculate Geometry” dialog box appears. Selected “Area” under “Property”, “US Survey Acres” in “Area Unit” and “NAD_1983_UTM_Zone_11N” in the Coordinate System” boxes. Click Apply. Click OK. **(Figure A2-28)**

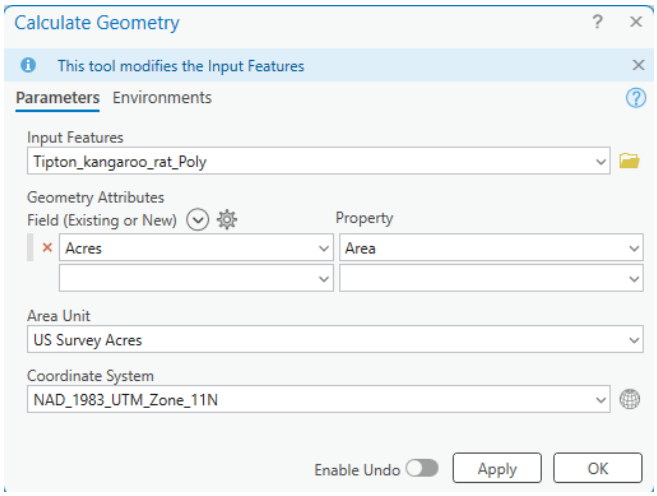


Figure A2-28. Screenshot of Calculate Geometry Dialog Box

2.7. Use Download USA NLCD Land Cover raster, process to determine Percentage of Interim Core Map Represented by NLCD[1] Land Covers

1. Using the MRLC viewer (https://www.mrlc.gov/viewer/) and uploaded a shapefile of area to use as an extent to download the NLCD that covers all the “Tipton_kangaroo_rat_Poly” records. **(Figure A2-29)** The file was downloaded and added to ArcPro and renamed, “NLCD_TKR_Area.tiff”.

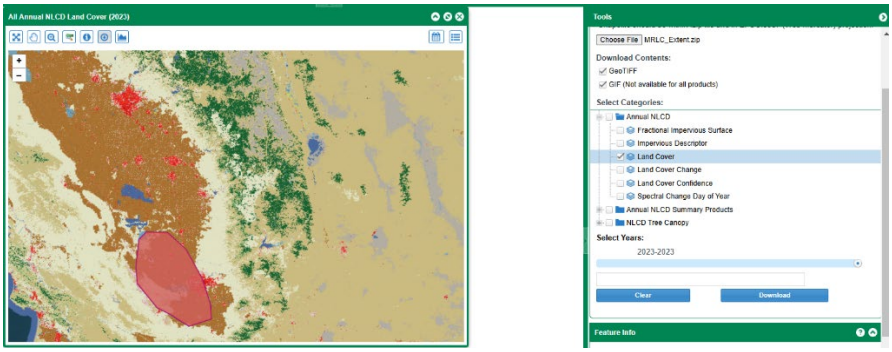


Figure A2-29. Screenshot MLRC Viewer with Shapefile extent

2. The "Extract by Mask" tool was used with "NLCD_TKR_Area.tiff" filtered by the same area within "Tipton_kangaroo_rat_Poly" as the extent. (Figure A2-61) In the "Environments" tab, changed the output coordinate system to match "Tipton_kangaroo_rat_Poly", which in this case is "USA_Contiguous_Albers_Equals_Area_Conic_USGS_version". (Figure A2-62) The output was named, "NLCD_MaskArea1". **(Figure A2-30) (Figure A2-31)**

