Core Map Documentation for the Salt Creek Tiger Beetle (*Cicindela nevadica lincolniana*)

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Interim Core Map Developer: Center for Biological Diversity

Species Summary

The Salt Creek tiger beetle ("SCTB") (Entity ID #4910) is a small, metallic brown to dark olive-green insectivorous beetle that has one of the most restricted ranges of any insect in the United States. The subspecies occurs only on mudbanks along segments of the Little Salt Creek and on sparsely-to-non-vegetated mudflats and seeps containing salt deposits on riparian saline wetlands located in northern Lancaster County of Nebraska's Eastern Saline Wetlands. The beetle has recent critical habitat that covers the entirety of its occupied range, and includes specific public lands such as the Frank Shoemaker Marsh, the Little Salt Creek East Wildlife Management Area, and Little Salt Creek Wildlife Management Area, and the Marsh Wren Community Wetland.

EPA Review Notes

The developers created this core map using the U.S Environmental Protection Agency's (EPA) 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. Some views in this documentation may not necessarily be the views of EPA or its staff.

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. EPA graded the best professional judgment level for this map as a 2 (limited). The developer expressed high confidence in the map, and the spatial extent of the map is well defined, areas outside of the critical habitat were removed based on interpretation of FWS documents. 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 for the Salt Creek tiger beetle is based on the species' designated critical habitat. That critical habitat consists of occupied habitat and suitable habitat that is currently slated for reintroduction. In total, approximately 1,110 acres (449 hectares) in Lancaster and Saunders Counties, Nebraska, fall within the boundaries of our revised critical habitat designation. This includes a 137-foot dispersal distance extended outward from occupied creeks and wetlands to provide the Salt Creek tiger beetle with access to salt flats within the flood plain.

An overlap analysis and core map are presented below:

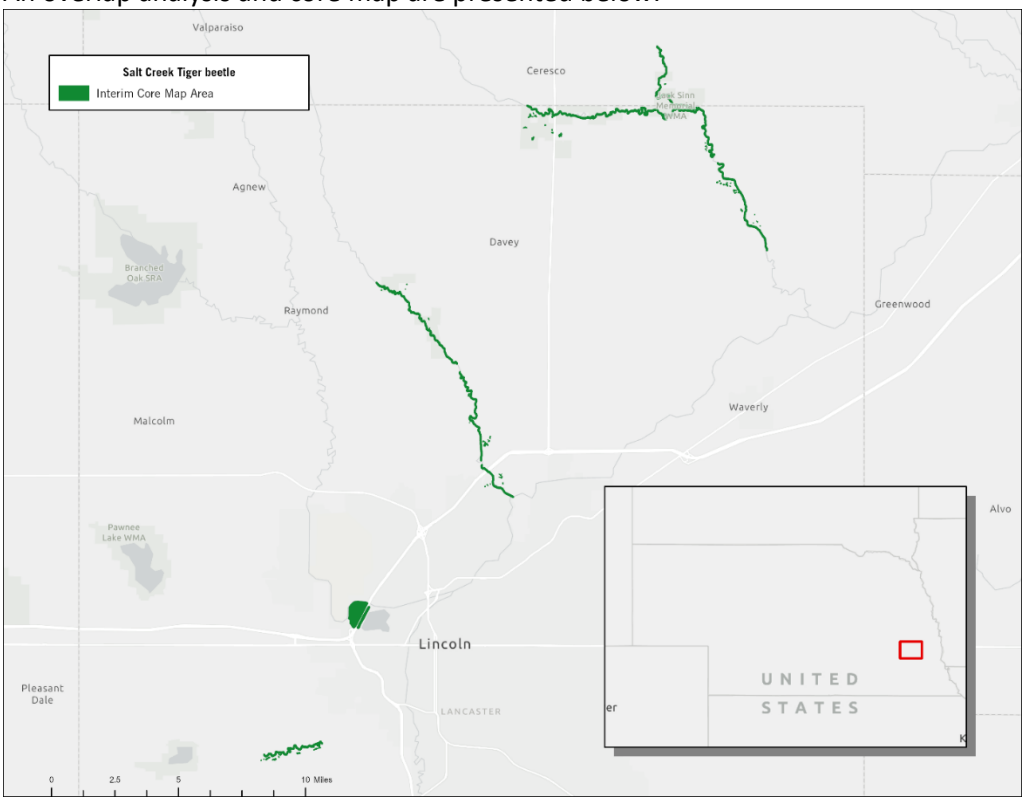

Figure 1. Salt Creek tiger beetle interim core map. The total is acreage is approximately 1,110 acres.

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

Example pesticide use sites/types	NLCD Landcover (Value)	% of core map represented by landcover	% of core map represented by example pesticide use
Forestry	Deciduous Forest (41)	1.1	1.1
Forestry	Evergreen Forest (42)	0	1.1
Forestry	Mixed Forest (43)	0	1.1
Agriculture	Pasture/Hay (81)	49.5	63.3
Agriculture	Cultivated Crops (82)	13.8	63.3
Mosquito adulticide, residential	Open space, developed (21)	2.2	7
Mosquito adulticide, residential	Developed, Low intensity (22)	4.3	7
Mosquito adulticide, residential	Developed, Medium intensity (23)	.5	7
Mosquito adulticide, residential	Developed, High intensity (24)	0	7
Invasive species control	Woody Wetlands (90)	1.3	28.4
Invasive species control	Emergent Herbaceous Wetlands (95)	14.9	28.4
Invasive species control	Open water (11)	.1	28.4
Invasive species control	Grassland/herbaceous (71)	12	28.4
Invasive species control	Scrub/shrub (52)	0	28.4
Invasive species control	Barren land (rock/sand/clay; 31)	.1	28.4

Evaluation of Known Location Information

Known locations all occur within the critical habitat. Reintroductions, both planned and ongoing, also occur within the critical habitat. Since this information was robust enough to determine all known locations, review of GBIF or iNaturalist data was unnecessary.

Approach Used to Create Core Map

The core map was developed using the "Process EPA Uses to Develop Core Maps for Draft Pesticide Use Limitation Areas for Species Listed by the U.S. Fish & Wildlife Service (FWS) and their Designated Critical Habitats" (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;
3. Develop the core map for the species; and
4. Document the core map

For step 1, CBD compiled available information for the Salt Creek tiger beetle from FWS. Appendix 1 provides the compiled information for the beetle, and influential information includes:

- The 2014 critical habitat, which covers all occupied habitat at that time and habitat designated for future reintroductions.
- The 2017 recovery plan, which includes additional details about the beetle's life history and future reintroduction efforts.

For step 2, CBD used the compiled information to identify the core map type. The extant populations and reintroduction sites identified by FWS were located within the species critical habitat. Based on this information, CBD selected the critical habitat core map type, which consists of occupied habitat and habitat sited for reintroductions. The range of the species was not selected as the core map because it contains currently unoccupied habitat, but it was used to confirm that extent of occupied river ranges that occurred outside the critical habitat.

For step 3, CBD used the best available data sources to generate the core map. All GIS data sources used for the Salt Creek tiger beetle are discussed in process documents, with the primary dataset being the critical habitat layer.

EPA in its process document states to include "adjacent catchments upstream of habitat" as well as "identify the catchments flowing into habitat and locate catchments adjacent to the catchments encompassing habitat." However, while the critical habitat is based on river miles, the beetle itself is not an aquatic species, so we did not consider catchments in any final map. Appendix 2 provides more details on the GIS data and analyses used to generate the interim core map.

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

Since the SCTB has an extremely restricted range, consideration of critical habitat is all that was needed to create the map. Range was considered, but the inclusion of substantial non-habitat took range out of consideration. A northern, unoccupied portion of the critical habitat was considered for exclusion of the core map, but was ultimately included due to planned reintroductions in that area.

Appendix 1. Information compiled for species during Step 1

1. Recent FWS documents

2017 Recovery Plan
2022 Five Year Review
2016 Five Year Review
2014 Critical Habitat

2. Background information

Status:

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

Resiliency – low, metapopulations of the subspecies continue to demonstrate low resiliency, as measured by population size and trends, and success rates of reintroductions are difficult to determine given the already low population sizes and limited available suitable habitats.
Redundancy – low, due to limited connectivity and the species narrow, restricted overall range.
Representation – low, due to limited connectivity and the species narrow, restricted overall range.

Habitat, Life History, and Ecology

Habitat:

The entire life cycle of the Salt Creek tiger beetle occurs in saline wetlands, on exposed saline mud flats, or along mud banks of streams and seeps that contain salt deposits and are sparsely vegetated. Larvae have been found only on moist salt flats and salt-encrusted banks of Little Salt Creek in northern Lancaster County. Adults prey on other insects on sandbar, mid-stream gravel bar, and salt flat habitats. Salt Creek tiger beetles require a permanent source of water; open, barren salt flat areas for construction of larval burrows, thermoregulation, and foraging; and mid-stream gravel bars as dispersal corridors.

A species-specific preference for salt and soil moisture is likely important for habitat partitioning and reduction in competition between the Salt Creek tiger beetle and other congener species of tiger beetles that live in saline wetlands. (Recovery Plan, 2017)

Diet:

A larval tiger beetle ambushes prey passing near the burrow entrance. Once it has captured its prey, the larval tiger beetle pulls it into the burrow with the aid of two pairs of hooks on the abdomen. These hooks also function to prevent the larva from being pulled from its burrow by larger prey or predators. Adults prey on other insects. (Recovery Outline, 2017)

Taxonomy:

The Salt Creek tiger beetle is a member of the family *Carabidae*, subfamily *Cicindelinae*, genus *Cicindela*. Eighty-five species and more than 200 subspecies of tiger beetles in the genus Cicindela are known from the United States. The Salt Creek tiger beetle was originally described as a separate species, *C. lincolniana*, but was later identified *C .n. lincolniana* as a subspecies of *C. nevadica* which evolved from *C. n. knausii*. Studies confirmed this sub-species' distinctiveness from other central Great Plains populations of *C. nevadica*. (Recovery Outline, 2017)

Full taxonomy is as follows:

Domain:	Eukaryota
Kingdom:	Animalia

Phylum:	Arthropoda
Class:	Insecta
Order:	Coleoptera
Suborder:	Adephaga
Family:	Cicindelidae
Genus:	*Cicindela*
Species:	*C. nevadica*
Subspecies:	***C. n. lincolniana***

Relevant Pesticide Use Sites:
Cultivation poses a threat to Salt Creek tiger beetle habitats generally through indirect means. Cultivation can increase sediment erosion and result in the introduction of pesticides into adjacent saline wetlands especially in the absence of a grass buffer. (Recovery Plan, 2017)
FWS reports in its recovery plan that pesticides are listed as a primary threat to the Salt Creek tiger beetle. Corn, soybean, and sorghum fields and pasture dominate the Little Salt Creek watershed and are potential sources of pesticide exposure to Salt Creek tiger beetles and their habitat. Insecticides that enter occupied habitats of the Salt Creek tiger beetle through runoff have the potential for indirect impacts through reduction of prey availability. Research on ground beetles (Carabidae) indicates that pesticide exposure may place adult Salt Creek tiger beetles at risk of decreased survival and reproduction. Insecticides and herbicides applied annually to lawns and landscaping in residential and commercial developments near Little Salt Creek also have the potential to enter the creek and impact the Salt Creek tiger beetle and its prey base. (Recovery Plan, 2017)

Relevant Recovery Criteria and Actions:
Objective: Our recovery objectives are to: a) establish self-sustaining metapopulations (comprised of multiple populations); b) establish these metapopulations on multiple stream segments located in the recovery areas identified in the recovery plan in Lincoln and Saunders counties; and c) reduce or eliminate threats to the subspecies, especially those related to agricultural development and practices.
Criteria:
For downlisting: a) establishment of three metapopulations of Salt Creek tiger beetles each numbering between 500 and 1,000 individuals to ensure population viability;
b) establishment of these three metapopulations in three recovery areas; and
c) at a minimum, no net loss of saline wetlands and streams and their associated functions in the Rock, Little Salt, Oak, and Haines Branch Creeks and floodplains since the time of listing (October 2005), with a likely need for restoration and establishment of additional habitat to support recovered populations.

