Core Map Documentation for the Reticulated Flatwoods Salamander (*Ambystoma bishopi*)

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Draft Interim Core Map Developer: Center for Biological Diversity

Species Summary

The reticulated flatwoods salamander (EntityID # 9943) is a pond-breeding amphibian with a complex life cycle; i.e., there is an aquatic egg and larval life history stage, as well as a terrestrial metamorphosed juvenile and adult stage. They are moderately-sized salamanders with relatively short, pointed snouts and stout tails. As adults, flatwoods salamanders migrate to ephemeral (seasonally-flooded) wetlands to breed in the fall, where females lay eggs singly on bare mineral soil in small depressions that later fill with water (Anderson and Williamson 1976; Palis 1995a, 1997).

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 reflect the viewpoints 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 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 for the reticulated flatwoods salamander is based on biological information, specifically the species' known locations. All current known locations have been identified by the U.S. Fish and Wildlife Service (FWS) in the 2020 Species Status Assessment and in the 2009 critical habitat determination. The known locations include critical habitat and two areas outside of the critical habitat.

All 16 critical habitat locations were considered occupied at the time of designation in 2009, but subsequent surveys indicate that two critical habitat areas on public land are considered no longer occupied. Critical habitat unit 2B on Blackwater River State Forest lands and critical habitat unit 6B on

Pine Log State Forest lands are no longer considered occupied (SSA 2020 p. 28) and were removed from the core map. All critical habitat areas on private land were presumed occupied and retained in the core map.

Two additional occupied areas were added to the core map. State wildlife agency staff found new breeding wetlands at Escribano Point Wildlife Management Area (WMA) in Santa Rosa County, FL, was surveyed in 2015-17 (SSA 2020 pp. 28-29). Precise locations of the breeding wetlands were not available and the entire southern portion of Escribano Point WMA was added to the core map. Additionally, many occupied breeding wetlands have been documented at Eglin Air Force Base (AFB) prior to listing and in recent surveys. These Department of Defense lands were not included in the critical habitat designation, but are considered extant in the SSA (SSA 2020 p. 28). Precise locations of occupied wetlands at Eglin AFB were not available. Areas within Eglin AFB that intersected with the ECOS range map were added to the core map (see Appendix 2 for more detail).

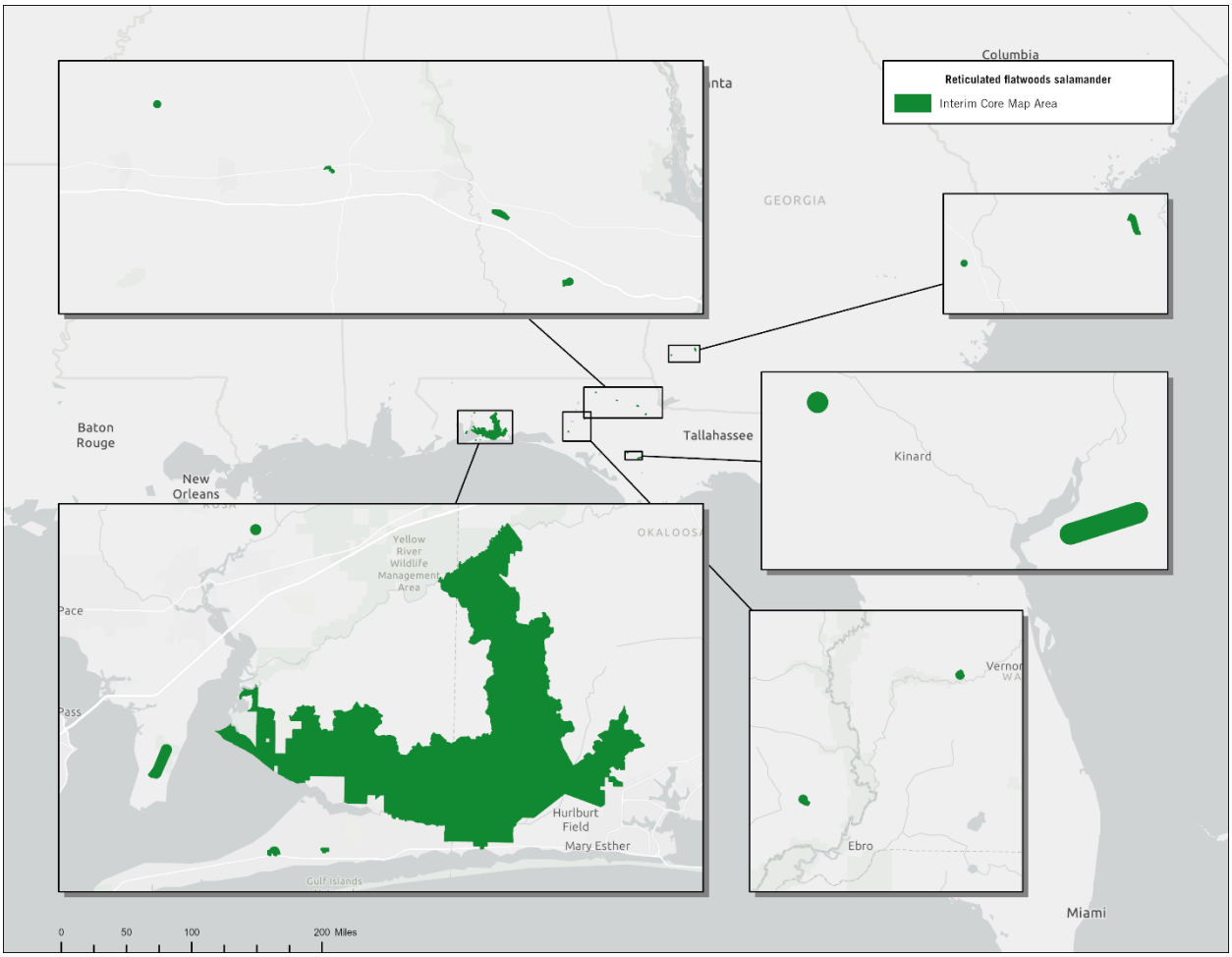

Figure 1. Reticulated flatwoods salamander's interim core map. (83,705 acres)

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	47
Forestry	Evergreen Forest (42)	47	47
Forestry	Mixed Forest (43)	0	47
Agriculture	Pasture/Hay (81)	3	3
Agriculture	Cultivated Crops (82)	0	3
Mosquito adulticide, residential	Open space, developed (21)	3	3.7
Mosquito adulticide, residential	Developed, Low intensity (22)	.7	3.7
Mosquito adulticide, residential	Developed, Medium intensity (23)	0	3.7
Mosquito adulticide, residential	Developed, High intensity (24)	0	3.7
Invasive species control	Woody Wetlands (90)	27.2	48.9
Invasive species control	Emergent Herbaceous Wetlands (95)	1	48.9
Invasive species control	Open water (11)	0.1	48.9
Invasive species control	Grassland/herbaceous (71)	10.7	48.9
Invasive species control	Scrub/shrub (52)	9.6	48.9
Invasive species control	Barren land (rock/sand/clay; 31)	.3	48.9

Evaluation of Known Location Information:

- 2009 Critical Habitat Designation

FWS designated critical habitat in 2009 based on known occupied sites. In total, 16 sites were designated critical habitat and were all considered occupied in 2009. Occupied areas in Eglin AFB, Hurlburt Field, and NOLF Holley were considered, but not included in the final designation. (See Appendix 1)

- 2020 Species Status Assessment

The best, most comprehensive set of location information is in the 2020 Species Status Assessment (SSA). The 2020 SSA, indicates that the reticulated flatwoods salamander had 20 populations at listing in 2009, but this number had decreased to six populations in Santa Rosa and Okaloosa counties in Florida, and Miller County in Georgia (**Table A1-4** and **FigureA1-2**). However, **Table A1-4** does not include populations found at Escribano Point WMA after 2015 which would add another six breeding wetlands (SSA 2020 p. 28). **Table A1-4** also presumes that all locations on private land are extirpated, but explicitly

states that "[m]any private land populations have not been effectively sampled between 2010 and 2015 to know if they are still occupied" (SSA 2020 p. 28). Without sufficient survey effort to assess their status, the Center gives populations on private lands the benefit of the doubt and retains them in the core map.

- iNaturalist, GBIF, and NatureServe occurrences
    - iNaturalist had seven research grade occurrences which all aligned with areas of the core map (specifically the Florida panhandle).
    - GBIF also had seven occurrences which all aligned with areas of the core map (specifically the Florida panhandle).
    - NatureServe displayed this species' distribution as aligning with the core map, with that distribution being focused on the Florida panhandle. However, the hexagonal areas were not specific enough to influence the core map.

Location data included in the Species Status Assessment is visualized in **Appendix 2**. **Appendix 1** includes additional details on the available known location information.

Approach Used to Create Core Map

The core map is based on biological information and includes designated critical habitat and known location information. Critical habitat was considered as the core map type but was not selected because it does not contain all the known locations with extant populations of this species identified by FWS. Designated critical habitat contained most, but not all the known extant locations. Two additional locations at the Escribano WMA and Eglin AFB (except for Biancur Field which was excluded given that it is an active airfield) which were added to the core map (see Appendix 1 for details on extant locations). The Center used the best available data sources identified by FWS in the 2020 Species Status Assessment.

The occupied areas are well known for the reticulated flatwoods salamander and a small amount of uncertainty was introduced to produce the core map. The uncertainty score for this core map is 2 ("limited") based on best professional judgement due to the addition of known occupied areas that are outside of the designated critical habitat. Added areas were based on ECOS range map and Public Areas Database sources.

Appendix 2 provides more details on the GIS analysis and data used to generate the core map.

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

- Range Map Approach for Core Map

A core map based on the species range was rejected because the ECOS range map is watershed scale and includes large areas of non-habitat. The known occupied pools are between 200 and 800 acres in size so a watershed scale core map is inappropriate.

- Critical Habitat Approach for Core Map

A core map based only on critical habitat would protect most sites known at listing, but would not include all sites. Some sites on Elgin Air Force Base were not designated as critical habitat and new sites have been found at Escribano Point Wildlife Management Area. Nearly all critical habitat is still considered occupied, but critical habitat alone does not contain all known sites.

- Habitat Modeling Approach for Core Map

A core map based on habitat modeling was rejected because the modeled habitat includes large areas of potential habitat that are unoccupied. FWS has created a habitat model for the reticulated flatwoods salamander (SSA 2020 p. 37) (**Figure 2**). This habitat model includes a large amount of unoccupied area and was judged to be inappropriate for a core map because enough information exists about known or presumed occupied sites to develop a core map.

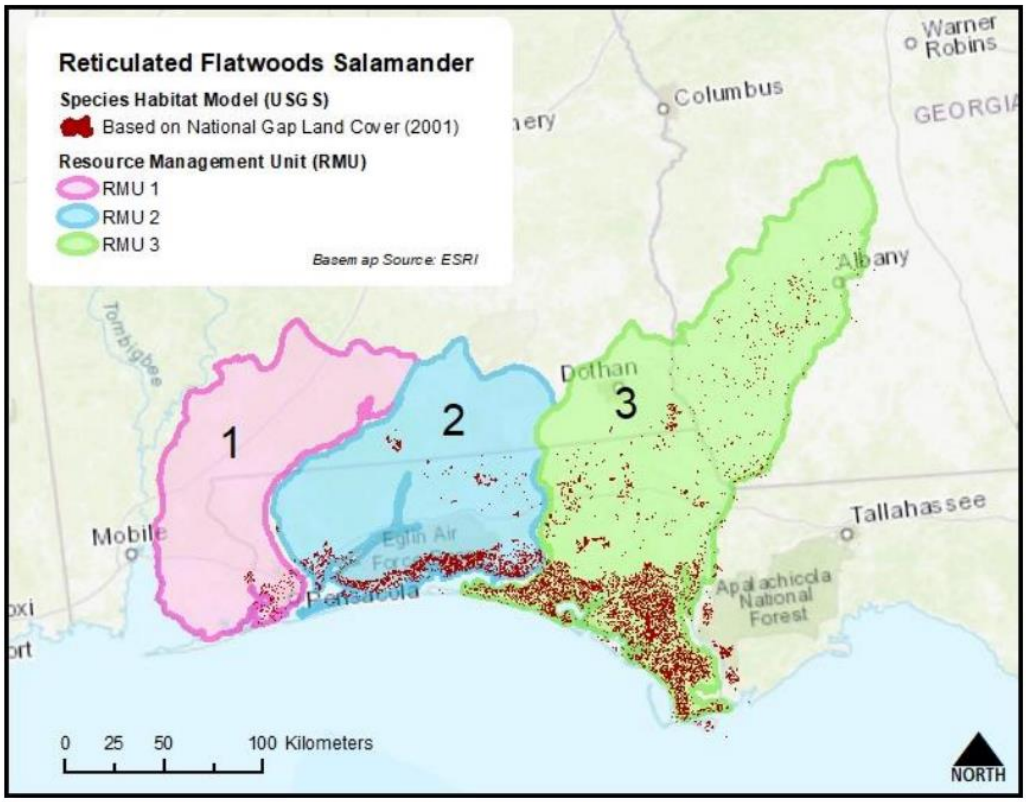

Figure 3.4 potential suitable habitat within each RMU boundary

Figure 2. Potential suitable habitat model output for the reticulated flatwoods salamander. Map from 2020 SSA p. 37.

- Other sources of information reviewed but not included

None

Appendix 1: Information Complied During Step 1 for the Reticulated Flatwoods Salamander

1. **Recent FWS Documentation/links**
   - 5-Year Status Review: Summary and Evaluation (May 2023). Available at https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/4104.pdf
   - U.S. Fish and Wildlife Service Recovery Plan For the Reticulated Flatwoods Salamander (*Ambystoma bishopi)* (June 2021) Available at https://ecos.fws.gov/docs/recovery_plan/20210615_RETICULATED_Flatwoods_Salamander_RP.pdf
   - 5-Year Status Review: Summary and Evaluation (August 2015) Available at https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2326.pdf
   - 74 Fed. Reg. 6700 (Feb. 10, 2009) Available at https://www.govinfo.gov/link/fr/74/6700?link-type=pdf

2. **Background information**
   - Status: Federally listed as endangered in 2009
     - Resiliency, redundancy, and representation (the 3Rs). All data from the 2020 Species Status Assessment and the 2023 Recovery Plan. Resiliency, assessed at the population level, describes the ability of the salamander to withstand stochastic disturbance events. Like many amphibians that breed in ephemeral wetlands, flatwoods salamanders exhibit dramatic fluctuations in abundance across years. Out of 29 occupied ponds assessed in the last SSA, 17 were assessed as highly resilient, 9 were moderately resilient, and 4 had low resilience. See **Table A1-1** for a summary of resiliency by occupied site.

Table A1-1. Assessments of resiliency of the reticulated flatwoods salamander at occupied sites. Table from 2020 SSA p. 33.

Property	Extremely low/ Mean	Extremely low/ SD	Low/ Mean	Low/ SD	Moderate/ Mean	Moderate/ SD	High/ Mean	High/ SD	Extremely High/Mean	Extremely High/SD	Total Ponds
EAFB	8	8.3	12	11.5	40	9.6	81	35.3	0	0.0	14
EPWMA	0	0.0	0	0.0	36	36.4	9	9.1	50	50.0	10
MWMA	0	0.0	0	0.0	0	0.0	100	0.0	0	0.0	2
GPWMA	100	N/A	0	N/A	0	N/A	0	N/A	0	N/A	1
YRMSP	0	N/A	0	N/A	100	N/A	0	N/A	0	N/A	1
HF	0	N/A	100	N/A	0	N/A	0	N/A	0	N/A	1
Total											**29**

Note: Responses are the percent pf extant breeding wetlands that fit into each point on the 5-point resiliency scale: (1) extremely low resiliency; (2) low resiliency; (3) moderate resiliency; (4) high resiliency; or (5) extremely high resiliency. EAFB= Eglin Air Force Base; EPWMA= Escribano Point WMA; MWMA= Mayhaw WMA (Georgia); GPWMA= Garcon Point WMA; YRMSP= Yellow River Marsh State Park; HF= Hurlburt Field.

Redundancy. The salamander has dwindled from 476 species at the time of listing to only 63 locations from 2010 to 2015. Loss of habitat coupled with the difficulty in amphibian recolonization areas after local extinction have created sever isolation in the remaining population. Multiple populations are required across the species range.