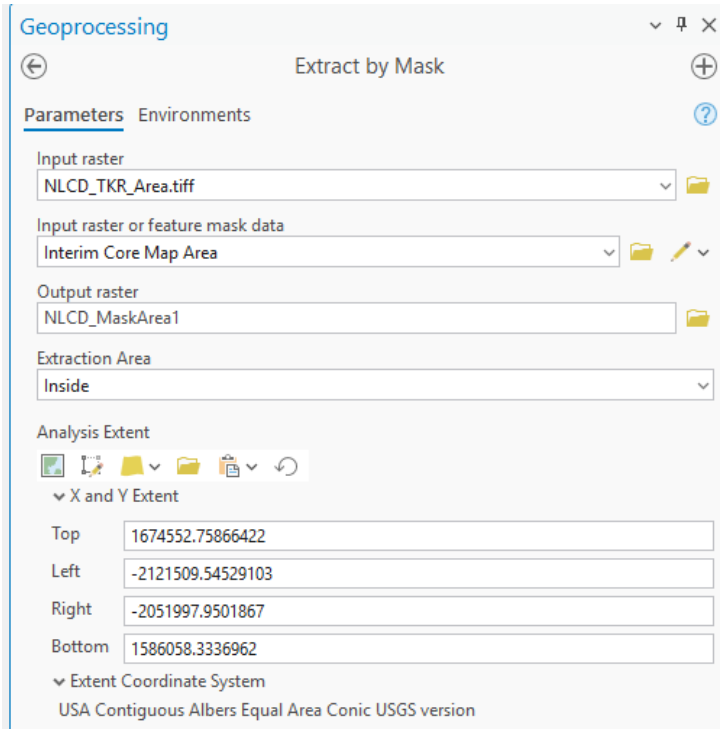


Figure A2-30. Screenshot "Extract by Mask" tool Parameters

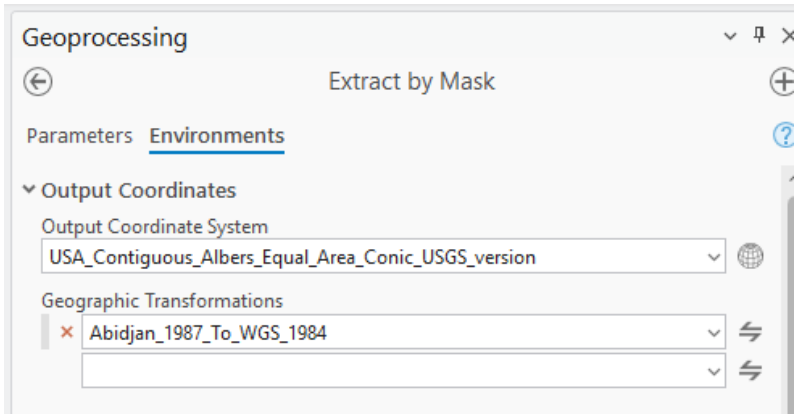


Figure A2-30. Screenshot "Extract by Mask" tool Environment

3. Used the "Tabulate Area" tool to determine the count of area for each NLCD code. **(Figure A2-31)**

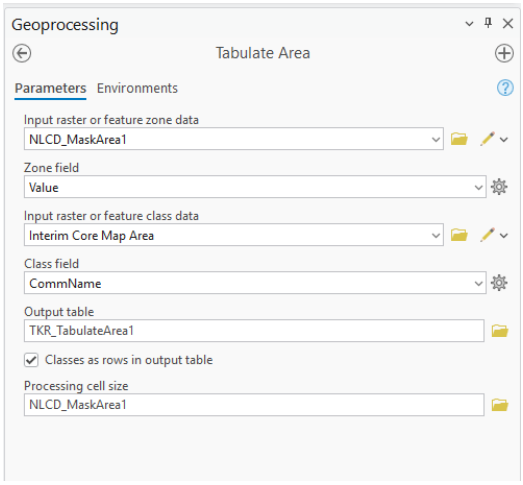


Figure A2-31. Screenshot "Tabulate" tool

4. Add a double field named, "Per" to the "TKR_TabulateArea1" table. Right clicked on field and selected "Calculate Field". Entered the formula "(!Count!/115916)*100". This calculated the percentage of NLCD within the core map area. **(Figure A2-32)** Review results and input into (Table 1. Percentage of Interim Core Map Represented by NLCD Land Covers and Associated Example Pesticide Use Sites/Types.)