For delisting, in addition to the downlisting criterion: establishment of three additional metapopulations (for a total of six metapopulations) of Salt Creek tiger beetles. These metapopulations would each number between 500 and 1,000 individuals for a minimum 10-year period to ensure viability. The distribution of these metapopulations would span at least four recovery areas. There should be protective measures in place to ensure the long-term persistence of these sites in the absence of ESA protections.
Recovery Actions:
The Salt Creek tiger beetle requires recovery area protection, through (1) protection of the majority of recovery areas that county towards demographic criterion through purchase, conservation easement, or enrollment in WRP, or establishment of buffers; (2) protection of recovery areas through land use

planning. The Salt Creek tiger beetle also requires restoration, management, and research, as well as rearing, propagation, and reintroduction in historical and occupied habitat. Experimental efforts are underway by the Entomology Department of the University of Nebraska at Lincoln (UNL), Lincoln Children's Zoo, and Henry Doorly Zoo to reintroduce SCTB at Little Salt Creek as well as unoccupied Rock, Oak, and Haines Branch creek. Monitoring is also required, as well as annual surveys to track status and trends, and including post-delisting monitoring as required by the Endangered Species Act.

Recommendations for Future Actions:

Conservation efforts by the Saline Wetlands Conservation Partnership, City of Lincoln, Lower Platte South Natural Resource District, and the Nebraska Game and Parks Commission are ongoing and will likely continue into the future. NRCS has spent considerable time working with private landowners to enroll land in Wetland Reserve Programs. As stated above, reintroductions will continue into the future and are critical to the recovery of the Salt Creek tiger beetle.

3. Description of Species Range:

The range for the Salt Creek tiger beetle was last updated on July 17, 2022. The range consists of rounded buffers around known occupied and recovery sites listed in the latest recovery plan, but consist of substantial non-habitat and development in the city of Lincoln.

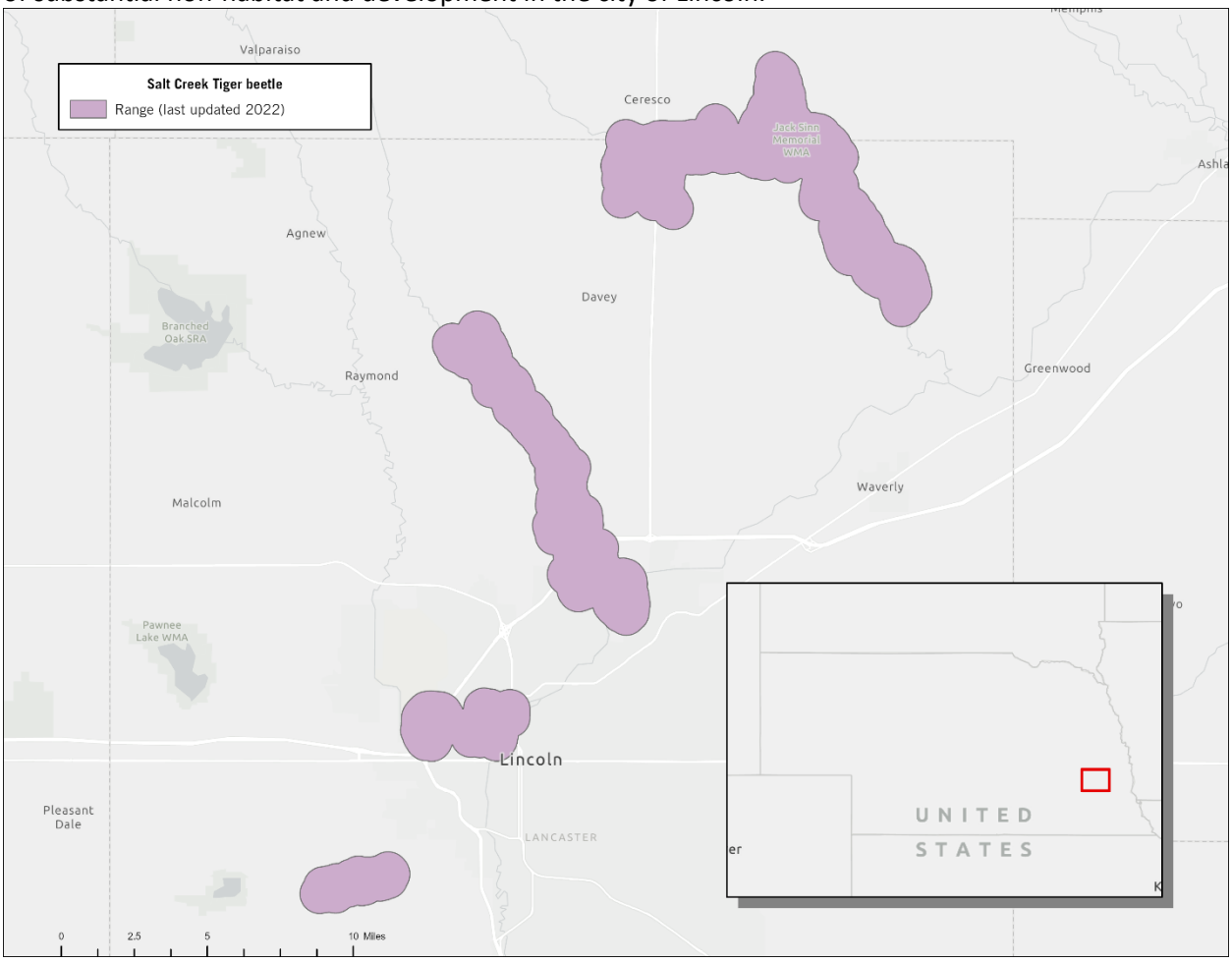

Figure A1-2. FWS range from ECOS for the Salt Creek Tiger Beetle last updated on July 12, 2022. The range is approximately 28,100 acres.

4. Critical Habitat:

In total, approximately 1,110 acres (449 hectares) in Lancaster and Saunders Counties, Nebraska, fall within the boundaries of our revised critical habitat designation.

This critical habitat designation includes saline wetlands and streams associated with Little Salt Creek and encompasses all three habitat areas occupied by the subspecies at the time of listing. It also includes saline wetlands and streams associated with Rock Creek and Oak Creek that are currently unoccupied, but supported the subspecies less than 20 years ago. (CH, 2014). Unoccupied critical habitat is potentially slated for reintroduction, and was thus included as part of this core map discussion. Additionally, a 137-foot (42 meter) dispersal distance was extended outward on either side of these creeks to provide the Salt Creek tiger beetle with access to a vegetative mosaic around the salt flats located in the floodplain.

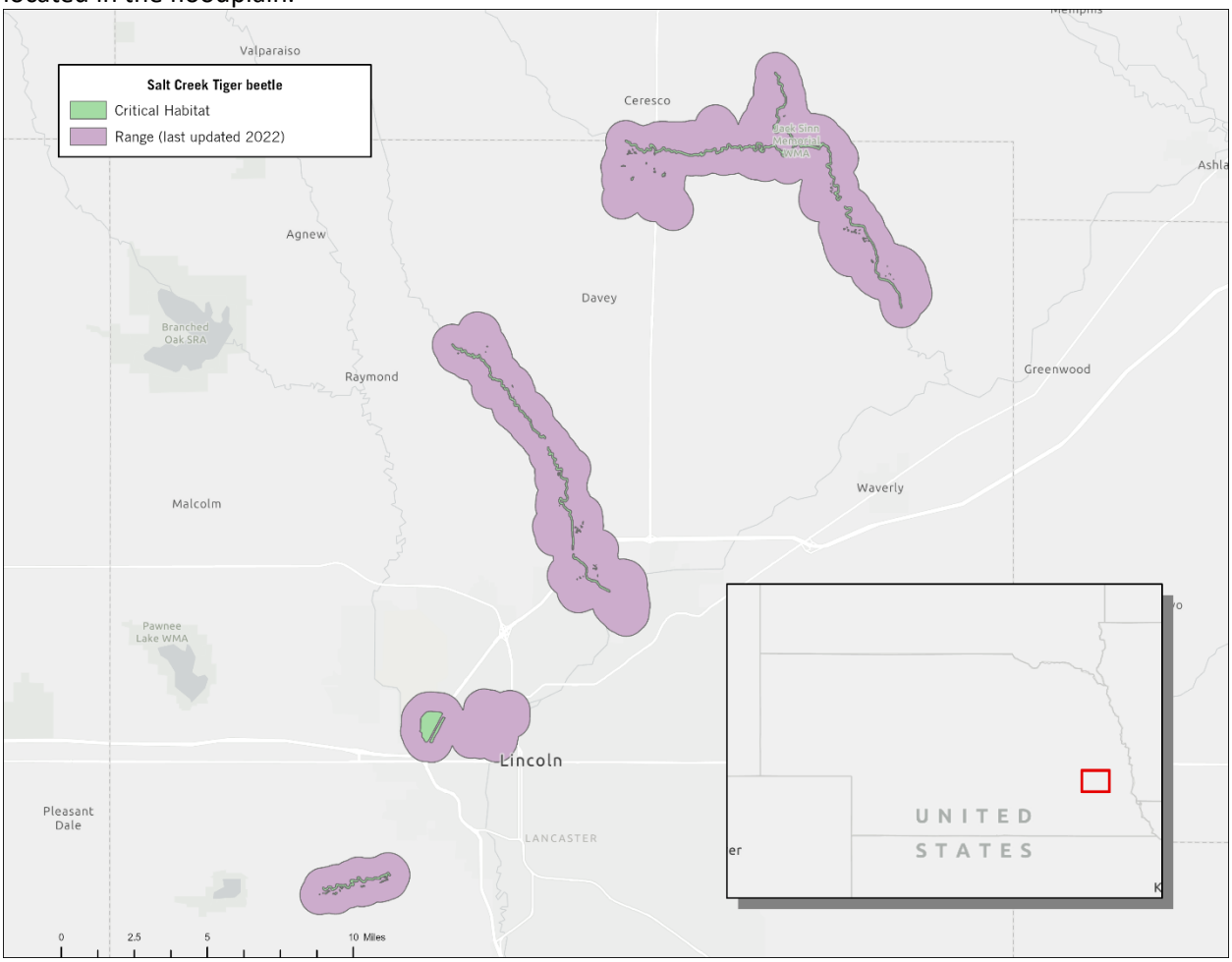

Figure A1-3. Critical habitat for the Salt Creek tiger beetle. The total acreage of critical habitat is approximately 1,110 acres.