Representation The reticulated flatwoods salamander historically occurred within the western Coastal Plain of the Florida panhandle, extreme southwestern Georgia, and extreme southeastern Alabama (Palis and Means, 2005). The species is currently represented in three separate metapopulations capable of at least short term sustainability. Two of these metapopulations are within Eglin Air Force Base (EAFB) and the other at Escribano Point Wildlife Management Area, outside the western boundary of Eglin, along the eastern coast of Pensacola Bay, Florida. However, all populations occur in only two Recovery Management Unit (“"RMU”), which greatly increases the risk of extinction without multiple groups of genetically diverse salamanders that occupy a variety of habitats across a species range. A summary of RMU reproduced below, which summarizes known location information referenced in Section X:

- 3R’s information presented in the 2020 SSA Recovery Management Unit 1
  - This unit currently no known/current populations as the vast majority occur in RMU 2 (Eglin AFB, Hurlburt Field, and Escribano Point WMA). However, there are areas of private ownership that have not been surveyed in decades. It is possible that remnant populations do occur on some private lands that are currently unavailable to survey. There are new efforts to prepare some private lands for potential translocation. Those plans are currently in development. There are historic sites on private land for which access and future plans are currently being negotiated.
- Recovery Management Unit 2
  - This unit contains the three resilient populations and will be the source for the great majority of recovery and reintroduction/translocation efforts aimed at recovering populations in RMU 1 and RMU 2 in the future. Precise population numbers are difficult to accurately convey as annual counts can be misleading if weather is not conducive to successful breeding years. As mentioned in the recovery plan, drought during breeding seasons seems to be more frequent, resulting in reduced breeding success or outright seasonal failure. The better description is trend information which seems to be holding steady or slightly increasing during this review period with several ponds having had larvae detected that were not detected prior to this 5-year review period.
- Recovery Management Unit 3
  - As is the case with RMU 1, this unit has only 1 semi-resilient population at Mehaw WMA in southern Georgia. This population is intermittently present depending on the season, and currently only presence/absence surveys are conducted.

Habitat

5-Year Review (2015)

- Breeding wetlands are located within mesic (moderate moisture) to intermediate mesic longleaf pine (Pinus palustris)-dominated flatwoods/savanna communities where adults and

metamorphosed juveniles spend the rest of their life outside of the breeding season. There are some variations in vegetation, geology, and soils among geographic areas within the range of the salamander; however, basic characteristics are fairly similar throughout. Longleaf pine flatwoods/savannas are characterized by low flat topography and relatively poorly drained, acidic, sandy soil that becomes seasonally saturated. In the past, this ecosystem was characterized by open pine woodlands maintained by frequent fires. Naturally ignited by lightning during spring and early summer, these flatwoods historically burned at intervals ranging from 1 to 4 years. The topography can vary from nearly flat to gently rolling hills (the latter is true especially in the Dougherty Plain of SW Georgia).

- The groundcover of the longleaf pine flatwoods/savanna ecosystem is typically dominated by wiregrass (Aristida stricta [= A. beyrichiana] Kesler et al., 2003). Other herbaceous plants often found in the groundcover include toothache grass (Ctenium aromaticum), bluestems (Andropogon spp.), beakrushes (Rhynchospora spp.), pitcherplants (Sarracenia spp.), meadowbeauties (Rhexia spp.), and a variety of legumes. Low-growing shrubs, such as saw palmetto (Serenoa repens), gallberry (Ilex glabra), blueberries (Vaccinium spp.), and huckleberries (Gaylussacia spp.) co-exist with a highly diverse suite of grasses and forbs in the groundcover.

- Flatwoods salamanders breed and deposit eggs in wetlands that are not yet inundated with water . Adults select areas of complex and diverse stands of herbaceous vegetation within breeding wetlands for egg deposition. In this microhabitat, eggs are typically located in small depressions that likely minimize desiccation of developing embryos in the otherwise dry wetland. As noted, management of breeding wetlands for this species should include a suite of management actions that increase the cover of herbaceous vegetation.

- Larval flatwoods salamanders occur in acidic , tannin-stained ephemeral wetlands (swamps or marshes) that typically range in size from <1 to 10 acres but may reach or exceed 30 ac (. Ponds typically fill in late fall or early winter, and dry in late spring or early summer. Summer thunderstorms may refill some ponds, but most of these dry again by early fall.

- Canopy cover of occupied ponds is typically moderate and ranges from near zero to almost 100%. When dry, breeding ponds burn naturally due to periodic wildfires (especially during late spring and summer), thus fire scars are frequent on live trees within the basin, and smaller trees and shrubs are often killed or topkilled.

- Depending on canopy cover and midstory, the herbaceous groundcover of breeding sites can vary widely, although larvae are most often associated with higher amounts of herbaceous cover, which, on average, is >40% coverage of the wetland . Most, but not all, breeding sites exhibit distinct vegetative zonation, with bands of different herbaceous plant assemblages in shallow vs. deeper portions of the pond.

- These ponds often harbor small fishes; the most typical species include pygmy sunfishes (Elassoma spp.), Eastern mosquitofish (Gambusia holbrookii), and banded sunfish (Enneacanthus spp.) (Palis, 1997) Typical amphibian associates of flatwoods salamander larvae include southern leopard frog (Ranasphenocephala), ornate chorus frog (Pseudacris ornata), and dwarf salamander (Eurycea quadridigitata) larvae, as well as larval and adult newts (Notophthalmus viridescens)

Diet

Because of its complex life cycle, the diet of the reticulated flatwoods salamander consists of aquatic prey consumed by larvae as well as terrestrial prey consumed by adults and juveniles. Freshwater crustaceans comprised of 96% of all invertebrates consumed by larval flatwoods, consisting mostly of isopods, amphipods, cyclopoids, copepods, and cladocerans. The only non-vertebrate prey item eaten by the salamander is larval dwarf salamanders.

Terrestrial salamanders are primarily fossorial and spend much of their time in crayfish burrows and root channels, where they are also known to consume earthworms. Adults and juveniles are noted opportunistic feeders consuming larval and adult insects, spiders, centipedes, isopods, and snails. (SSA, 2020)

Taxonomy

The reticulated flatwoods salamander is a species of the tiger salamander family (Ambystomatidae:Ambystoma). The currently accepted classification for the reticulated flatwoods salamander is (Integrated Taxonomic Information System, 2018):

Phylum: Chordata
Class: Amphibia
Order: Caudata
Family: Ambystomatidae
Genus: Ambystoma
Species: Bishopi

Relevant Pesticide Use Sites

The 2015 5-year review notes that pesticides and herbicides may pose a threat to amphibians such as the reticulated flatwoods salamander because their permeable eggs and skin readily absorb substances from the surrounding aquatic or terrestrial environment. Negative effects on amphibians may include delayed metamorphosis, paralysis, reduced growth rates, and mortality. Herbicides used near reticulated flatwoods salamander breeding ponds may alter the density and species composition of vegetation surrounding a breeding site and reduce the number of potential sites for egg deposition, larval development, or shelter for migrating salamanders. Aerial spraying of herbicides over outdoor ponds has been shown to reduce zooplankton diversity, a food source for larval reticulated flatwoods salamanders and cause very high (68-100 percent) mortality in tadpoles and juvenile frogs (5 Year Review, 2015).

Adjacent agricultural croplands and pasturelands, mosquito treatment areas, invasive species treatment, and other non-crop vegetation management are potential pesticide uses that could impact the reticulated flatwoods salamander.

Relevant Recovery Criteria and Actions

Objective:

Recovery actions to achieve the recovery objectives over the next 20 years are to determine if the species is progressing toward the overall goal of restoring adequate redundant populations to representative portions throughout its historic range where possible whether the extant populations demonstrate resiliency to the extent that the species no longer require the protection of the Endangered Species Act.

Criteria:

(1) At least 101 resilient metapopulations exhibit a stable or increasing trend are extant or re-established as evidenced by natural recruitment, and multiple age classes

(2) Approximately one third of the 101 (roughly 34) resilient metapopulations are present in each of the three Recovery Management Units (RMUs; Figure 1) that represent the spatial distribution of historic range: RMU 1 (Western Complex), RMU 2 (Eglin Complex), and RMU 3 (Eastern Complex).

(3) Threats have been addressed and/or managed to the extent that the species will remain viable into the foreseeable future. Breeding and adjacent upland habitats within the resilient metapopulations are protected long-term though management agreements, public ownership, or other means, in sufficient quantity and quality to support growing populations.

Recovery Actions:

Ensure adequate, high-quality habitat is available to support a resilient reticulated flatwoods salamander population.

Increase the number of resilient reticulated flatwoods salamander populations to the extent possible of its historic range, within the three RMUs. In implementing this, FWS has endeavored to increase possibility of reintroduction despite inherent difficulties and have had some success in “headstarting” i.e. rearing captive eggs and returning to natal ponds.

Improve knowledge needed to increase the number of resilient reticulated flatwoods salamander populations through research and adaptive management

Recommended Future Activities:

Use herbicides selectively to remove hardwoods and non-native vegetation from breeding and upland habitats.

Populations of salamanders can persist in less-than-ideal habitat which may differ from what is presented above. Appropriate management will be needed at most of these sites to prevent the populations from disappearing as habitat conditions worsen. For example, fire suppression at many sites has led to greater canopy closure in the overstory of both the flatwoods uplands and ephemeral ponds (Bishop and Haas 2005, Gorman et al. 2009, Gorman et al. 2013) and the shrub layers of both habitats have similarly increased (Gorman et al. 2013). This has resulted in a lower cover of herbaceous

groundcover that is less diverse. In the absence or paucity of growing-season fire, slash and/or pond pine may become dominant over longleaf pine in the flatwoods uplands.

Further, the ecotone between the breeding wetland and associated flatwoods may be obscured or nonexistent, replaced with a dense layer of shrubs, such as titi, fetterbush, and dog hobble (Leucothoe spp.) due to fire suppression or exclusion (Gorman et al. 2013). Additionally, prescribed burns across the range of the species are conducted most often in winter and early spring when ponds would typically be flooded and less likely to burn (Bishop and Haas 2005). To increase effective burning of flatwoods salamander habitat, land managers should diversify burning strategies (Bishop and Haas 2005). Other options may include burning uplands during the dormant season and return in the growing season to burn wetlands when they are dry (Gorman et al. 2009). Mechanical treatments can be coupled with fire to restore sites that have become too overgrown for fire alone to restore the site (Gorman et al. 2013). Other types of suboptimal habitat, such as roadside ditches and borrow pits that have the physical and biotic characteristics of natural breeding sites may be used by flatwoods salamanders, especially when located near natural breeding ponds (Anderson and Williamson, 1976; Palis, 1995b; Stevenson, 1999; Gorman and Haas, unpubl. data).

3. Description of Species Range

Historically, flatwoods salamanders (both species) occurred throughout the Coastal Plain of the southeastern U.S., across South Carolina, Georgia, Alabama, and the panhandle of Florida. *Ambystoma bishopi* occurred in Mobile, Baldwin, Covington, and Houston counties in Alabama, Escambia, Santa Rosa, Okaloosa, Walton, Holmes, Washington, Bay, Jackson, Calhoun, and Gulf counties in Florida, and Seminole, Decatur, Early, Miller, Baker, Dougherty, and Lee counties in Georgia. Over time and despite recently increased efforts to survey historical locations and find new populations, the combined range of *A. bishopi* has dwindled from 476 historical locations (i.e., mostly individual breeding sites) prior to 1999 to only 63 locations over the last five years (86.8% loss) (see **Figure A1-2** for a map of current and historic sites).

As of 2020, the reticulated flatwoods salamander is known to occupy wetlands in Santa Rosa and Okaloosa Counties, Florida, and Miller County, Georgia (SSA 2020 p. 28). The ECOS range map updated on January 28, 2022, (**Figure A1-3**), reflects buffers around occupied wetlands and the accompanying watersheds and includes substantially more occupied area than the three counties considered to have extant populations.

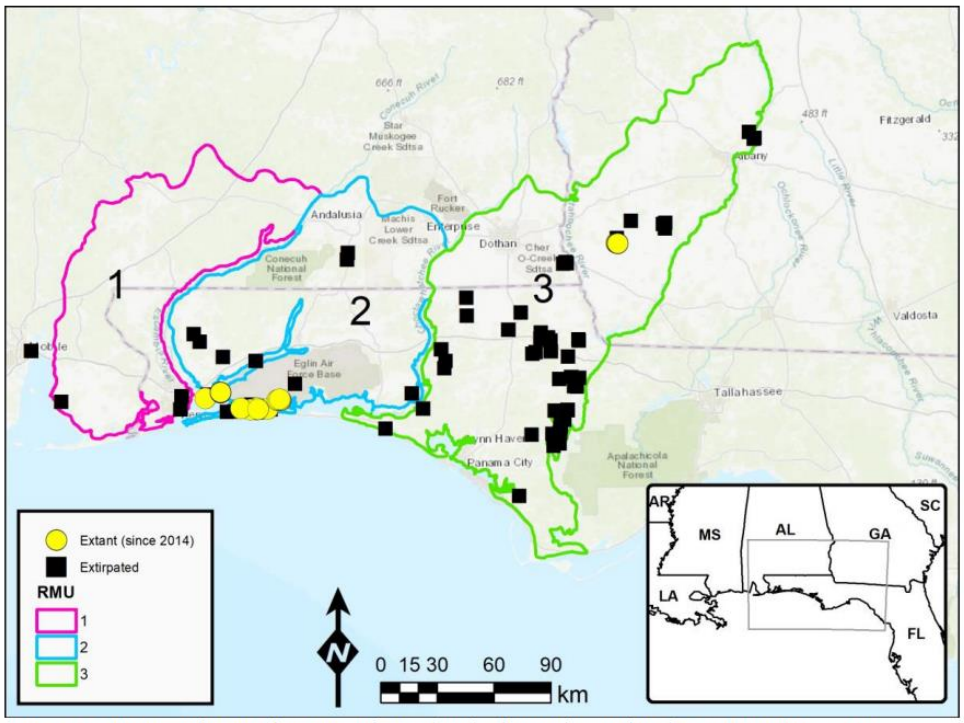

Figure 2.3. Historic and extant locations of reticulated salamanders within the current RMU context.

Figure A1-2. Historic and extant locations of the reticulated flatwoods salamander. Map from the 2020 SSA.

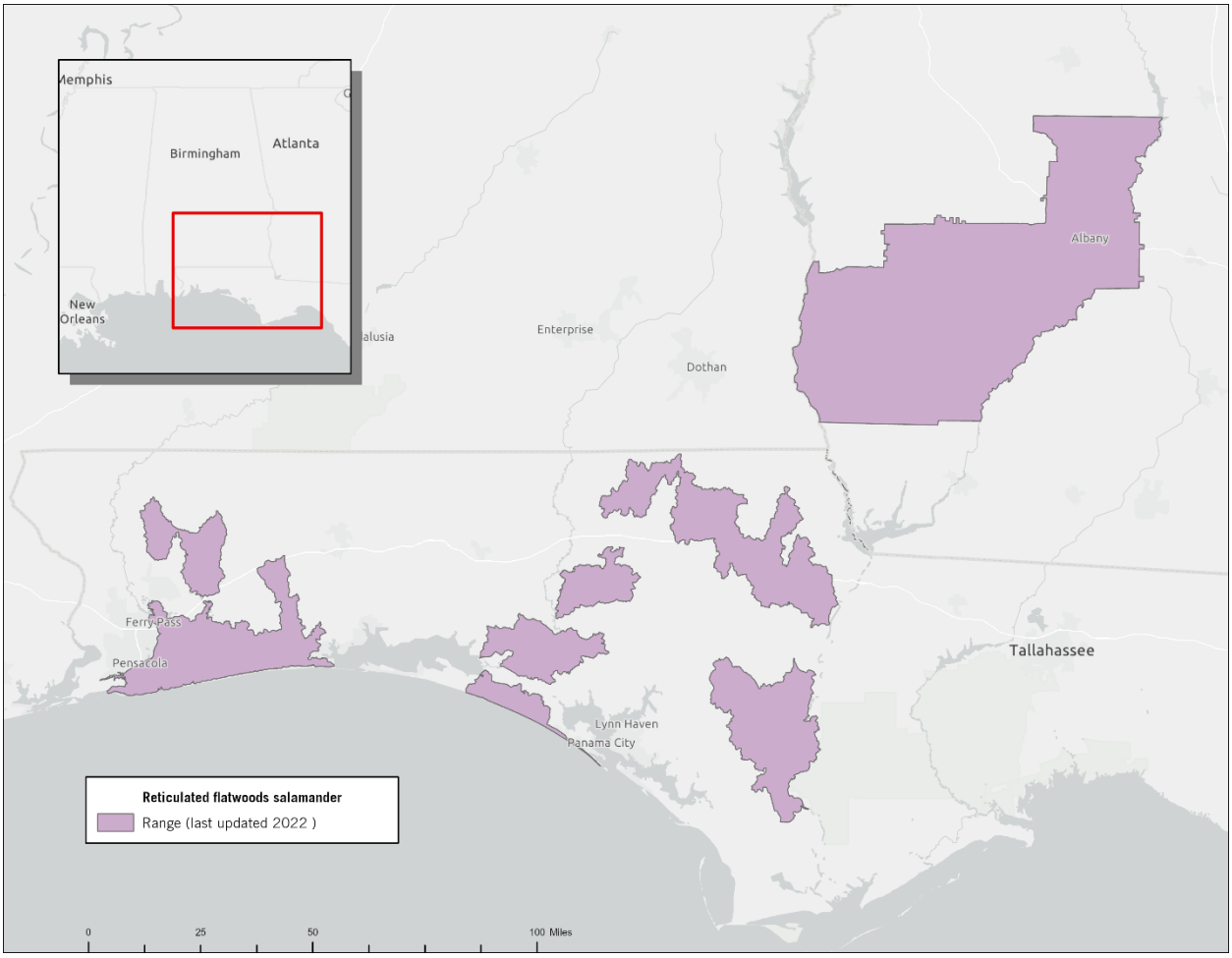

Figure A1-3. ECOS range map for the reticulated flatwoods salamander. Updated on January 28, 2022.