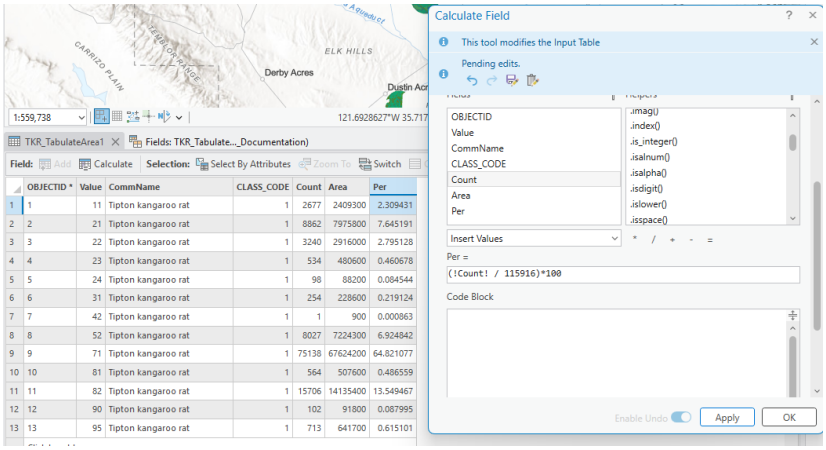


Figure A2-32. Screenshot "Tabulate" tool

2.8. Rationale to not use the EPA Modified Cultivated Layer to "erase" agricultural land in the interim core map layer

1. Switched the base layer to "Imagery". Symbolized the "EPA Modified Cultivated Land" layer with an orange hatch fill and set the transparency at 50%. Labeled the "Vegetation - Great Valley Ecoregion_ds2632" feature class by "Map Class".
2. Zoomed into areas of the interim core map and could see that both the "Imagery" and the "Vegetation - Great Valley Ecoregion_ds2632" indicated that although the "EPA Modified Cultivated Land" indicated cultivated land, both the "Imagery" and "Vegetation - Great Valley Ecoregion_ds2632" often showed something different. **(Figure A2-33) (Figure A2-34)**

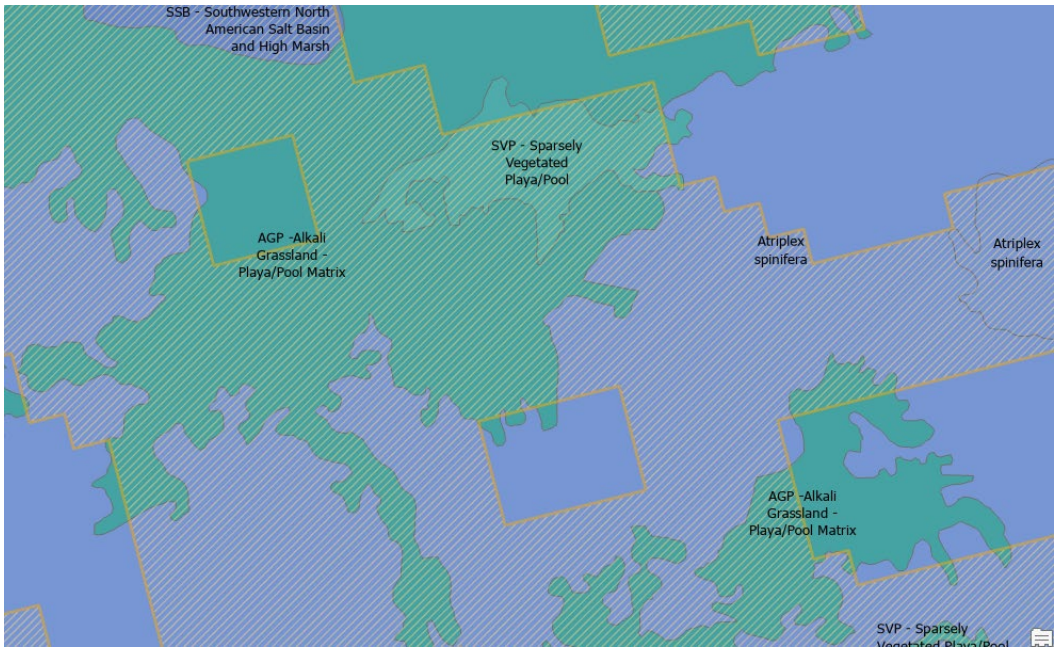


Figure A2-33. Screenshot Interim Core Map area with Gold Hatched Modified Cultivated Land layer and labeled Vegetation - Great Valley Ecoregion_ds2632

Figure A2-34. Screenshot Interim Core Map area with Gold Hatched Modified Cultivated Land layer and Imagery base map

3. Because of the visually reviewing, using the “Erase” tool with the “Modified Cultivated Land” layer will remove land that falls under habitable criteria for the Tipton kangaroo rat and was not done.