5. Known Locations

Comments to the 5 Year Review indicate that since it has not been annually surveyed, and "given the availability of suitable habitat, the Salt Creek tiger beetle could still be present at this site (Old Oak Creek)." (5 YR, 2022)

Reintroductions are stated to occur in currently unoccupied critical habitat. (CH, 2014)

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

The core map type for this species is based on biological information of all known FWS critical habitats for the Salt Creek tiger beetle reported in its 2014 revised critical habitat document.
This section details the data and steps used to create the core map for the Salt Creek tiger beetle based on this biological information.

1. **References and Software**
   - World UTM Grid: https://services.arcgis.com/P3ePLMYs2RVChkJx/arcgis/rest/services/World_UTM_Grid/FeatureServer
   - FWS Species critical habitat: https://ecos.fws.gov/docs/crithab/zip/FCH_Cicindela_nevadica_ssp_lincolniana_20140506.zip
   - Software used: ArcGIS Pro version 3.2

2. **Datasets and Procedures Used in Core Map Development**

2.1. Create a copy of template EPA polygon, copy and paste critical habitats

1. In ArcPro, create a copy of the template EPA polygon feature class for the Salt Creek tiger beetle named "EPA_Salt_Creek_Tiger_beetle_Poly".
2. Export a copy of the 2006 FWS critical habitat "FCH_Cicindela_nevadica_ssp_lincolniana_20140506" shapefile as a feature class. It is named "SCTB_CriticalHabitat".
3. Go to the field view of "EPA_Salt_Creek_Tiger_beetle_Poly". Right click on "EPA_Salt_Creek_Tiger_beetle_Poly"à Data DesignàFields. Right click on the "Descriptio" à Left click on "Copy". Go to the field view of "SCTB_CriticalHabitat"à Right click on "Click here to add a new field" àLeft click on "Paste". **(Figure A2-1) (Figure A2-2)**

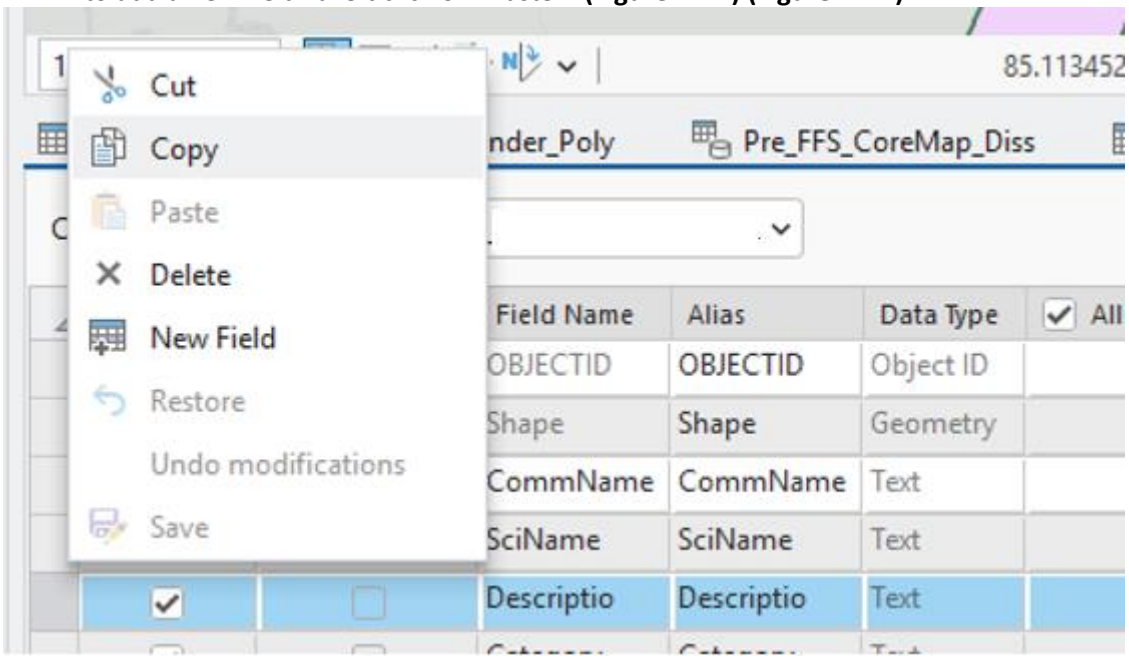

Figure A2-1. Screenshot of "Copy" field

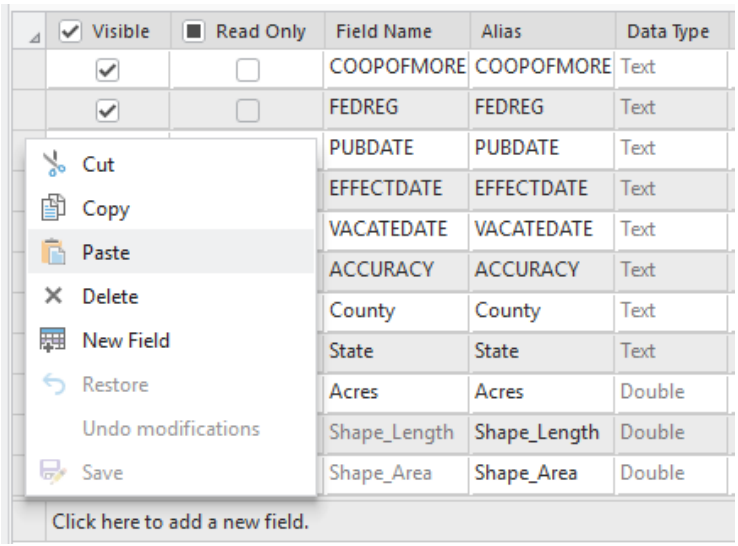

Figure A2-2. Screenshot of "Paste" field

4. Use "Calculate Field" in the "Descriptio" field in "SCTB_CriticalHabitat" feature class. Click on "Descriptio" field à Select "Calculate Field"àType "Salt Creek Tiger beetle critical habitat. Unit name is " + !UNITNAME! + ". Subunit name is " + !SUBUNITNAM! + "." as the expression. àClick Apply **(Figure A2-3)**

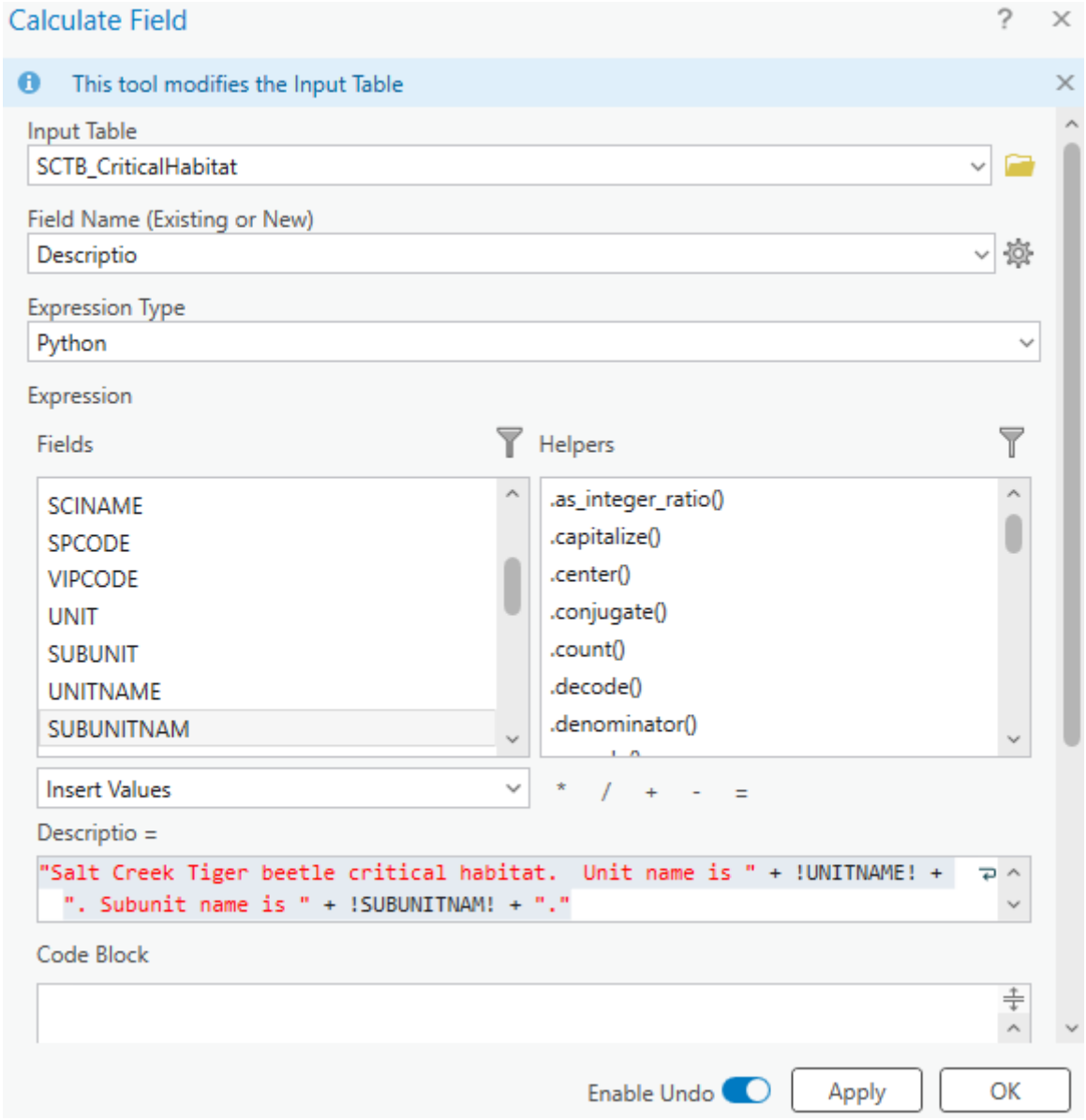

Figure A2-3. Screenshot of "Calculate Field"

5. Copy and paste all the records from the "SCTB_CriticalHabitat" to the "EPA_Salt_Creek_Tiger_beetle_Poly" layer.

2.2. Update the "CommName", "SciName", "Category", "EPA_Code", "FWS_Code", "CBD_Code", "Heritage", and "ECOS_WebPg" field with Field Calculator. Calculate Geometry acres of Polygon Layer.