4. Description of Critical Habitat

FWS designated critical habitat in 2009. The critical habitat consists of 16 areas (14 in Florida and 2 in Georgia) that range in size from 57 acres to 877 acres (**Figure A1-4**). All critical habitat was considered occupied at listing.

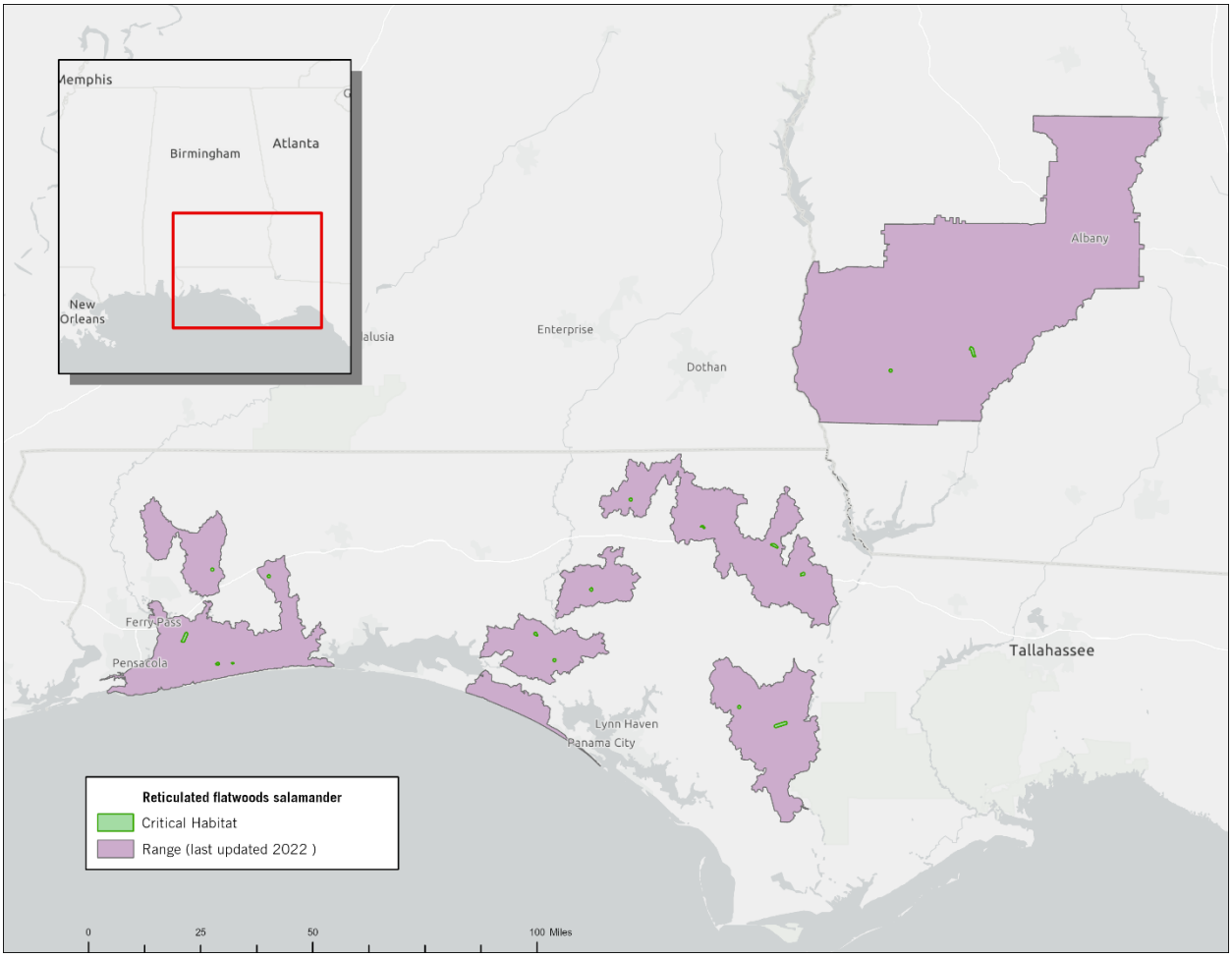

Figure A1-4. Critical habitat for the reticulated flatwoods salamander. The total acreage of the critical habitat is approximately 4,453.

Table A1-2. Summary of critical habitat units for the reticulated flatwoods salamander. Data from 74 Fed. Reg. 6700, 6728 (Feb. 10, 2009).

Table 1 shows the occupied units for the reticulated flatwoods salamander.

TABLE 1—OCCUPANCY OF RETICULATED FLATWOODS SALAMANDER (RFS) BY CRITICAL HABITAT UNIT

Unit	Occupied at time of listing	Currently occupied (but not occupied at time of listing)	Size of unit in acres (ac) (hectares (ha))
Florida Units			
RFS–1	X		687 ac (278 ha).
RFS–2, Subunit A	X		162 ac (66 ha).
RFS–2, Subunit B	X		162 ac (66 ha).
RFS–3, Subunit A	X		148 ac (60 ha).
RFS–3, Subunit B	X		57 ac (23 ha).
RFS–6, Subunit A	X		213 ac (86 ha).
RFS–6, Subunit B	X		162 ac (66 ha).
RFS–7, Subunit A	X		162 ac (66 ha).
RFS–7, Subunit B	X		165 ac (67 ha).
RFS–8, Subunit A	X		110 ac (45 ha).
RFS–8, Subunit B	X		358 ac (145 ha).
RFS–8, Subunit C	X		244 ac (99 ha).
RFS–9, Subunit A	X		162 ac (66 ha).
RFS–9, Subunit B	X		877 ac (355 ha).
Georgia Units			
RFS–10, Subunit A	X		162 ac (66 ha).
RFS–10, Subunit B	X		622 ac (252 ha).

TABLE 2—AREAS DETERMINED TO MEET THE DEFINITION OF CRITICAL HABITAT FOR THE RETICULATED FLATWOODS SALAMANDER BUT WERE EXEMPTED FROM FINAL CRITICAL HABITAT DESIGNATION

[Totals may not sum due to rounding]

Geographic area	Definitional areas acres (hectares)	Area exempted from final designation acres (hectares)	Reason
NOLF Holley	289 (117)	289 (117)	INRMP.
Eglin Air Force Base	1,880 ac (761 ha)	1,880 ac (761 ha)	INRMP.
Hurlburt Field	712 ac (288 ha)	712 ac (288 ha)	INRMP.
Total (Okaloosa and Santa Rosa counties, Florida)	2,881 ac (1,166 ha)	2,881 ac (1,166 ha).	

Table 3 provides the approximate area encompassed within each critical habitat unit determined to meet the definition of critical habitat for the reticulated flatwoods salamander. Acre and hectare values were individually computer-generated using GIS software, rounded to nearest whole number, and then summed. Table 4 shows the occupied units for the frosted flatwoods salamander.

TABLE 3—CRITICAL HABITAT UNITS FOR THE RETICULATED FLATWOODS SALAMANDER (RFS)

[Totals may not match due to rounding]

Subunit	Federal ac (ha)	State ac (ha)	Local ac (ha)	Private ac (ha)	Total ac (ha)
Florida Units					
RFS–1		466 ac (186 ha)		221 ac (89 ha)	687 ac (275 ha).
RFS–2, Subunit A				162 ac (66 ha)	162 ac (66 ha).
RFS–2, Subunit B		162 ac (66 ha)			162 ac (66 ha).
RFS–3, Subunit A				148 ac (60 ha)	148 ac (60 ha).
RFS–3, Subunit B			25 ac (10 ha)	32 ac (13 ha)	57 ac (23 ha).
RFS–6, Subunit A				213 ac (86 ha)	213 ac (86 ha).
RFS–6, Subunit B		162 ac (66 ha)			162 ac (66 ha).
RFS–7, Subunit A				162 ac (66 ha)	162 ac (66 ha).
RFS–7, Subunit B				165 ac (67 ha)	165 ac (67 ha).
RFS–8, Subunit A				110 ac (45 ha)	110 ac (45 ha).
RFS–8, Subunit B				358 ac (145 ha)	358 ac (145 ha).

TABLE 3—CRITICAL HABITAT UNITS FOR THE RETICULATED FLATWOODS SALAMANDER (RFS)—Continued

[Totals may not match due to rounding]

Subunit	Federal ac (ha)	State ac (ha)	Local ac (ha)	Private ac (ha)	Total ac (ha)
RFS–8, Subunit C				244 ac (99 ha)	244 ac (99 ha).
RFS–9, Subunit A				162 ac (66 ha)	162 ac (66 ha).
RFS–9, Subunit B				877 ac (355 ha)	877 ac (355 ha).
Georgia Units					
RFS–10, Subunit A		162 ac (66 ha)			162 ac (66 ha).
RFS–10, Subunit B				622 ac (252 ha)	622 ac (252 ha).
Total	0 ac (0 ha)	952 ac (397 ha)	25 ac (10 ha)	3,476 ac (1,396 ha)	4,453 ac (1,803 ha).

5. Known Locations/Occurrence Data

When the 2009 final listing rule was published (74 FR 6700), there were 20 existing populations of *A. bishopi* (SSA 2020 p. 28). Of the 20 populations recognized in 2009, 11 existed on private lands (mainly designated critical habitat areas), and nine on public lands.

In Alabama, the reticulated flatwoods salamander was historically known to occur in four southern counties. Despite more recent survey effort, the last observation of the species (of what we now have determined is the reticulated flatwoods salamander) in Alabama was in Houston County in 1981. The reticulated flatwoods salamander is considered extirpated from Alabama (SSA 2020 p. 27).

In Georgia, *A. bishopi* was recently found in two wetlands on the Mayhaw Wildlife Management Area, Miller County (**Table A1-3**). Prior to 2015, this species had not been detected in Georgia since 2001, but in some cases surveys were limited. The Center considers both critical habitat sites in Georgia to be presumed extant because survey effort has not shown the salamander to be extirpated from private lands.

In Florida, recent surveys have detected *A. bishopi* in Santa Rosa and Okaloosa Counties. Within these counties, 16 breeding wetlands on EAFB have had at least one detection from 2010 to 2015, with most being occupied during multiple years within this time frame. Additionally, larvae were detected at one site on Hurlburt Field and one site on property owned by Santa Rosa County in 2014. Larvae were detected at Garcon Point in 2014, and in 2015, larvae were detected at a breeding wetland at Yellow River Marsh Preserve State Park for the first time since 2006. Lastly, A. bishopi was detected at one site on Naval Outlying Landing Field (NOLF) Holley in 2010 and another site in 2011, but no salamanders have been detected since 2011 (SSA 2020 p. 28).

From October 2015 to April 2016, migrating adult and subadult *A. bishopi* were captured at four drift fence locations at Escribano Point Wildlife Management Area (WMA) in Santa Rosa County, FL. Additionally, larvae were dipnetted from four wetlands that were adjacent to two of the drift fence arrays. These captures represent the first detections of this species at this location. As of 2018, six new breeding wetlands have been found, bringing the current total of number of breeding sites at Escribano WMA to 10 (SSA 2020 p. 28).

The 2020 SSA, states that *A. bishopi* is only known from Santa Rosa and Okaloosa counties in Florida. The Center considers critical habitat on private lands in other counties to be presumed extant because survey effort has not shown these sites to be extirpated.

Table A1-3. The number of populations of the reticulated flatwoods salamander at listing at in subsequent surveys. Table from the 2020 SSA (p. 28).

Property	Populations according to 2009 listing	Occupied in 2010	Occupied in 2015
Eglin AFB/Hurlburt Field	3	2	2
NOLF Holley	1	1	0
Pine Log State Forest	1	0	0
Mayhaw Wildlife Management Area	1	0	2
Northwest FL Water Man. Dist. (NWFL WMD) and Blackwater River State Forest	1	0	0
NWFLWMD and yellow River Marsh Preserve SP (Garcon Point)	1	1	1
Santa Rosa County	1	1	1
Private property*	11	0	0
TOTAL	**20**	**5**	**6**

***Many private land populations have not been effectively sampled between 2010 and 2015 to know if they are still occupied.**

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 2009 US-FWS critical habitats for the Reticulated Flatwoods Salamander, except for unit name "RFS-6, Subunit B" and "RFS-2, Subunit B". In the 2020 SSA on page 28 Table 2.2., there are zero populations in 2010 and 2015 for these areas. Two additional areas were added. The USGS PADUS V 4.0 Yellow River Wildlife Management Area - Escribano Point and USFWS Reticulated flatwoods salamander range clipped by USGS PADUS V 4.0 Eglin Air Force Base area.

This section details the data and steps used to create the core map for the Reticulated Flatwoods Salamander 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_Ambystoma_bishopi_20090210.zip
- FWS Species range: https://ecos.fws.gov/docs/species/shapefiles/usfws_D042_V01_Ambystoma_bishopi_current_range.zip
- USGS (Protected Areas Database US) PAD-US file Version 4.0 https://www.usgs.gov/programs/gap-analysis-project/science/pad-us-data-download
- Software used: ArcGIS Pro version 3.2

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

2.1. Create 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 reticulated flatwoods salamander, named "EPA_Reticulated_flatwoods_salamander_Poly".
2. Export a copy of the 2009 FWS critical habitat "FCH_Ambystoma_bishopi_20090210" shapefile as a feature class. It is named, "FCH_Ambystoma_bishopi_20090210_NewField".
3. Go to the field view of "EPA_Frosted_Flatwoods_salamander_Poly". Right click on "EPA_Frosted_Flatwoods_salamander_Poly"à Data DesignàFields. Right click on the "Descriptio" à Left click on "Copy". Go to the field view of "FCH_Ambystoma_bishopi_20090210"à Right click on "Click here to add a new field"àLeft click on "Paste". **(Figure A2-1) (Figure A2-2)**

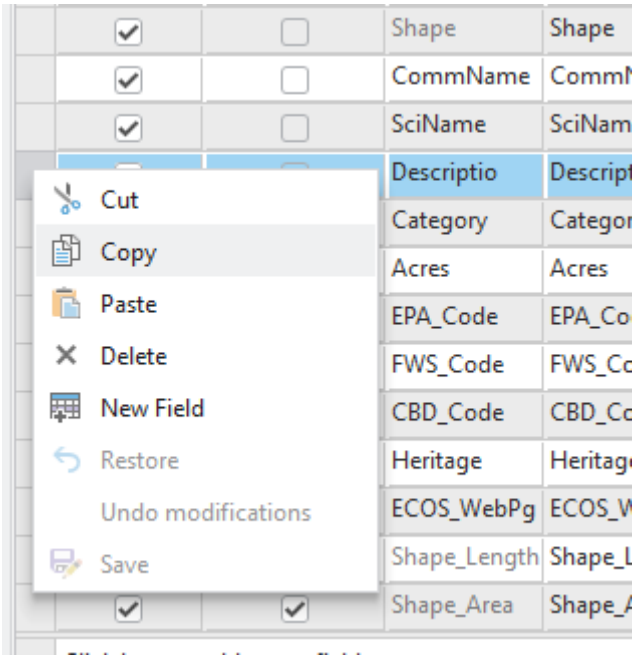

Figure A2-1. Screenshot of "Copy" field

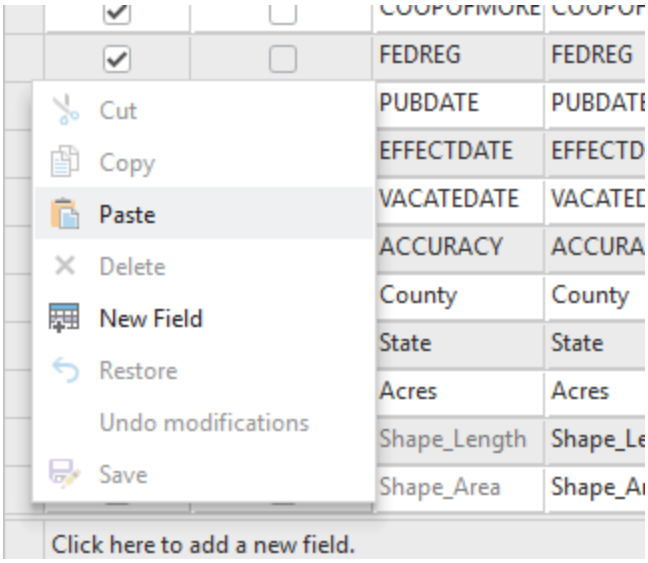

Figure A2-2. Screenshot of "Paste" field

4. Use “Calculate Field” in the “Descriptio” field in the FWS Critical Habitat exported feature class. Click on “Descriptio” field à Select “Calculate Field”àType "Reticulated flatwoods salamander critical habitat. Unit name is " + !UNITNAME! + "." **à** Click Apply **(Figure A2-3)**

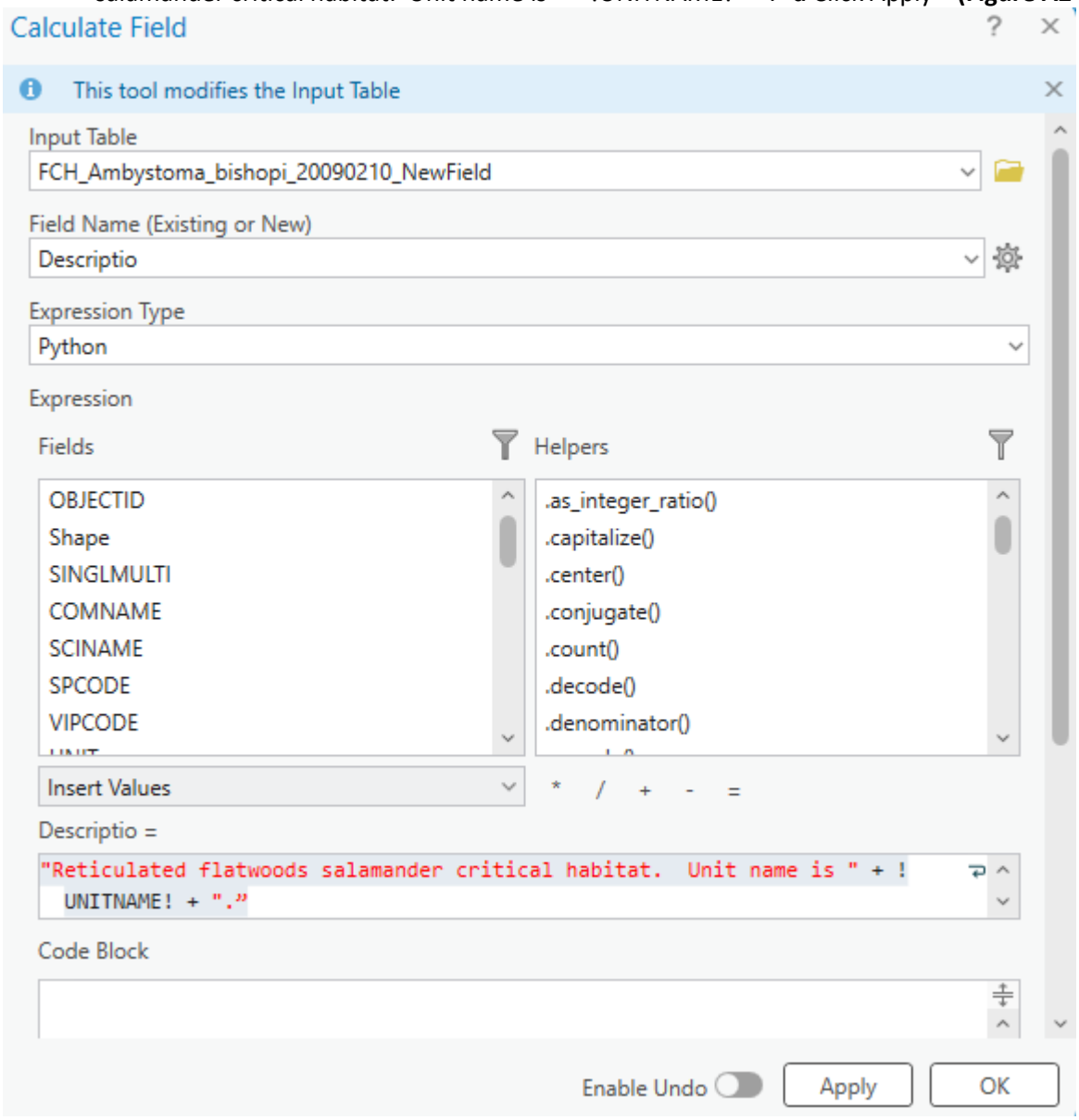

Figure A2-3. Screenshot of “Calculate Field”

5. Create a definition query to filter out the two critical habitats that are no longer occupied. ('RFS-6, Subunit B' and 'RFS-2, Subunit B') **(Figure A2-4)**

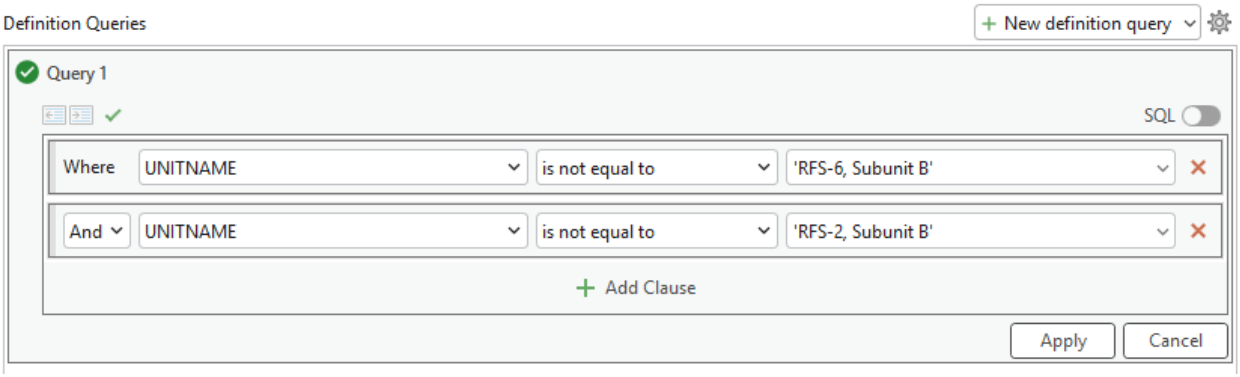

Figure A2-4. Screenshot of "Definition Query"

6. Copy and paste the records from "FCH_Ambystoma_bishopi_20090210_NewField" to "EPA_Reticulated_flatwoods_salamander_Poly".
7. Create a definition query to filter two records from the USGS PAD-US layer. The records are for "Eglin Air Force Base" and "Yellow River Wildlife Management Area - Escribano Point". **(Figure A2-5)**

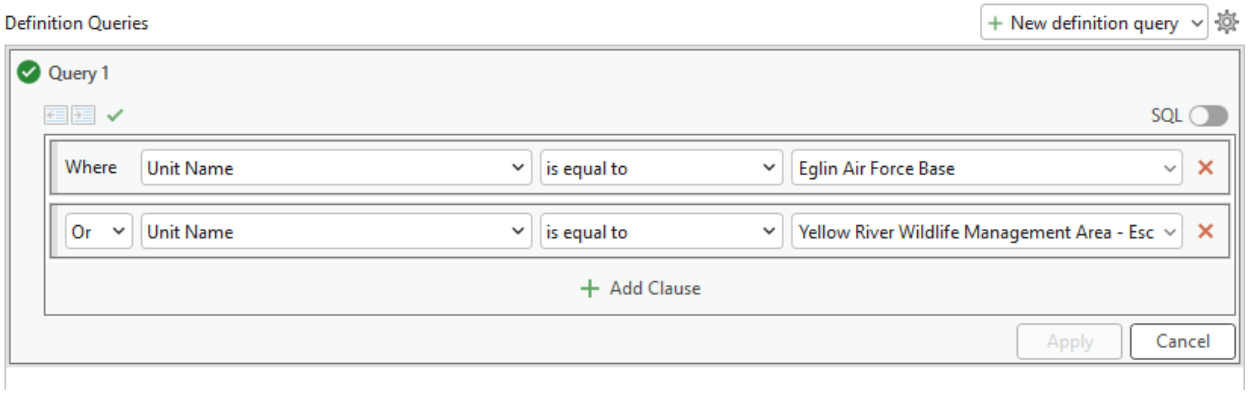

Figure A2-5. Screenshot of "Definition Query"

8. Copy and paste the records from "USGS PAD-US V 4.0" to "EPA_Reticulated_flatwoods_salamander_Poly". Update the respective "Descriptio" fields with "USGS PAD-US V 4.0 Eglin Air Force Base area clipped by "US FWS Reticulated flatwood salamander range" and "USGS PADUS V 4.0 Yellow River Wildlife Management Area - Escribano Point."

9. Set the definition query in “EPA_Reticulated_flatwoods_salamander_Poly” to where the “Descriptio” field equals “USGS PAD-US V 4.0 Eglin Air Force Base area clipped by “US FWS Reticulated flatwood salamander range.” **(Figure A2-6)**

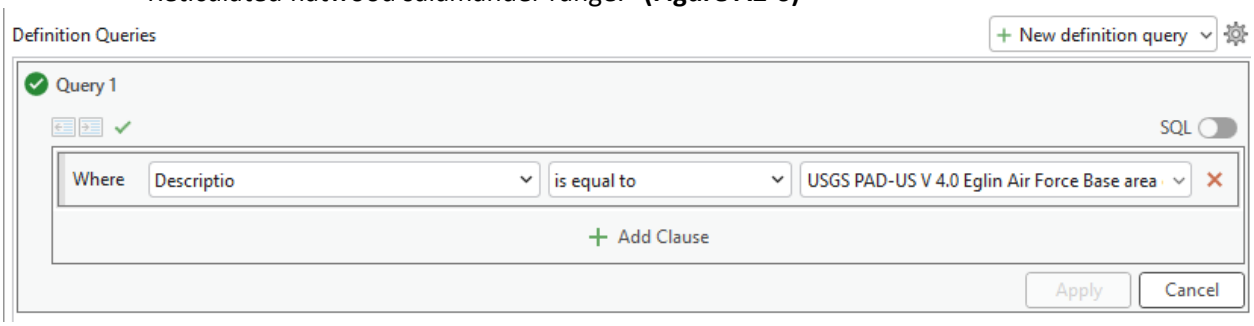

Figure A2-6. Screenshot of “Definition Query”

10. The newly created record in “EPA_Reticulated_flatwoods_salamander_Poly” with a “Descriptio” field of “USGS PAD-US V 4.0 Eglin Air Force Base area clipped by “US FWS Reticulated flatwood salamander range” will be clipped by the Range. “Edit” à Click “Modify”àClick “Clip”à Use the “Select by Rectangle” tool to select features from the “Range” and “EPA_Reticulated_flatwoods_salamander_Poly” feature classes. à Move “EPA_Reticulated_flatwoods_salamander_Poly” to be the “target” feature. àSelect the “Preserve” option under “When clipping features” à Click “Clip”. Update the “description” field to describe the clip method by on the Range.

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 " Reticulated flatwoods salamander " below the field name à Set “Enable Undo” à Click “Apply” **(Figure A2-7)**

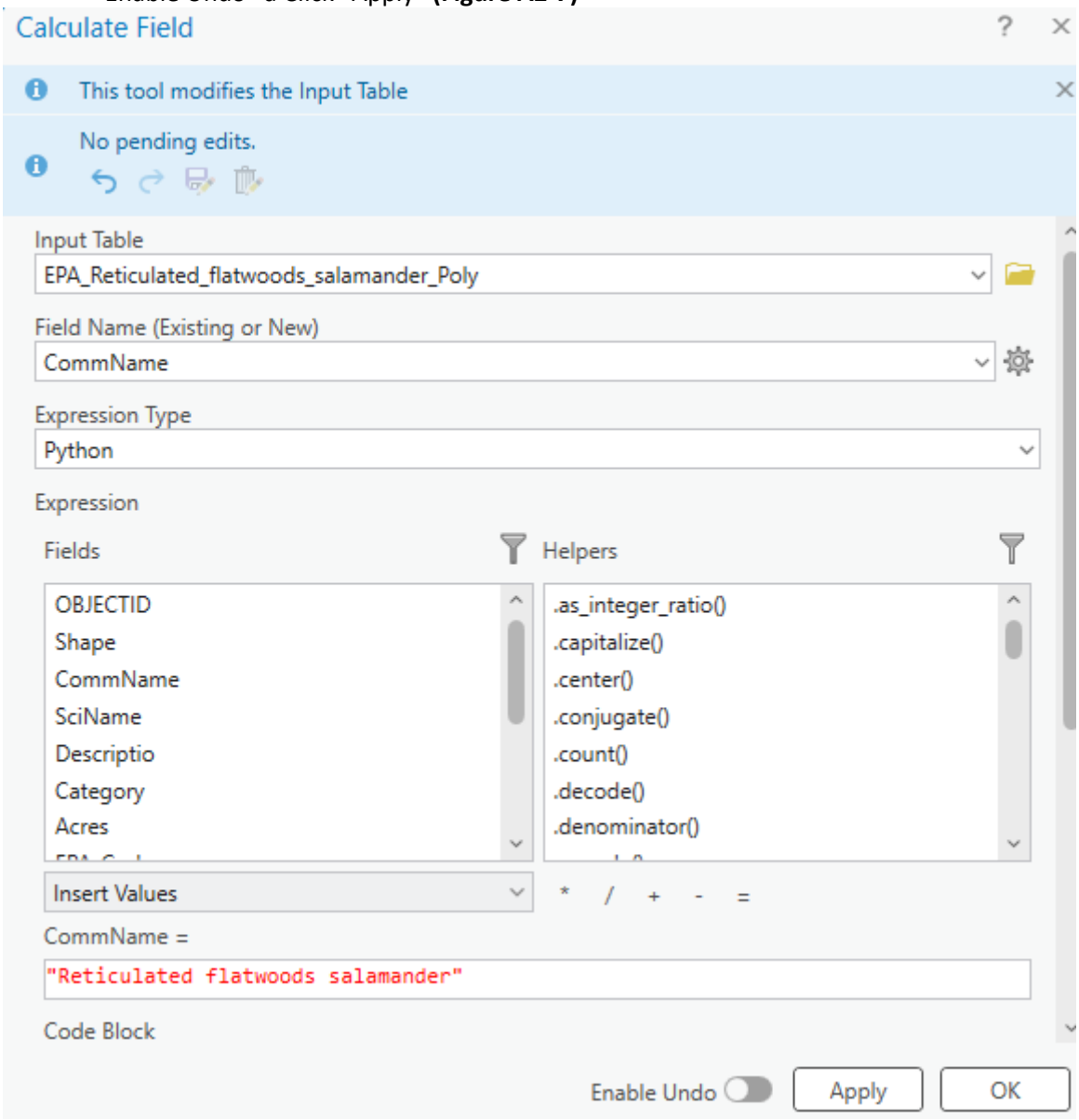

Figure A2-7. Screenshot of “Calculate Field” tool

2. Update the “SciName” field with Field Calculator. Right clicked on “SciName” àSelect “Calculate Field” à Enter "Ambystoma bishopi" below the field name à Click “Apply” **(Figure A2-8)**