1. Update the "CommName" field with Field Calculator. Right clicked on "CommName" àSelect "Calculate Field" à Enter " Salt Creek Tiger beetle" below the field name à Set "Enable Undo" à Click "Apply" **(Figure A2-4)**

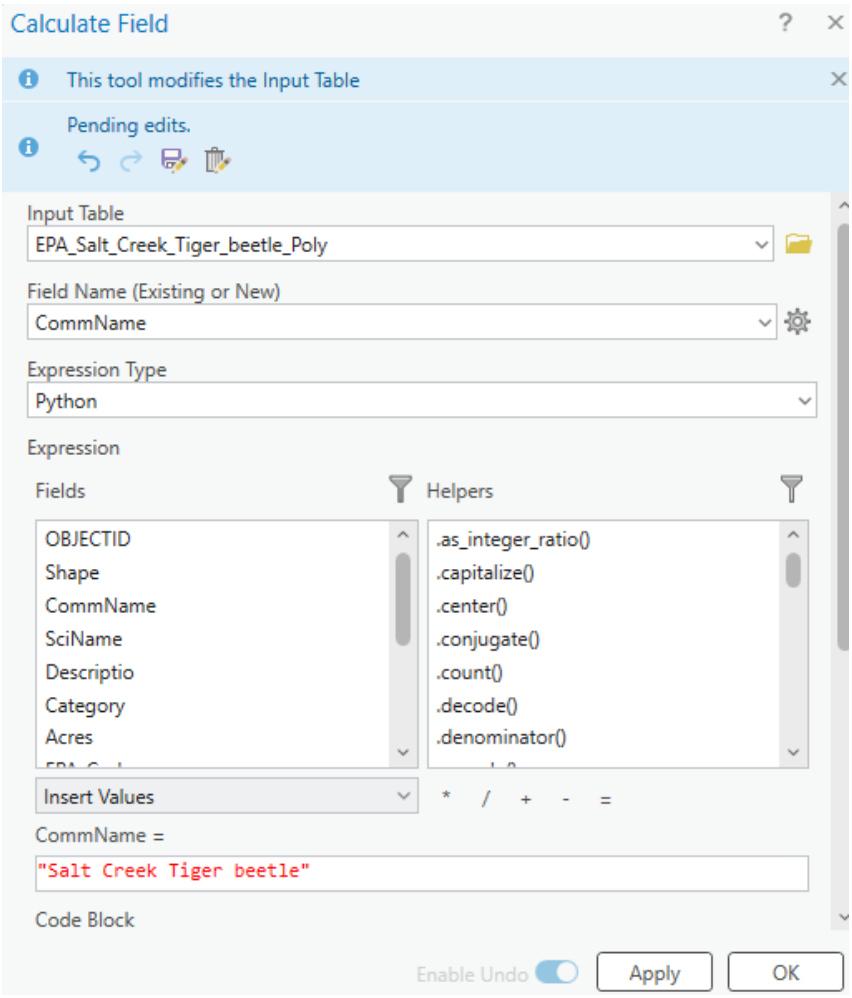

Figure A2-4. Screenshot of "Calculate Field" tool

2. Update the "SciName" field with Field Calculator. Right clicked on "SciName" àSelect "Calculate Field" à Enter "Cicindela nevadica lincolniana" below the field name à Click "Apply" **(Figure A2-5)**

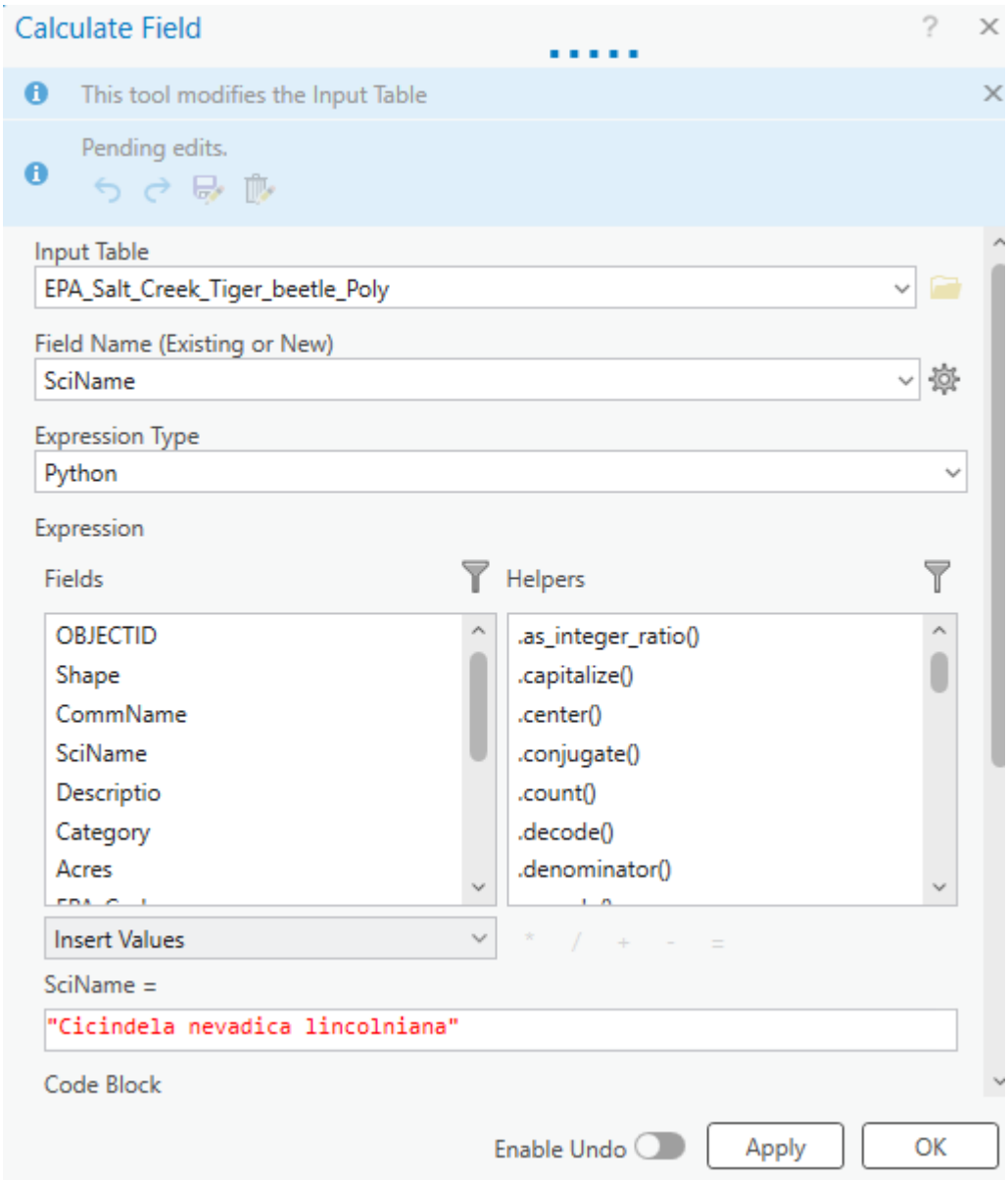

Figure A2-5. Screenshot of "Calculate Field" tool

3. Update the "Category" field with Field Calculator. Right clicked on "Category" àSelect "Calculate Field" à Enter "Area of occupancy" below the field name à Click "Apply" **(Figure A2-6)**

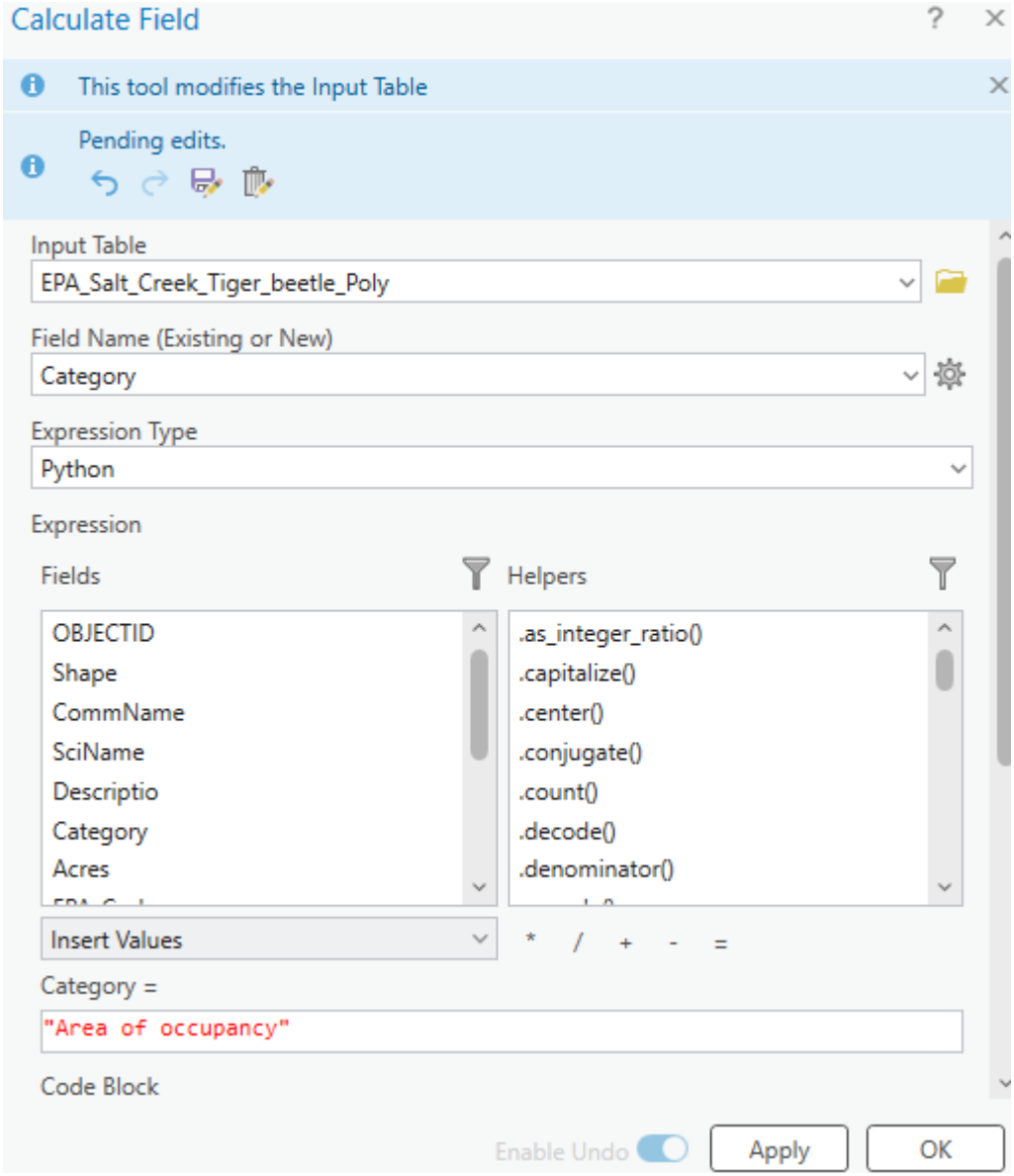

Figure A2-6. Screenshot of "Calculate Field" tool

4. Update the "EPA_Code" field with Field Calculator. Right clicked on "EPA_Code" àSelect "Calculate Field" à Enter "4910" below the field name à Click "Apply" **(Figure A2-7)**