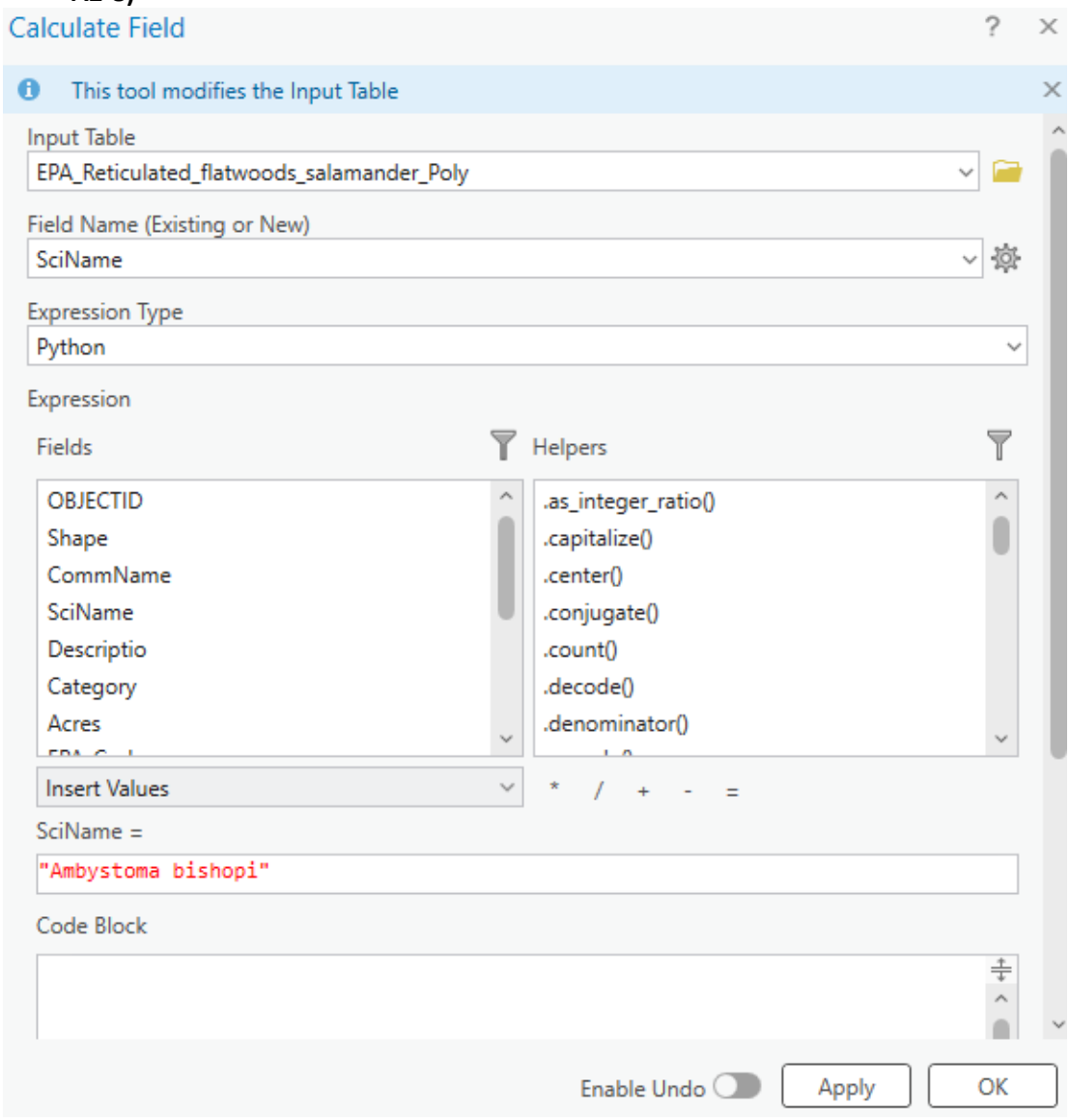

Figure A2-8. Screenshot of “Calculate Field” tool

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” **(FigureA2-9)**

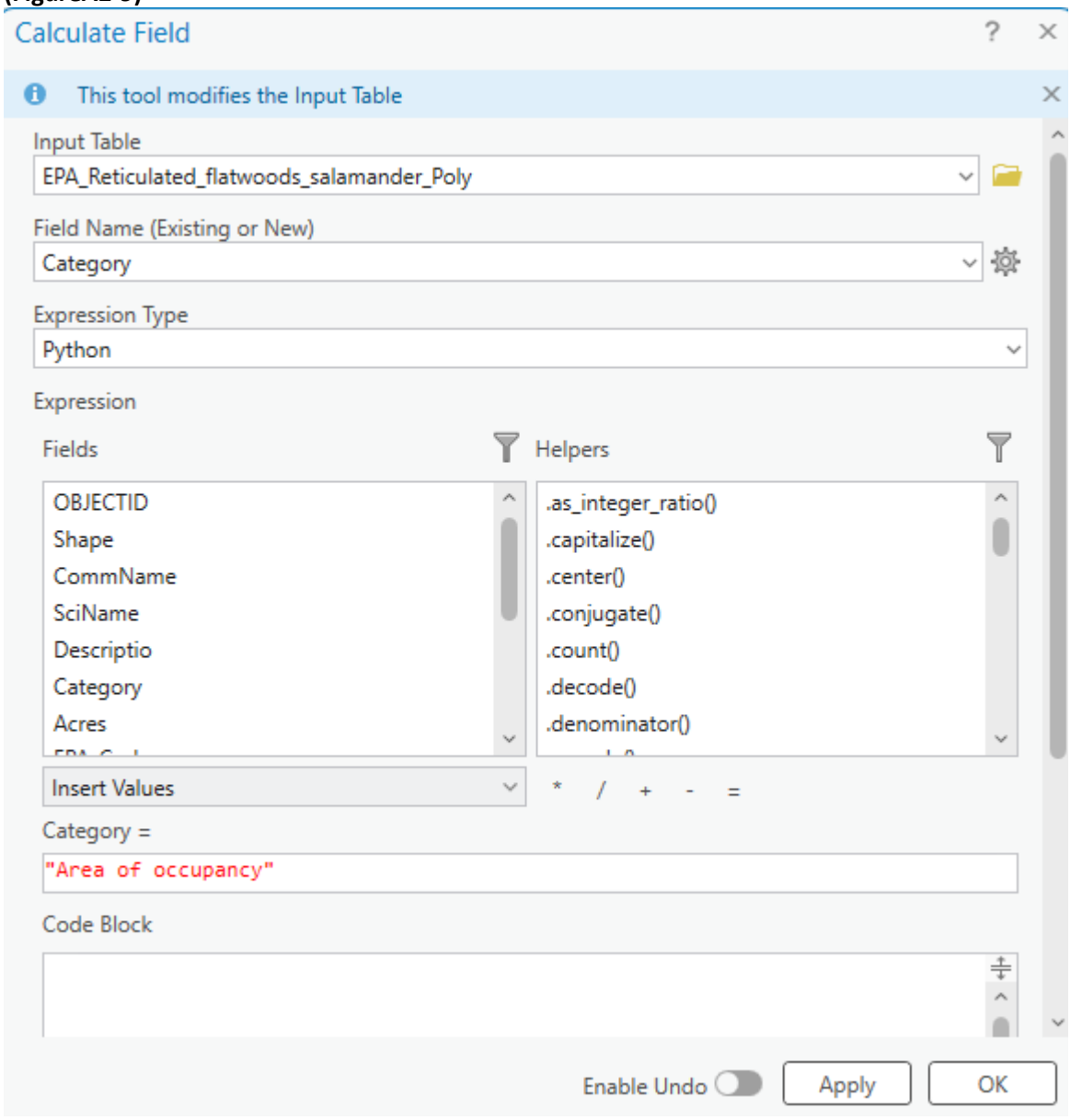

Figure A2-9. Screenshot of “Calculate Field” tool

4. Update the “EPA_Code” field with Field Calculator. Right clicked on “EPA_Code” àSelect “Calculate Field” à Enter "9943" below the field name à Click “Apply” **(Figure A2-10)**

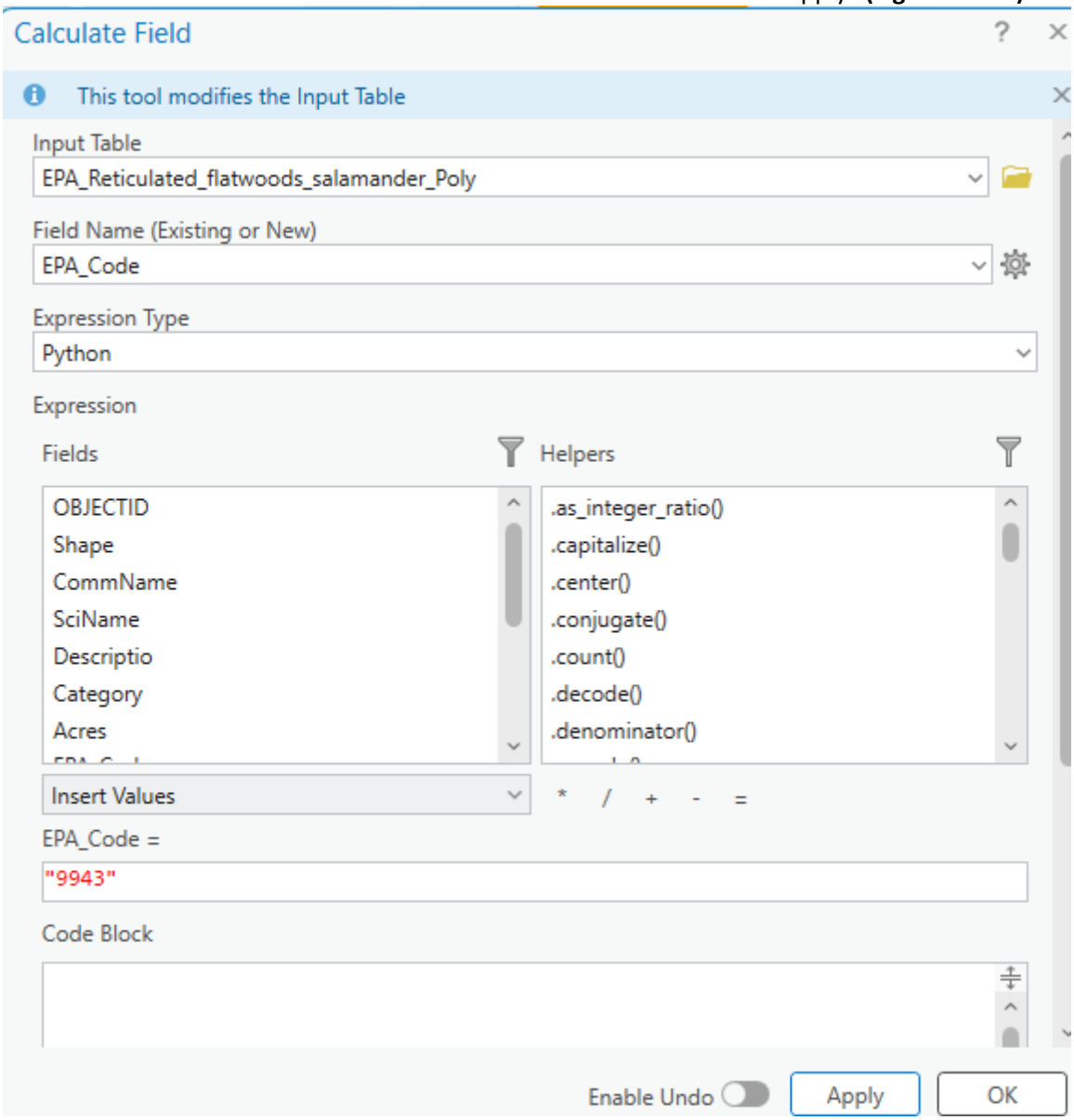

Figure A2-10. Screenshot of “Calculate Field” tool

5. Update the “FWS_Code” field with Field Calculator. Right clicked on “FWS_Code” àSelect “Calculate Field” à Enter "D042" below the field name à Click “Apply” **(Figure A2-11)**

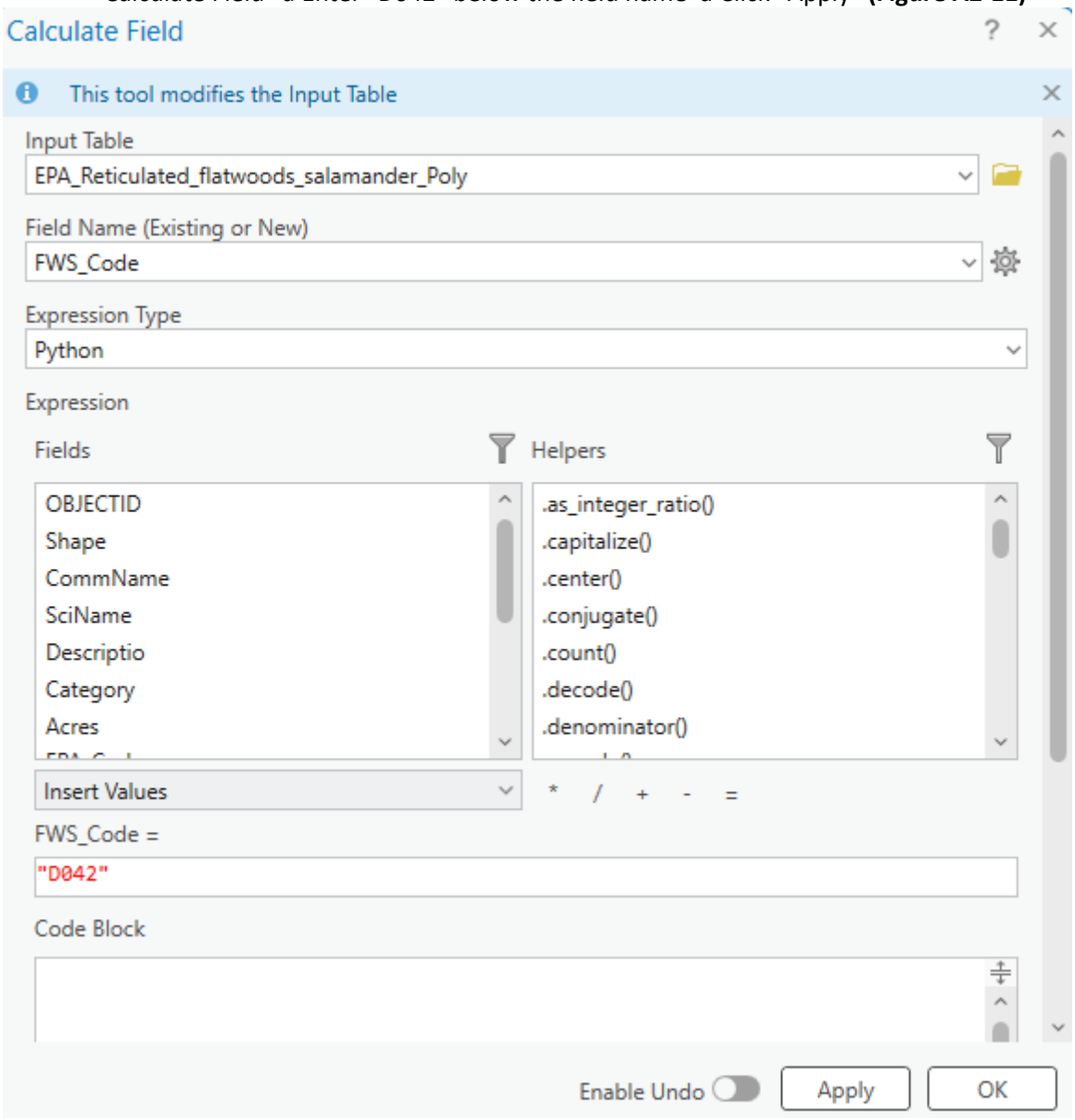

Figure A2-11. Screenshot of “Calculate Field” tool

6. Update the “CBD_Code” field with Field Calculator. Right clicked on “CBD_Code” àSelect “Calculate Field” à Enter "795656" below the field name à Click “Apply” **(Figure A2-12)**

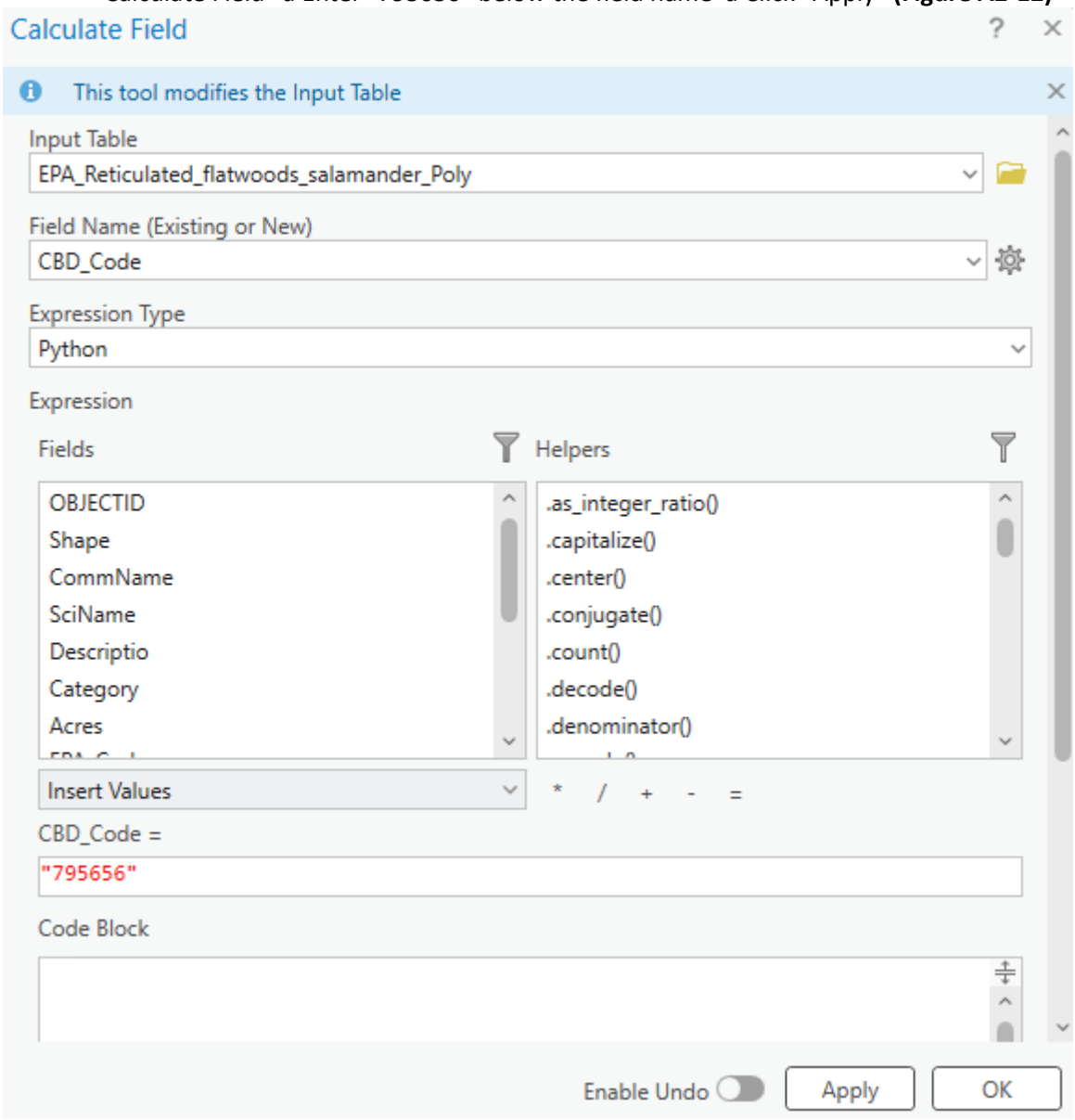

Figure A2-12. Screenshot of “Calculate Field” tool

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 A2-13)**

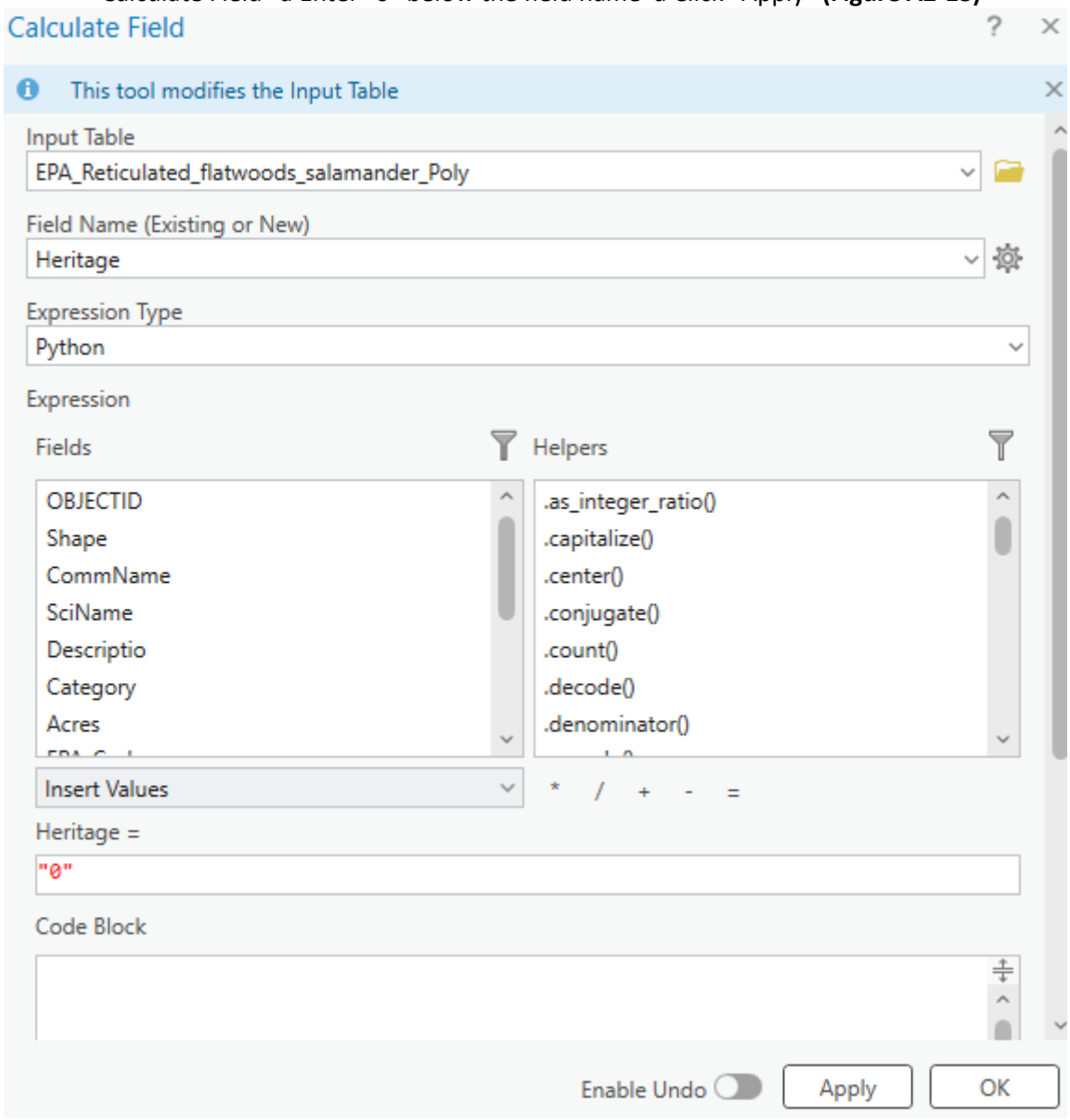

Figure A2-13. Screenshot of “Calculate Field” tool

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/8939 " below the field name à Click “Apply” **(Figure A2-14)**

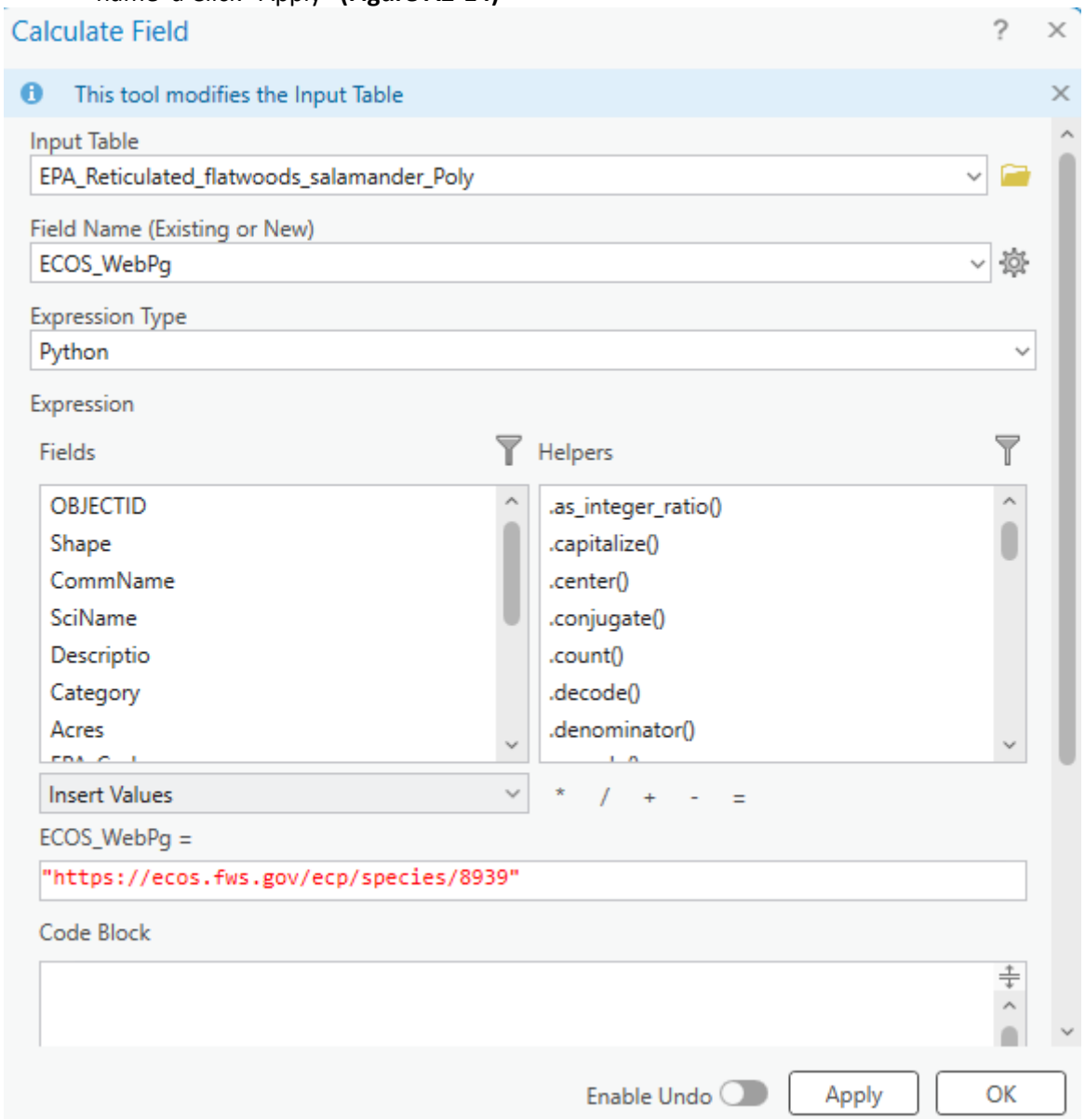

Figure A2-14. Screenshot of “Calculate Field” tool

9. “World UTM Grid” layer and identify the UTM zone as “16”. 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_16N” in the Coordinate System” boxes. Click Apply. Click OK. **(Figure A2-15)**

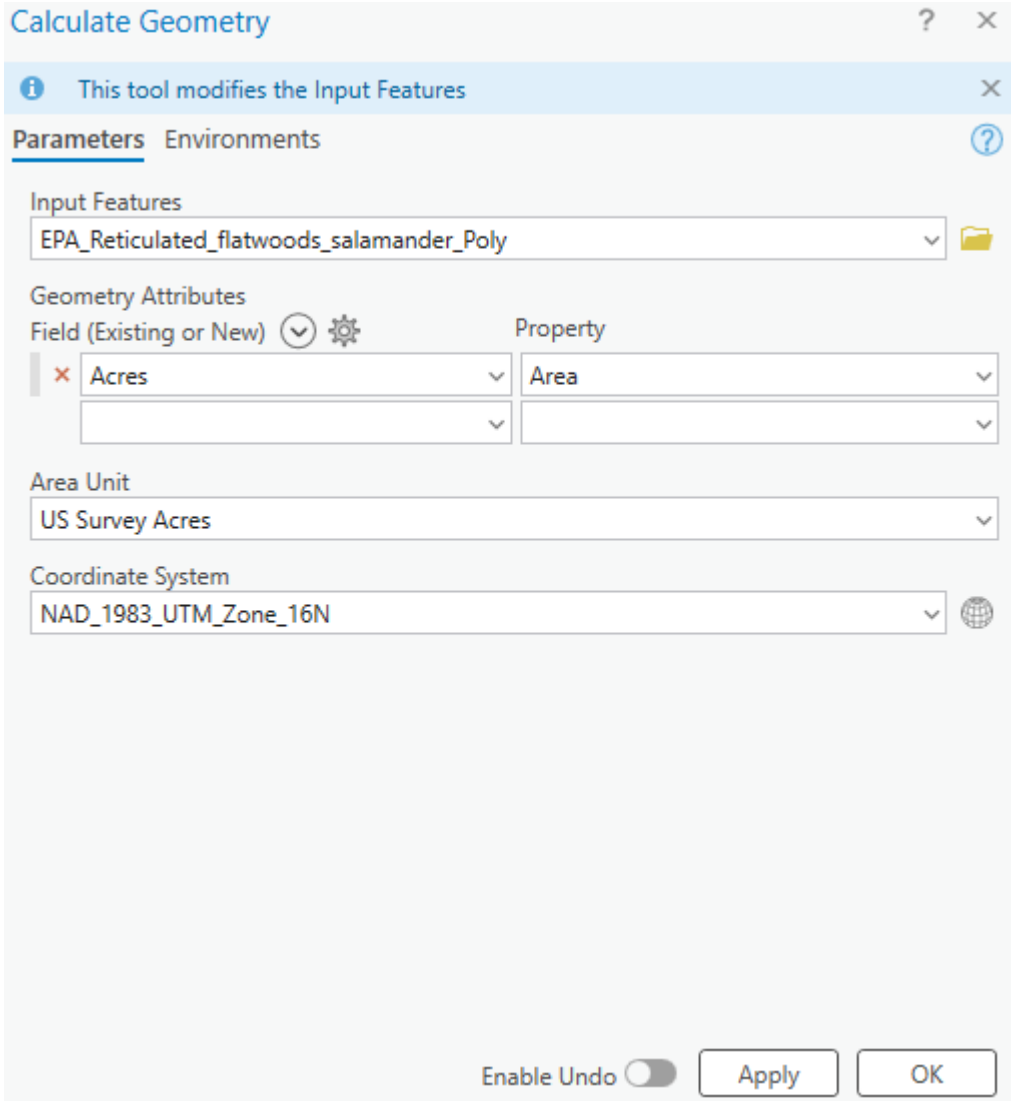

Figure A2-15. Screenshot of “Calculate Geometry” tool

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

1. Use "Select by Location" tool with "EPA_Reticulated_flatwoods_salamander_Poly" as the input feature and "CultivateAreas_Over25acres" as the selecting Features. **(Figure A2-16)**

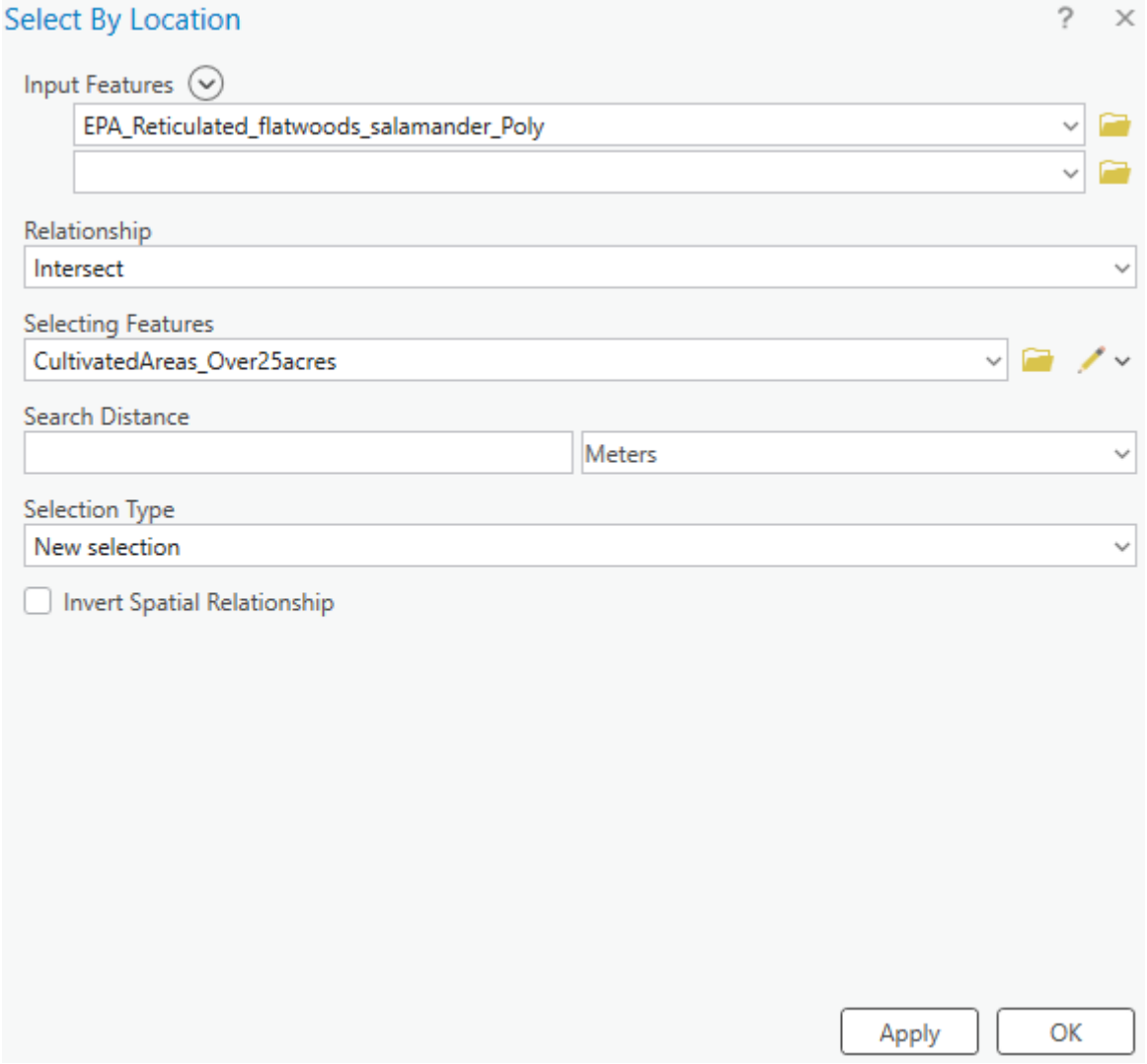

Figure A2-16. Screenshot of "Select by Location" tool

2. Five polygons in the “EPA_Reticulated_flatwoods_salamander_Poly” (orange) are selected. Zoom to the selected polygons (with 50% transparency) and it shows that the overlap is very minimal. The method to remove “CultivateAreas_Over25acres” (blue) from the “EPA_Frosted_Flatwoods_salamander_Poly” is insignificant and will not be done. **(Figure A2-17) (Figure A2-18) (Figure A2-19) (Figure A2-20) (Figure A2-21)**