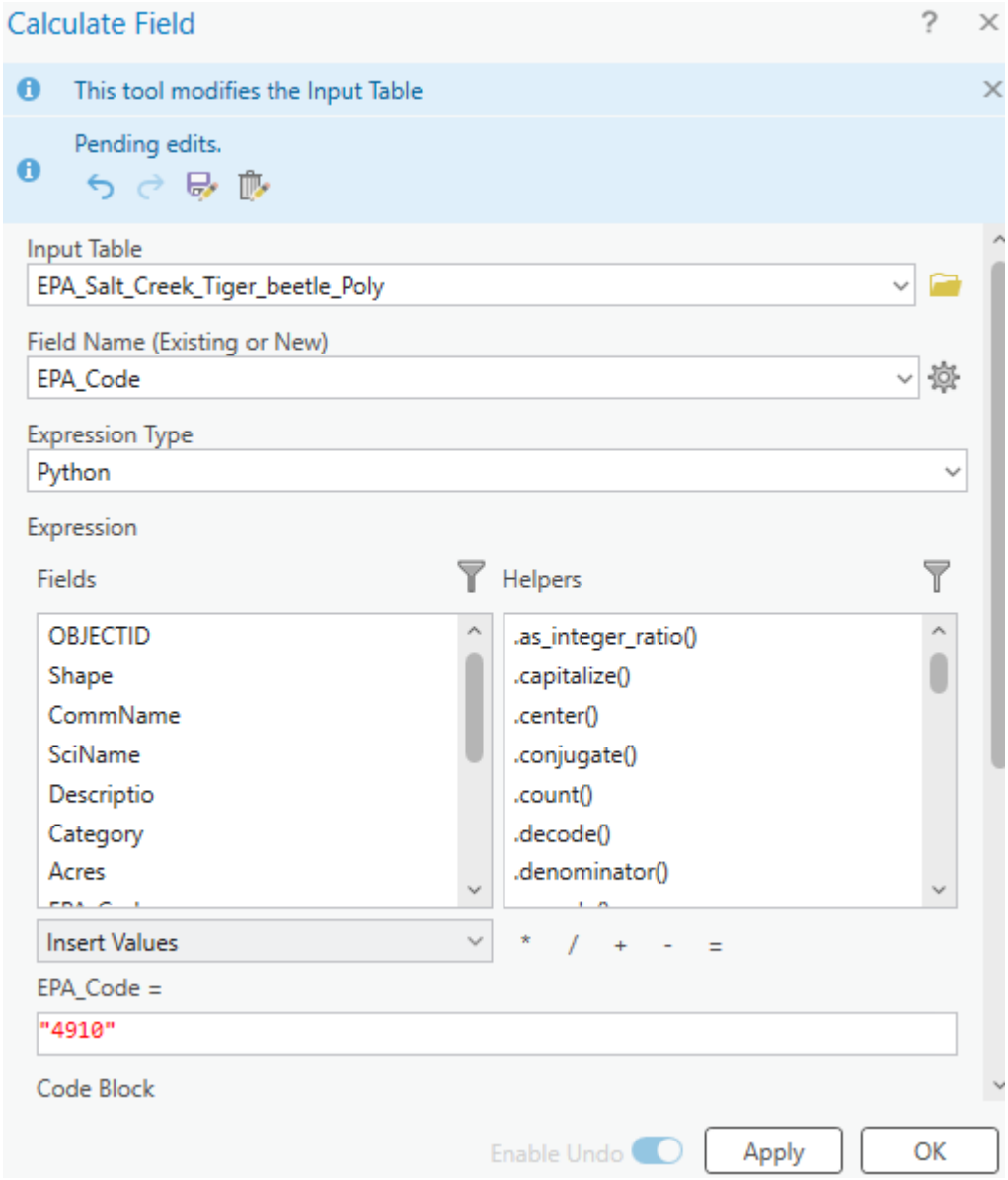

Figure A2-7. Screenshot of "Calculate Field" tool

5. Update the "FWS_Code" field with Field Calculator. Right clicked on "FWS_Code" àSelect "Calculate Field" à Enter "I0QR" below the field name à Click "Apply" **(Figure A2-8)**

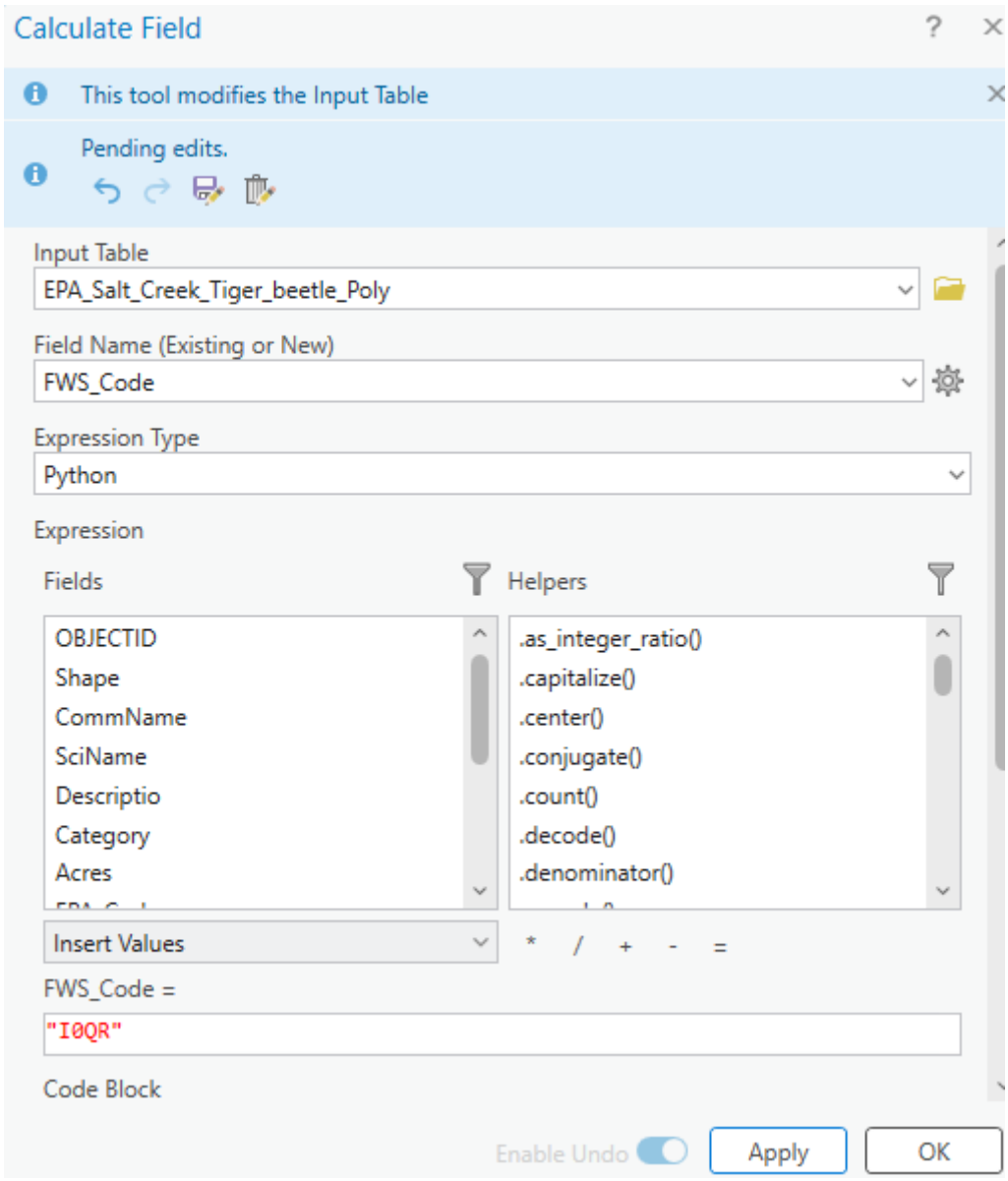

Figure A2-8. Screenshot of "Calculate Field" tool

6. Update the "CBD_Code" field with Field Calculator. Right clicked on "CBD_Code" àSelect "Calculate Field" à Enter "4534" below the field name à Click "Apply" **(Figure A2-9)**

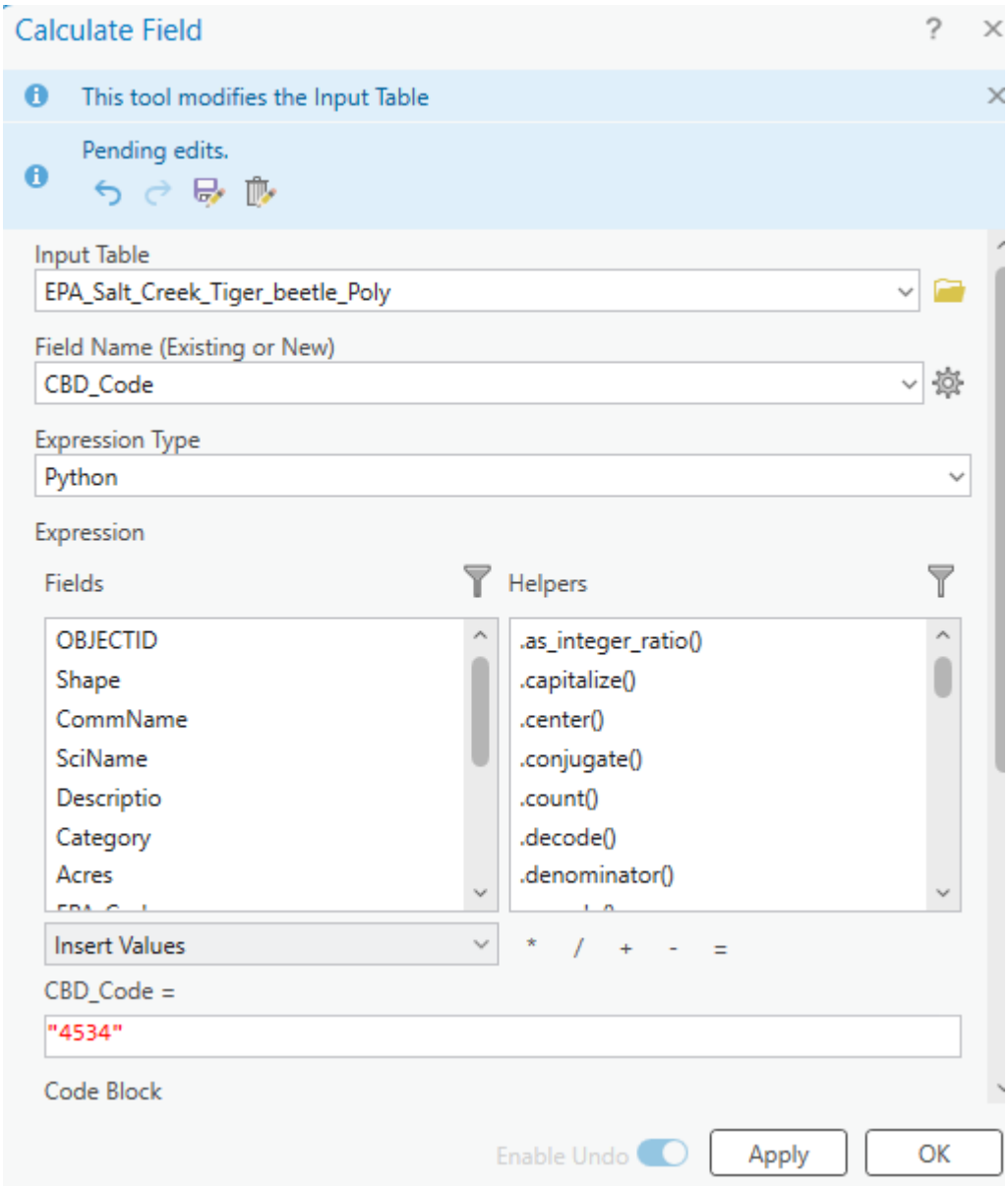

Figure A2-9. Screenshot of "Calculate Field" tool

7. Update the "Heritage" field with Field Calculator. Right clicked on "Heritage" àSelect "Calculate Field" à Enter "0" below the field name à Click "Apply" **(Figure A2-10)**

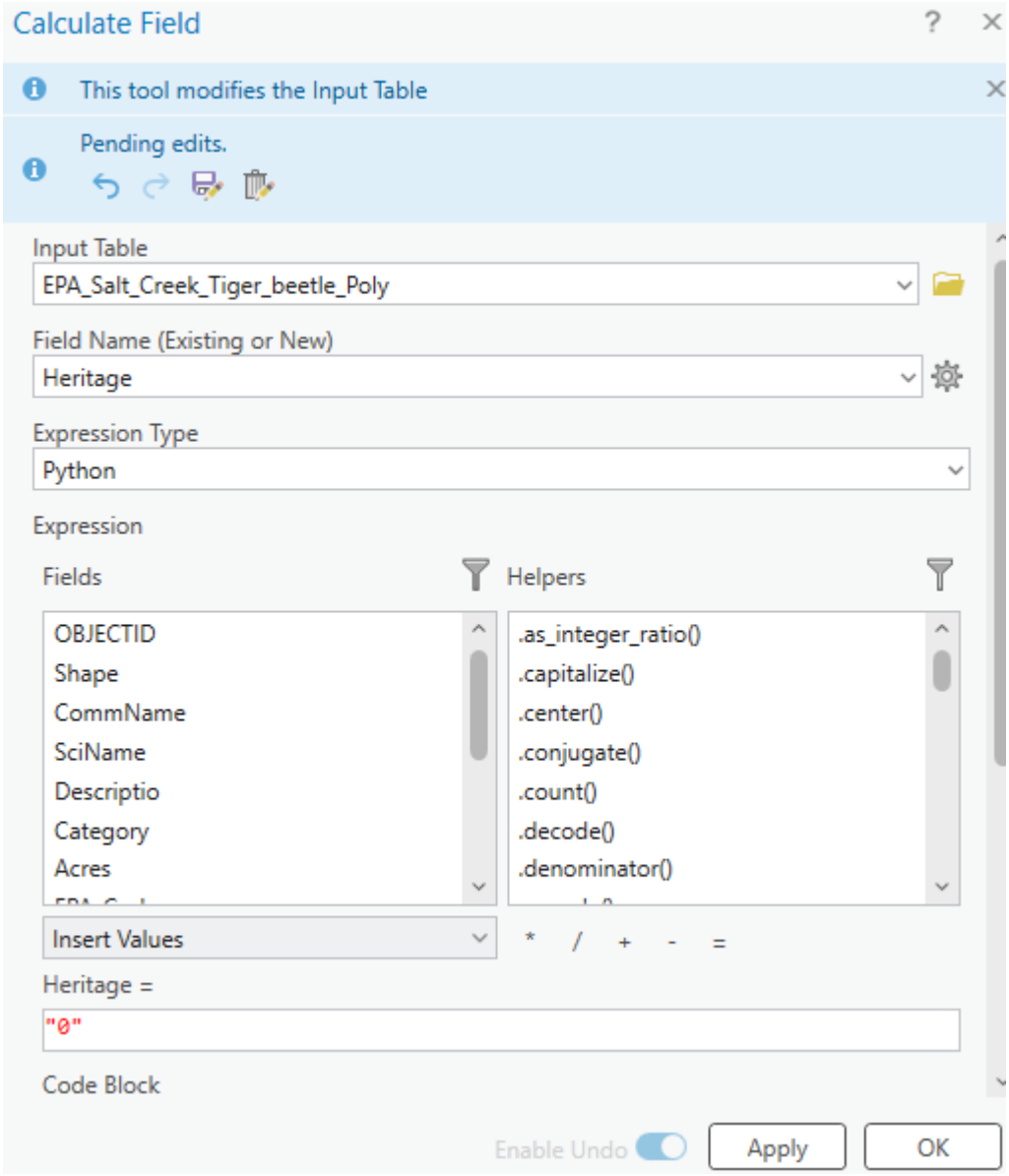

Figure A2-10. Screenshot of "Calculate Field" tool

8. Update the "ECOS_WebPg" field with Field Calculator. Right clicked on "ECOS_WebPg" àSelect "Calculate Field" à Enter " https://ecos.fws.gov/ecp/species/342" below the field name à Click "Apply" **(Figure A2-11)**

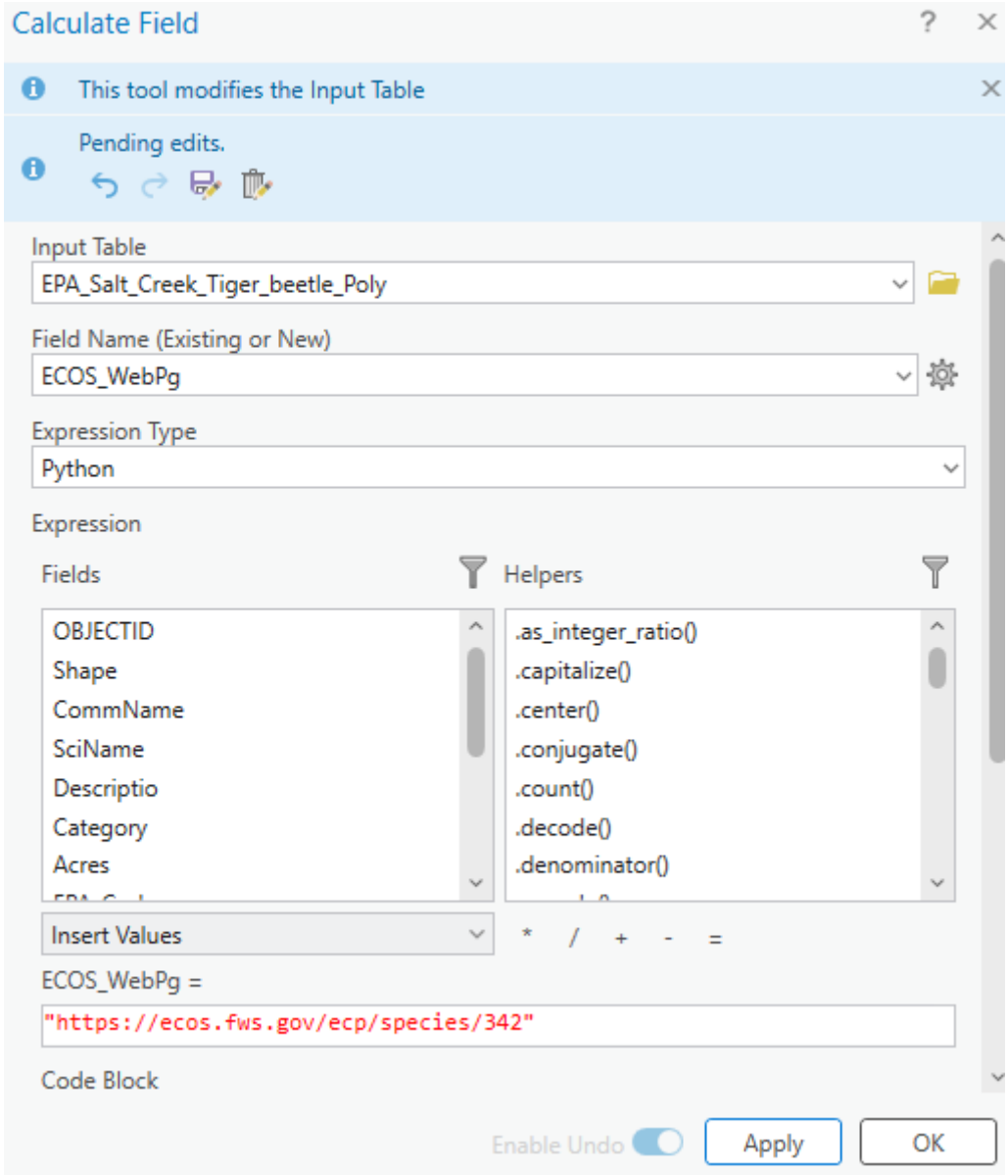

Figure A2-11. Screenshot of "Calculate Field" tool

9. "World UTM Grid" layer and identify the UTM zone as "14". Right-click on the "Acres" fieldàleft-click on "Calculate Geometry". "Calculate Geometry" dialog box appears. Select "Area" under "Property", "US Survey Acres" in "Area Unit" and NAD_1983_UTM_Zone_14N" in the Coordinate System" boxes. Click Apply. Click OK. **(Figure A2-12)**