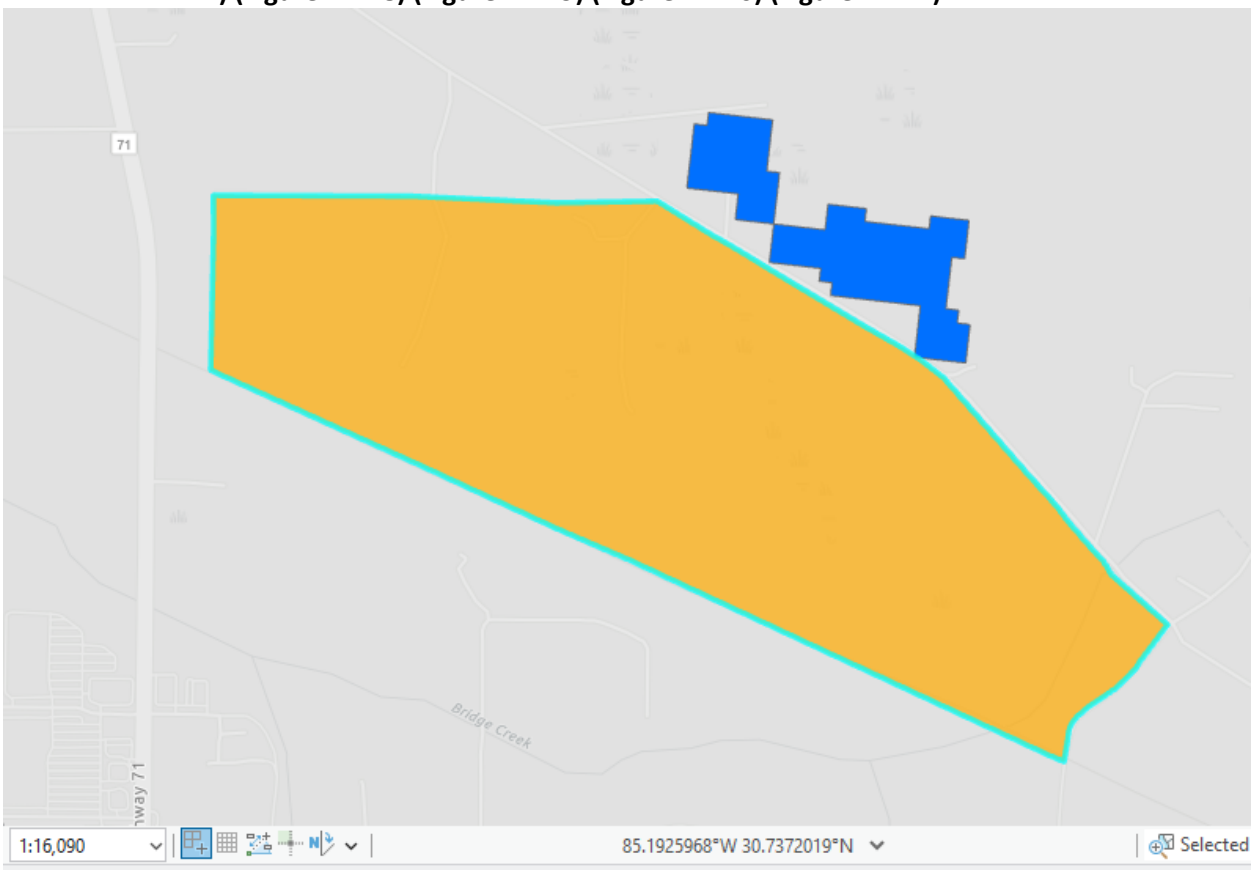

Figure A2-17. Screenshot of “Select by Location” Intersect Result

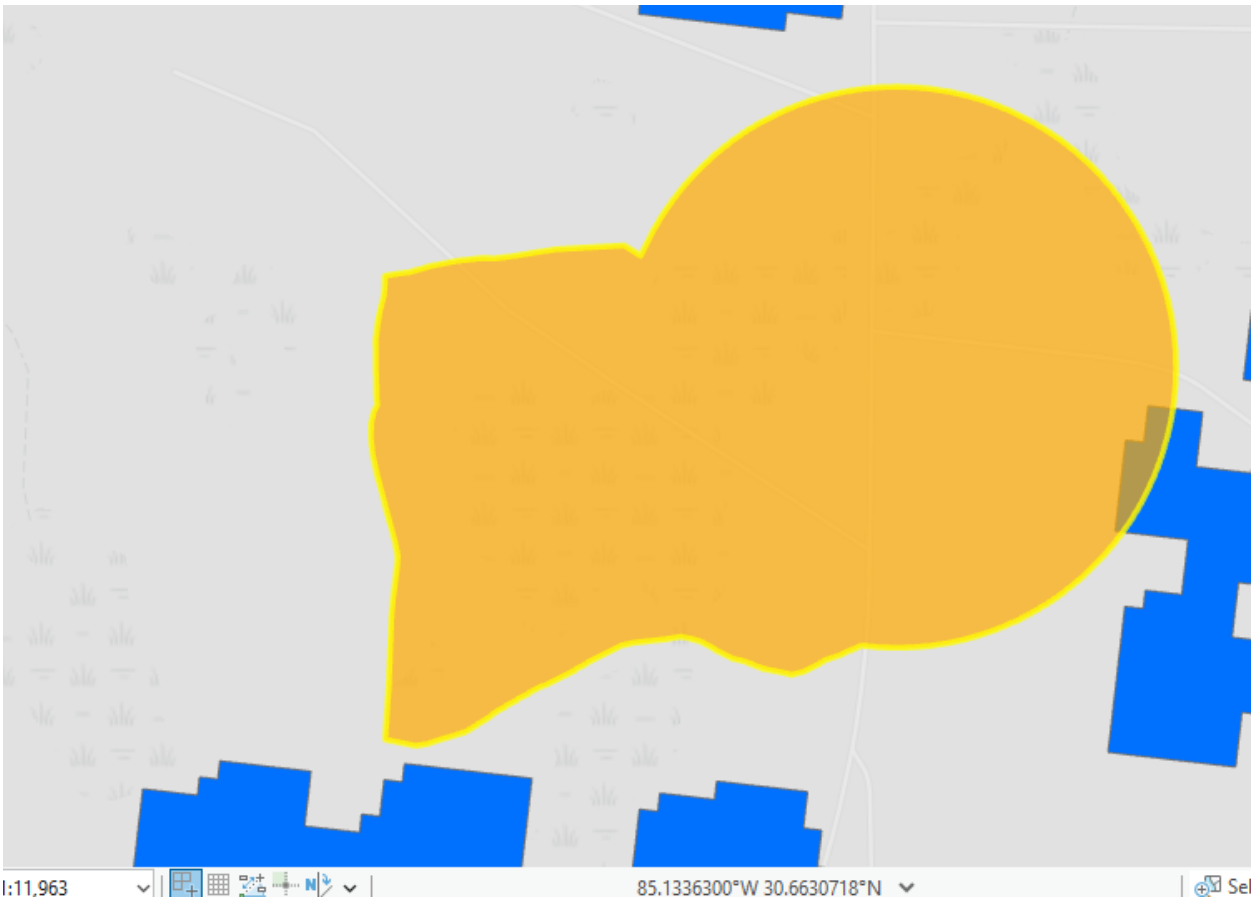

Figure A2-18. Screenshot of "Select by Location" Intersect Result

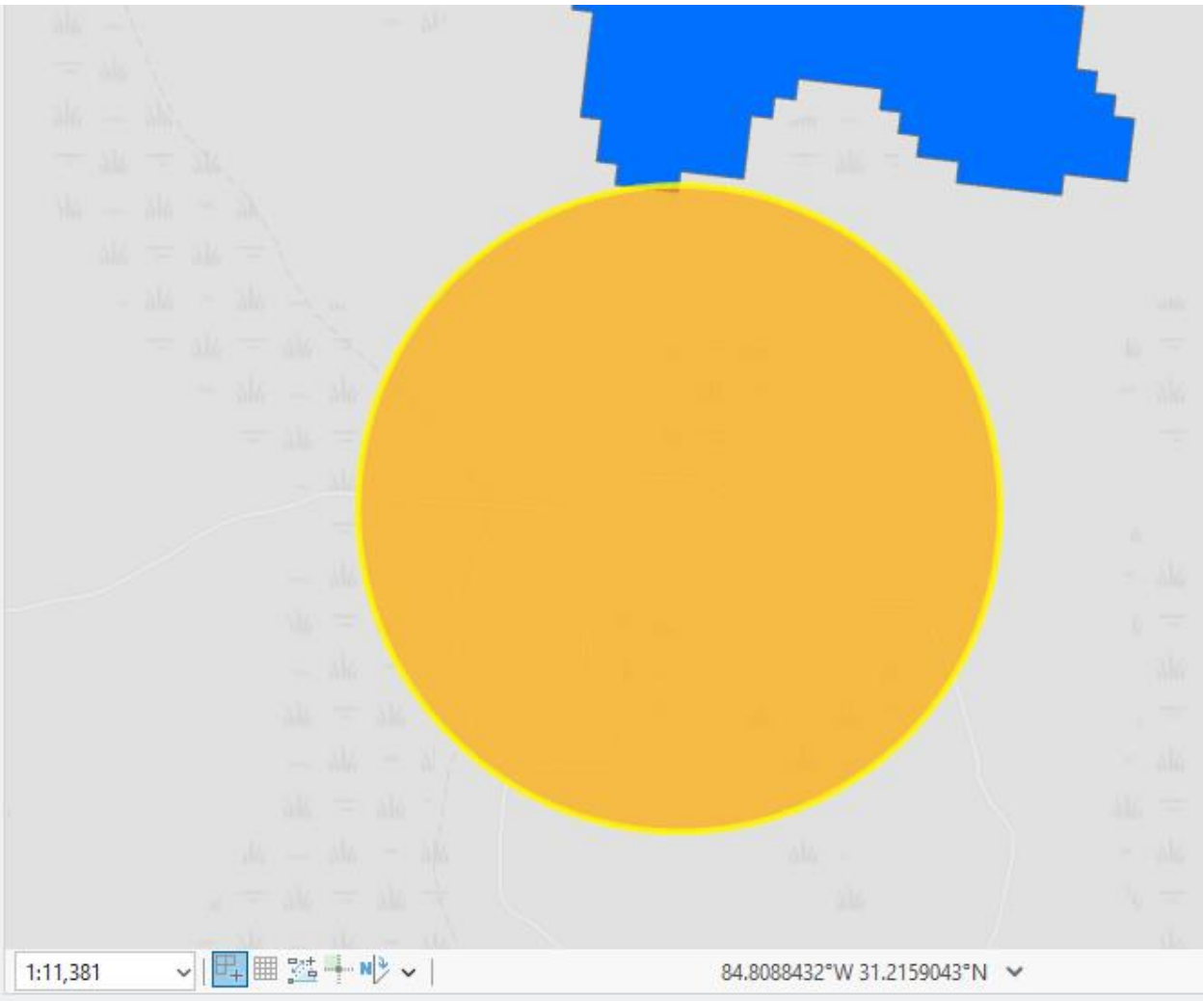

Figure A2-19. Screenshot of "Select by Location" Intersect Result

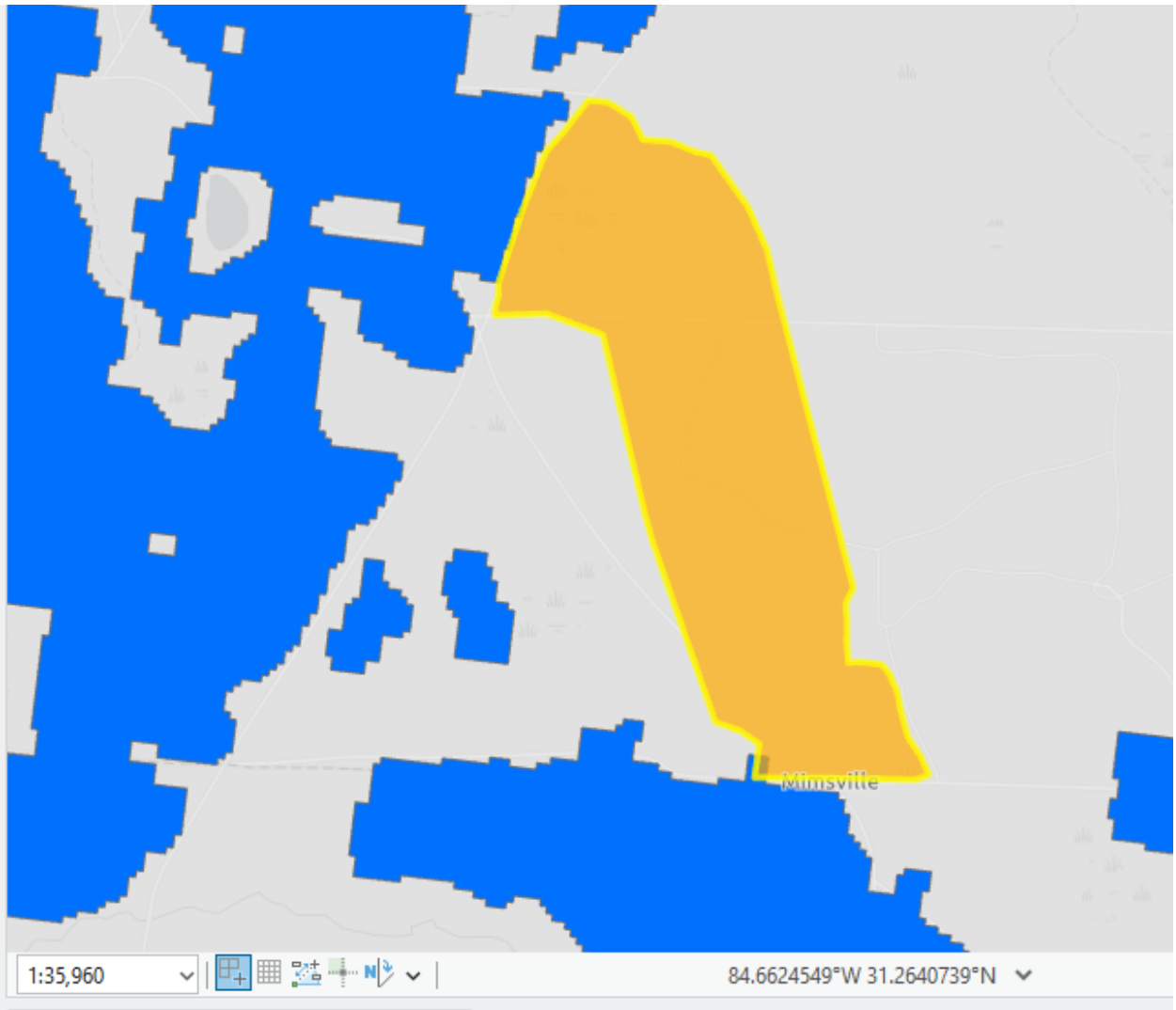

Figure A2-20. Screenshot of "Select by Location" Intersect Result

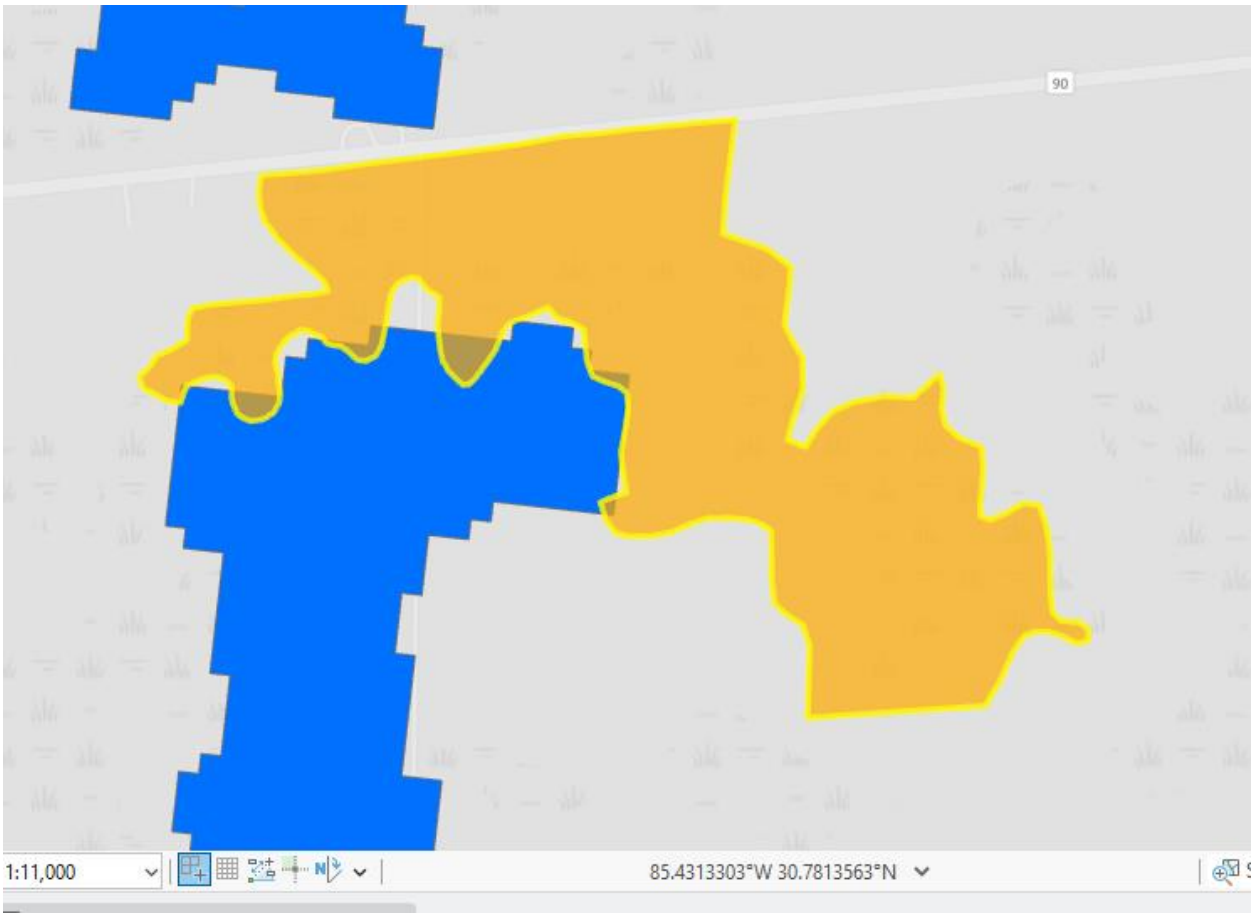

Figure A2-21. Screenshot of "Select by Location" Intersect Result

2.4. 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_Reticulated_flatwoods_salamander_Poly" records. **(Figure A2-22)** Downloaded the file and add it to ArcPro and name it, "NLCD_RFS_Area1.tiff".

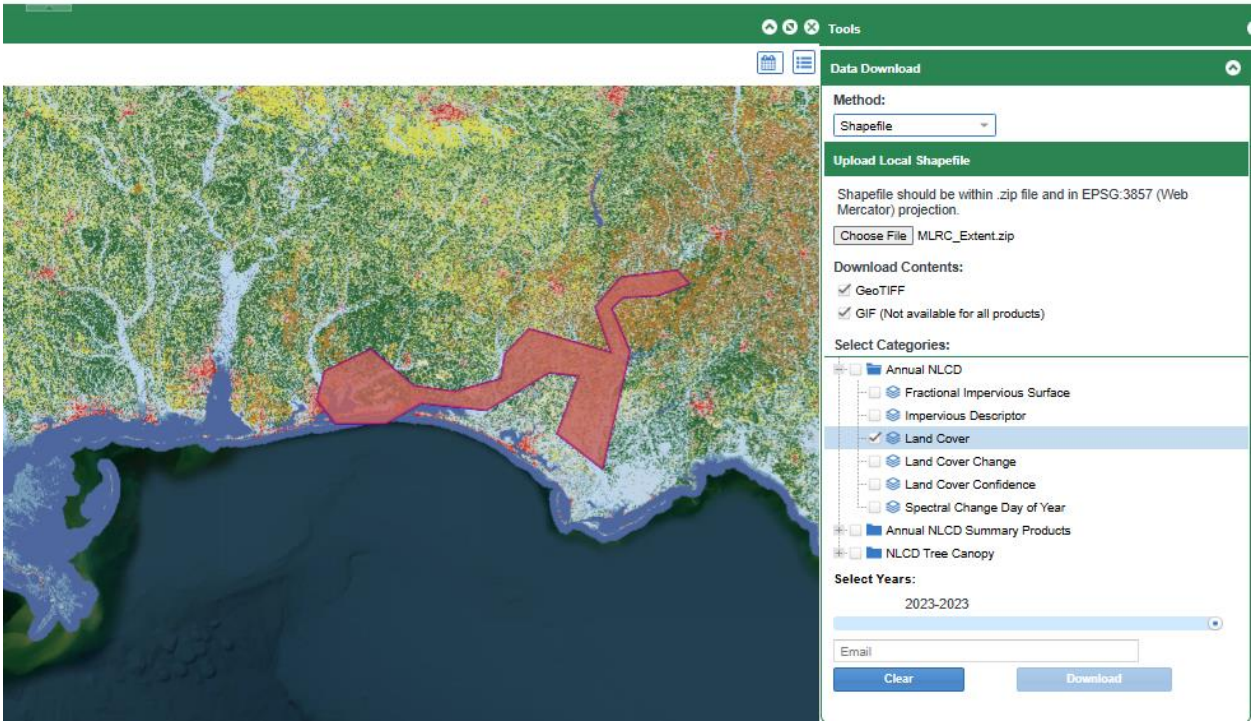

Figure A2-22. Screenshot MRLC Viewer with Shapefile Extent

2. Use the “Extract by Mask” tool with “NLCD_RFS_Area1.tiff” filtered by the same area within “EPA_Reticulated_flatwoods_salamander_Poly” as the extent. In the “Environments” tab, change the output coordinate system to match “EPA_Reticulated_flatwoods_salamander_Poly”, which in this case is “USA_Contiguous_Albers_Equals_Area_Conic_USGS_version”. The output is named, “NLCD_MaskArea1”. **(Figure A2-23) (Figure A2-24)**

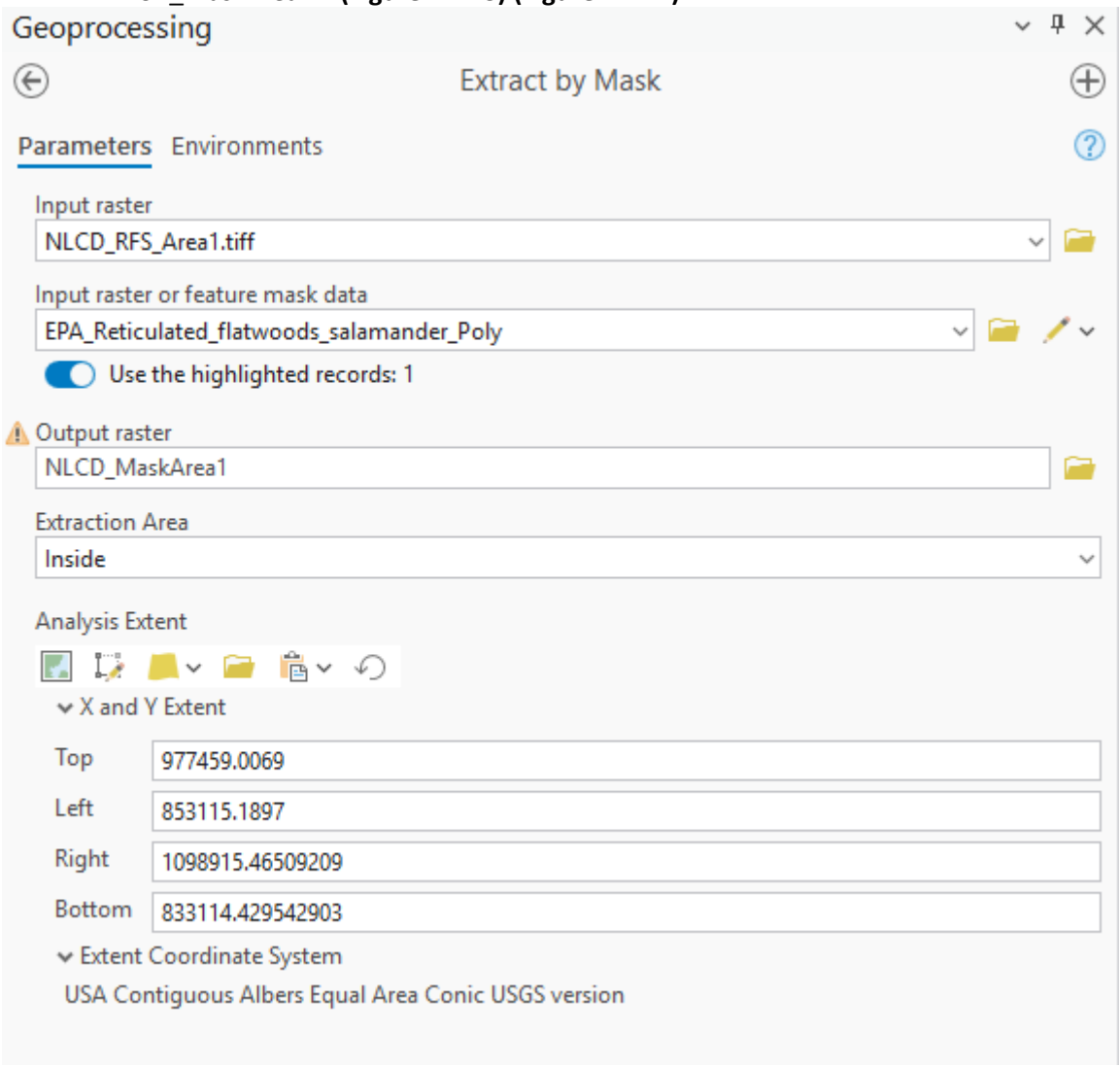

Figure A2-23. Screenshot “Extract By Mask” Tool Parameters

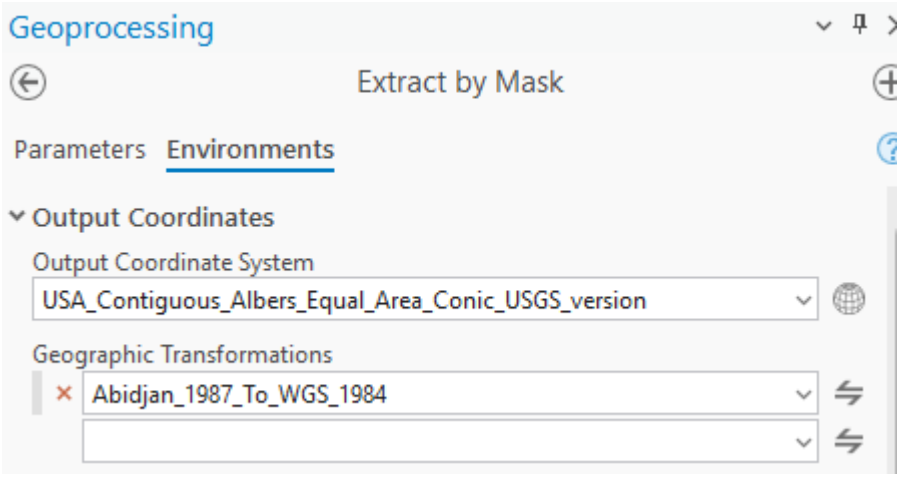

Figure A2-24. Screenshot "Extract By Mask" Tool Environments

3. Use "Tabulate Area" tool to determine the count of area for each NLCD code. **(Figure A2-25)**

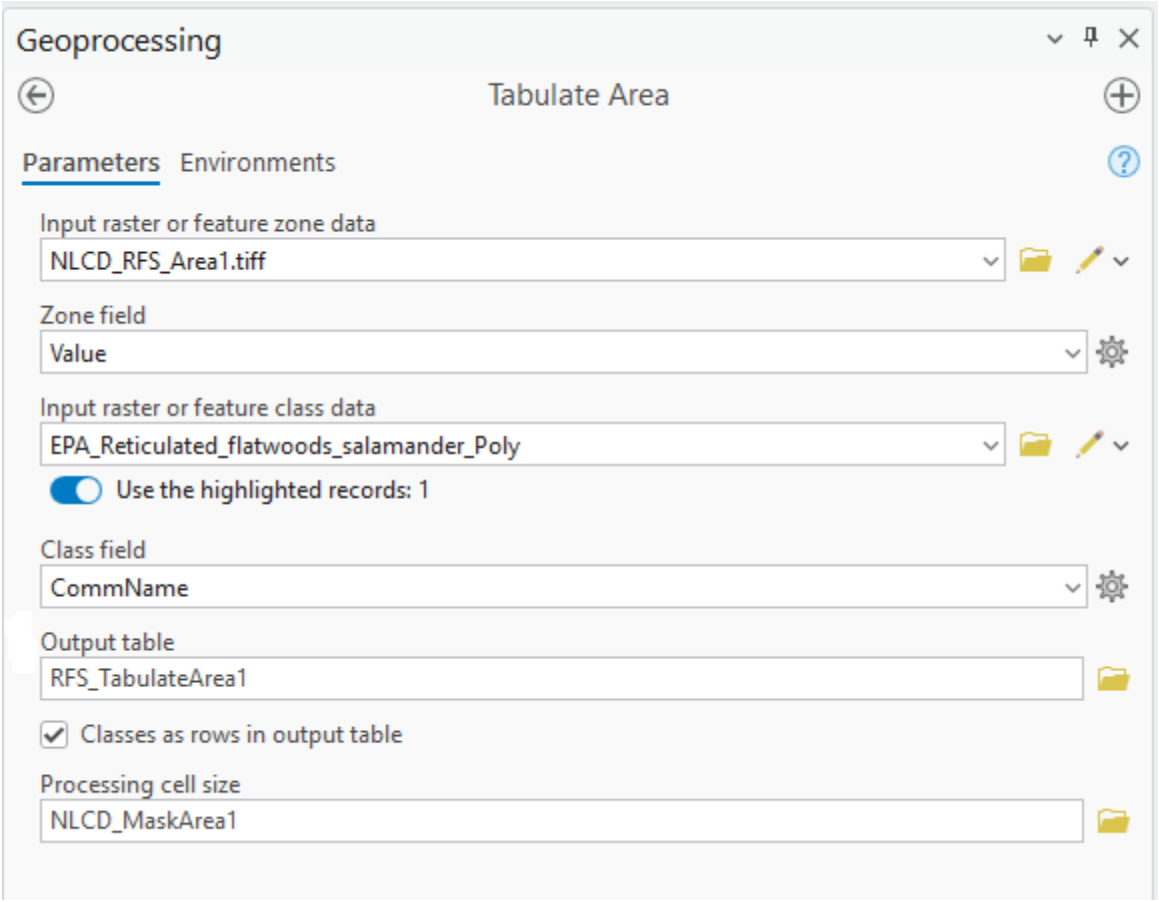

Figure A2-25. Screenshot "Tabulate Area" Tool

4. Add a double field named, “Per” to the “RFS_TabulateArea1” table. Right click on field and select “Calculate Field”. Enter the formula “(!Count!/ 376719)*100”. This calculates the percentage of NLCD within the core map area. **(Figure A2-26)** Review results and input into (Table 1. Percentage of Interim Core Map Represented by NLCD Land Covers and Associated Example Pesticide Use Sites/Types.)

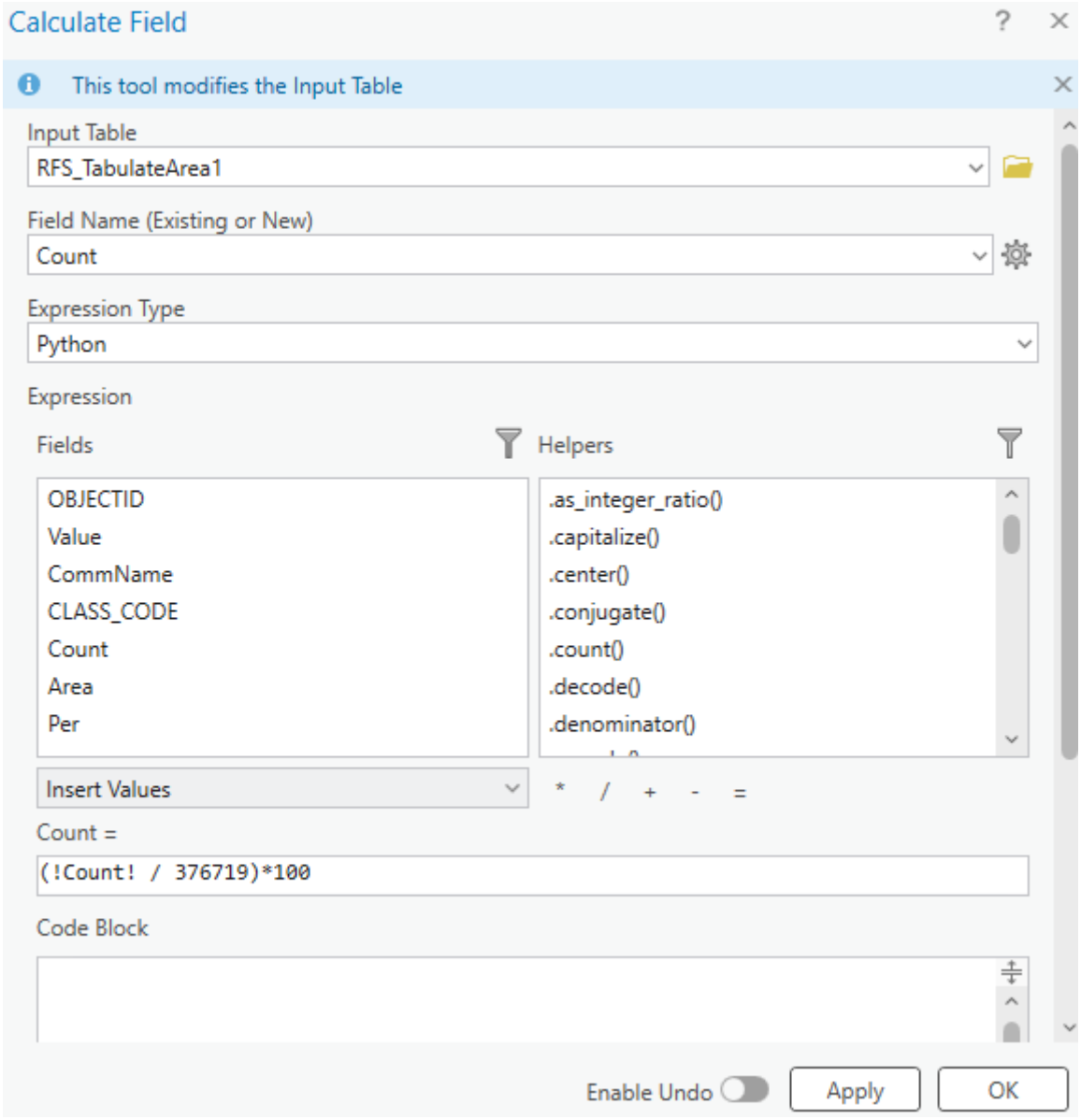

Figure A2-26. Screenshot of “Calculate Field” tool