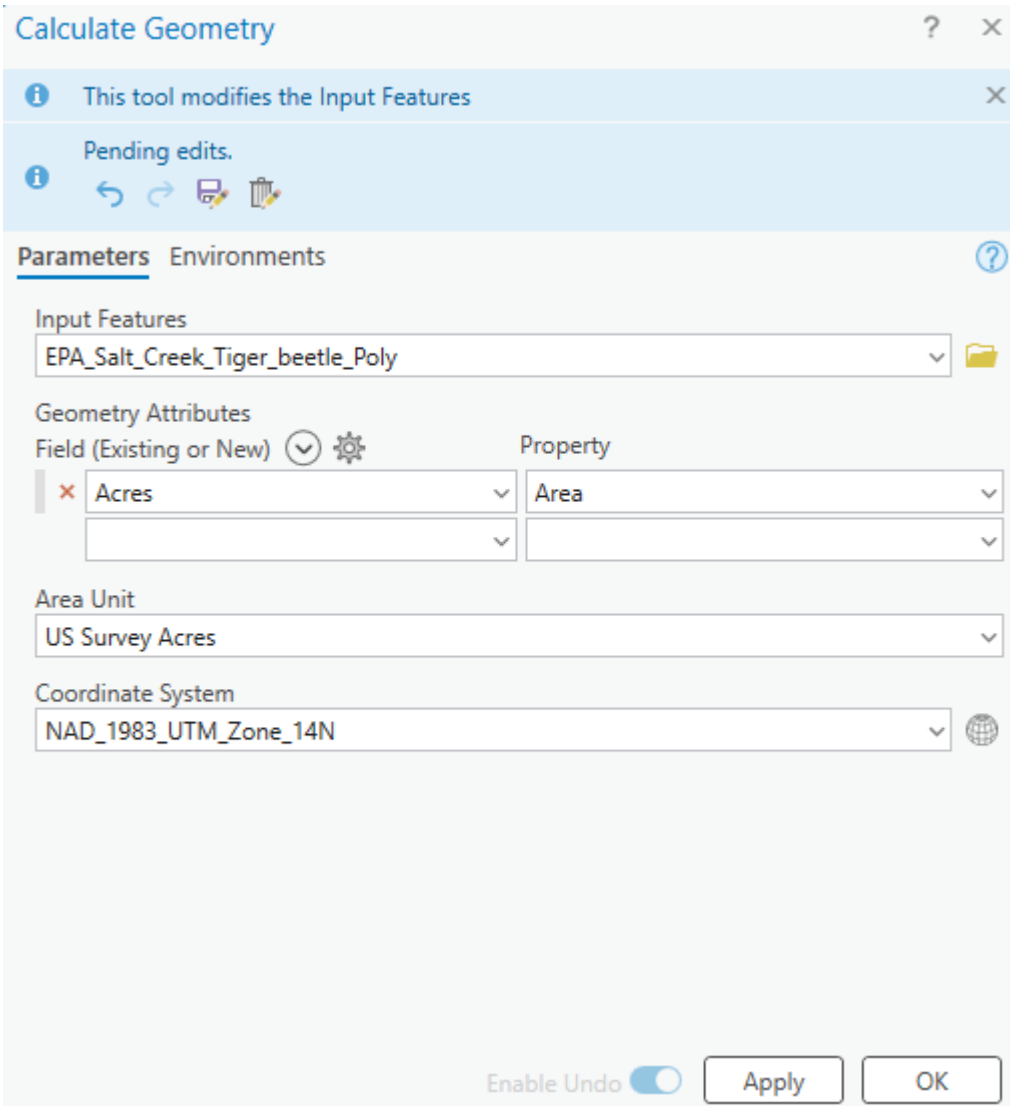

Figure A2-12. Screenshot of "Calculate Geometry" tool

2.3. Check if EPA's "CultivateAreas_Over25acres" overlaps "EPA_Frosted_Flatwoods_salamander_Poly" feature class

1. As mentioned in the critical habitat determination, the entire life cycle of the Salt Creek tiger beetle occurs in saline wetlands, on exposed saline mud flats, or along mud banks of streams and seeps that contain salt deposits and are sparsely vegetated. Additionally, a 137-foot (42 meter) dispersal distance was extended outward on either side of these creeks to provide the Salt Creek tiger beetle with access to a vegetative mosaic around the salt flats located in the floodplain. The intersection of cultivated land and the critical habitat is small, and removal of this area could increase the likelihood of extirpation. This process was not done.

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

1. In the critical habitat comments (3) and (7), there were concerns expressed about the reduction of the acreage. Any further reduction by geo-processing without knowledge of the ecosystem can cause long-term negative impact to the species and was not done.

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

1. Use the MRLC viewer (https://www.mrlc.gov/viewer/) and upload shapefile of area to use as an extent to download the NLCD that covers all the “EPA_Salt_Creek_Tiger_beetle_Poly” records. **(Figure A2-13)** Downloaded the file and add it to ArcPro and name it, “NLCD_SCTB_Area1.tiff”.

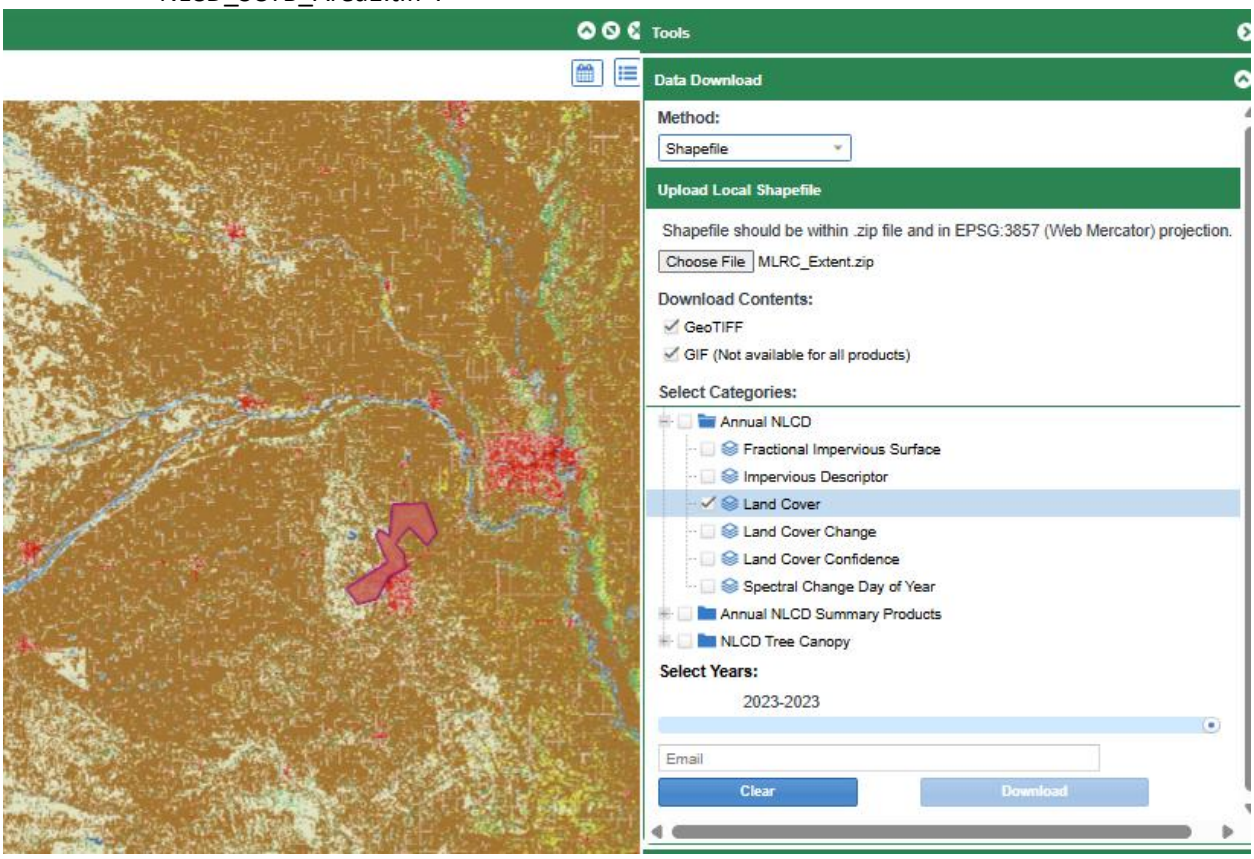

Figure A2-13. Screenshot MRLC Viewer with Shapefile Extent

2. Use the “Extract by Mask” tool with “NLCD_SCTB_Area1.tiff” filtered by the same area within “EPA_Salt_Creek_Tiger_beetle_Poly” as the extent. In the “Environments” tab, change the output coordinate system to match “EPA_Salt_Creek_Tiger_beetle_Poly”, which in this case is “USA_Contiguous_Albers_Equals_Area_Conic_USGS_version”. The output is named, “NLCD_MaskArea1”. **(Figure A2-14) (Figure A2-15)**

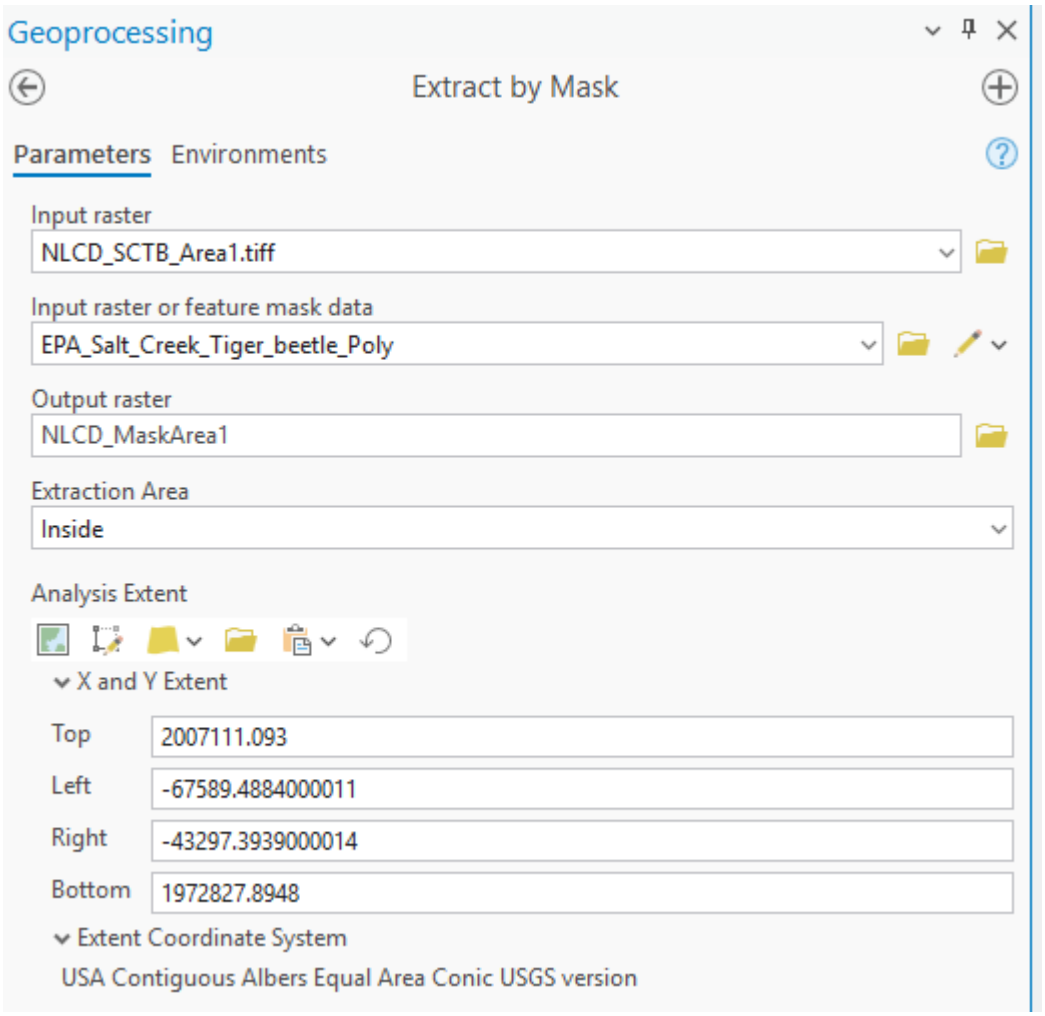

Figure A2-14. Screenshot "Extract By Mask" Tool Parameters

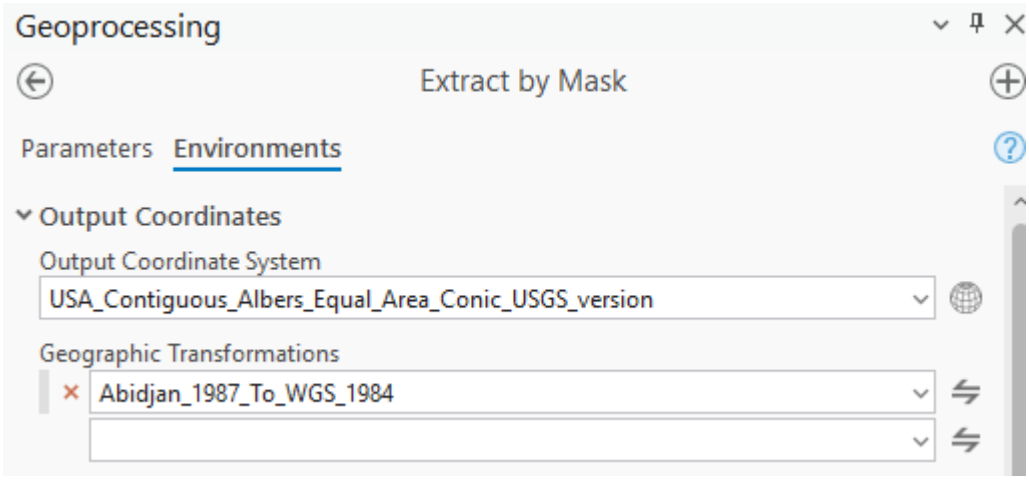

Figure A2-15. Screenshot "Extract By Mask" Tool Environments

3. Use “Tabulate Area” tool to determine the count of area for each NLCD code. **(Figure A2-16)**

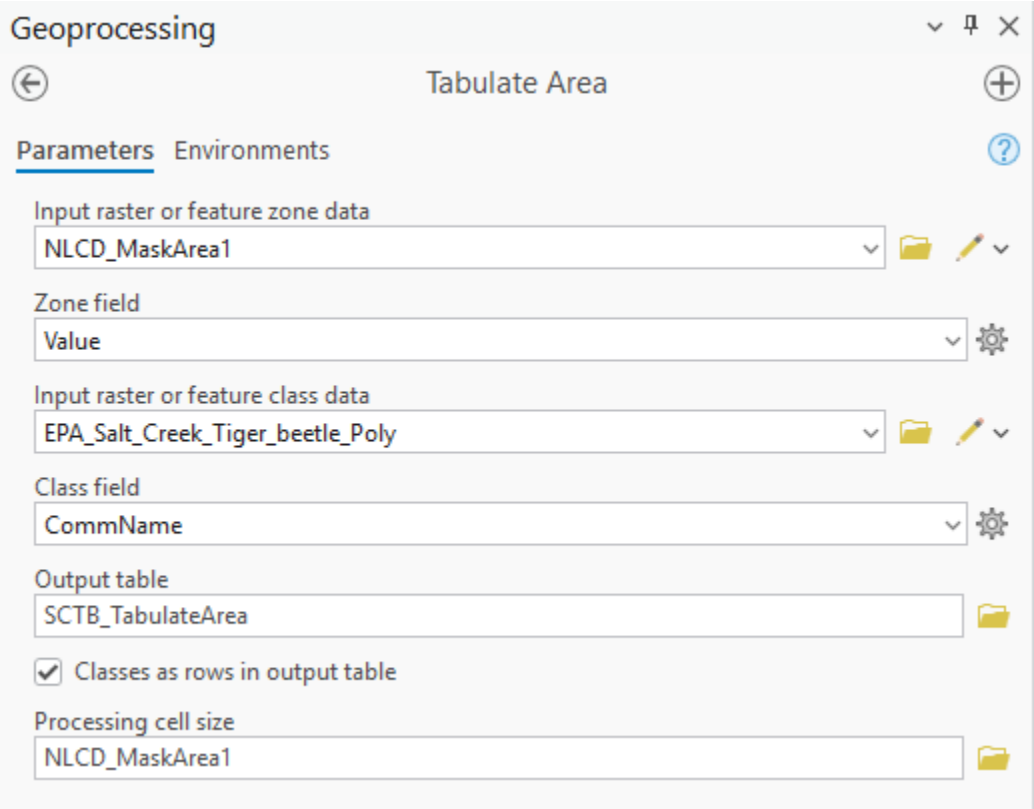

Figure A2-16. Screenshot “Tabulate Area” Tool

4. Add a double field named, “Per” to the “SCTB_TabulateArea1” table. Right click on field and select “Calculate Field”. Enter the formula “(!Count!/ 4985)*100”. This calculates the percentage of NLCD within the core map area. **(Figure A2-23)** Review results and input into (Table 1. Percentage of Interim Core Map Represented by NLCD Land Covers and Associated Example Pesticide Use Sites/Types.)

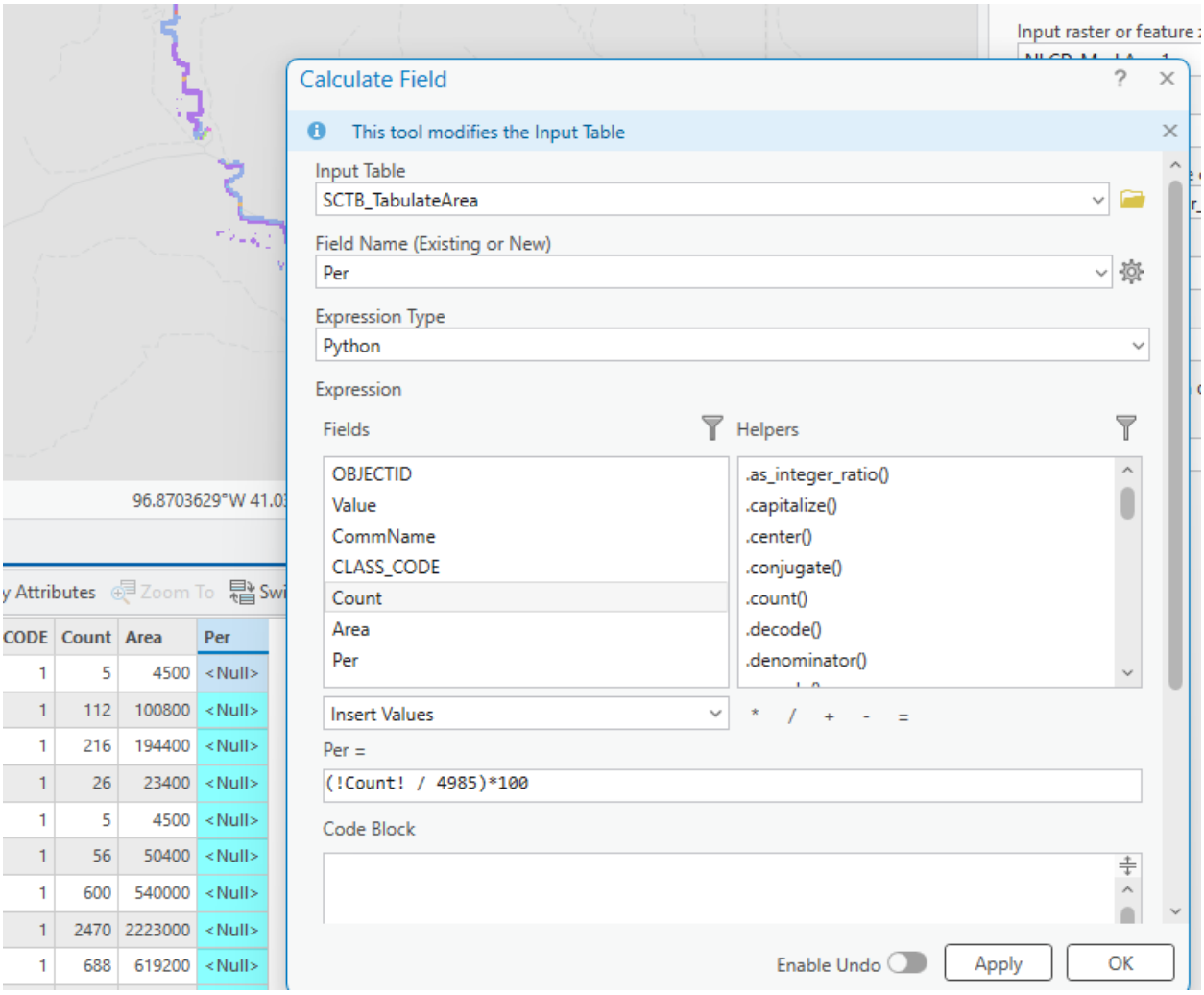

Figure A2-17. Screenshot of "Calculate Field" tool