Wildlife Habitat Conservation and Connectivity Planning for the Corkscrew Road Area

Final Report

Presented to

Florida Wildlife Federation

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Introduction

The area known as the DRGR (Density Reduction/Groundwater Resource) in southeast Lee County is under tremendous growth and development pressure. It is an area comprising about 85,000 ac and is impacted primarily by expanding residential development, agricultural and mining interests. It is an important area for surface water storage and wildlife habitat. The area is used by Florida panthers, black bears and other wildlife. A large portion of the area currently in agriculture is transitioning to residential development and mining activities. This has the potential to adversely impact Florida panther use through significant habitat loss and fragmentation, increased traffic and human population density.

Lee County's DRGR comprehensive plan overlay primarily addresses groundwater protection and surface water storage and movement. The effects on terrestrial wildlife habitat were not a primary consideration in the development of the overlay. Piecemeal planning of individual parcels has led to fragmented, disconnected and/or tenuously connected habitat of questionable function within the context of establishing a viable network of suitable habitat areas for the Florida panther.

Understanding that there will be future land use intensification of this area, it is essential that a viable habitat conservation and connectivity plan be created. Such a plan can help guide future development to the most appropriate locations while protecting important habitat linkages and reserve areas that are significant to Florida panther recovery goals as well as other wildlife needs in the area.

This report evaluates current and future habitat connectivity based on wildlife movement patterns and existing and future land use plans in furtherance of prior work recently completed in the area (Smith et al 2019). It also includes recommendations for measures to ensure ecological integrity of a practical and sustainable network of wildlife habitat reserves and linkages while providing for diverse land use needs (e.g., conservation, residential, agriculture and mining).

Background Information

Our previous study (Smith et al. 2019) provided an initial assessment of the movement patterns of panthers and other wildlife with respect to Corkscrew Road, specifically targeting likely road crossing locations and needs for safe wildlife crossing structures. Our findings included recognition that this area has been significantly transformed by agriculture, mining and residential development. Typically expected wildlife movement patterns were dramatically altered as a result. These human activities have created artificial wildlife movement patterns in adaptation to the creation of water storage impoundments, large retention areas, canals or ditches, active surface mines, row crops and citrus groves, and residential developments.

More long-term study of these movement patterns and habitat use was needed to support the creation of a Wildlife Habitat Conservation and Connectivity Plan and to address the value to target wildlife species of existing agriculture, mining and low-density residential land uses and to identify potential habitat restoration needs. Proposed field activities included setting up camera traps at selected sites (based on telemetry data and habitat features) to monitor frequency of panther presence: 1) crossing highways or approaching as if to cross and 2) using "gaps" to move between protected conservation lands.

Methods

We conducted a wildlife habitat suitability and habitat linkage assessment and feasibility study using the Florida panther as the primary target species. Field surveys and GIS analysis were the primary investigative tools used to evaluate habitat value, functional landscape connectivity, effects of roads and various existing and future land uses.

Existing data used in the analysis included Florida Fish and Wildlife Conservation Commission (FWC) land cover v3.4, land ownership (Lee County), public lands and conservation easements, roads, FWC and Florida Natural Areas Inventory (FNAI) species occurrence data, FWC telemetry and road-kill data, Florida Ecological Greenways Network, Lee County 20/20, Eastern Collier HCP, Rodina and SW Hendry Sector Plans.

The study area included all major public conservation areas within and surrounding the Corkscrew Road area (fig. 1). This included potential connections to larger conservation reserve areas for Florida panther in Okoalacoochee Slough State Forest (OK Slough SF) to the northeast and the Camp Keias Strand (CKS) southeast of Immokalee, which connects to the Florida Panther National Wildlife Refuge (fig. 2).

Field Data Collection

Camera traps within the Corkscrew Road Study Area were placed at key locations that would indicate panther movements between the larger public conservation lands and easements (fig. 3). Indicators used for selecting camera trap sites were panther sightings (source: FWC/FNAI) and panther telemetry (source: FWC) that was previously recorded, existing trails and habitat features. We also selected sites adjacent to roads where either panther or bear roadkill (source: FWC) had been recorded or panther telemetry data indicated possible road crossings.

Camera trap sites included multiple cameras (Browning Dark Ops) that were checked approximately every three months. Cameras were set to collect still photographs 24 hrs/day in 3 image bursts with a 20 sec delay between triggers. Camera traps were set to run from Dec 2020 to Nov 2021 and could be removed and/or shifted to different locations based on data capture performance.

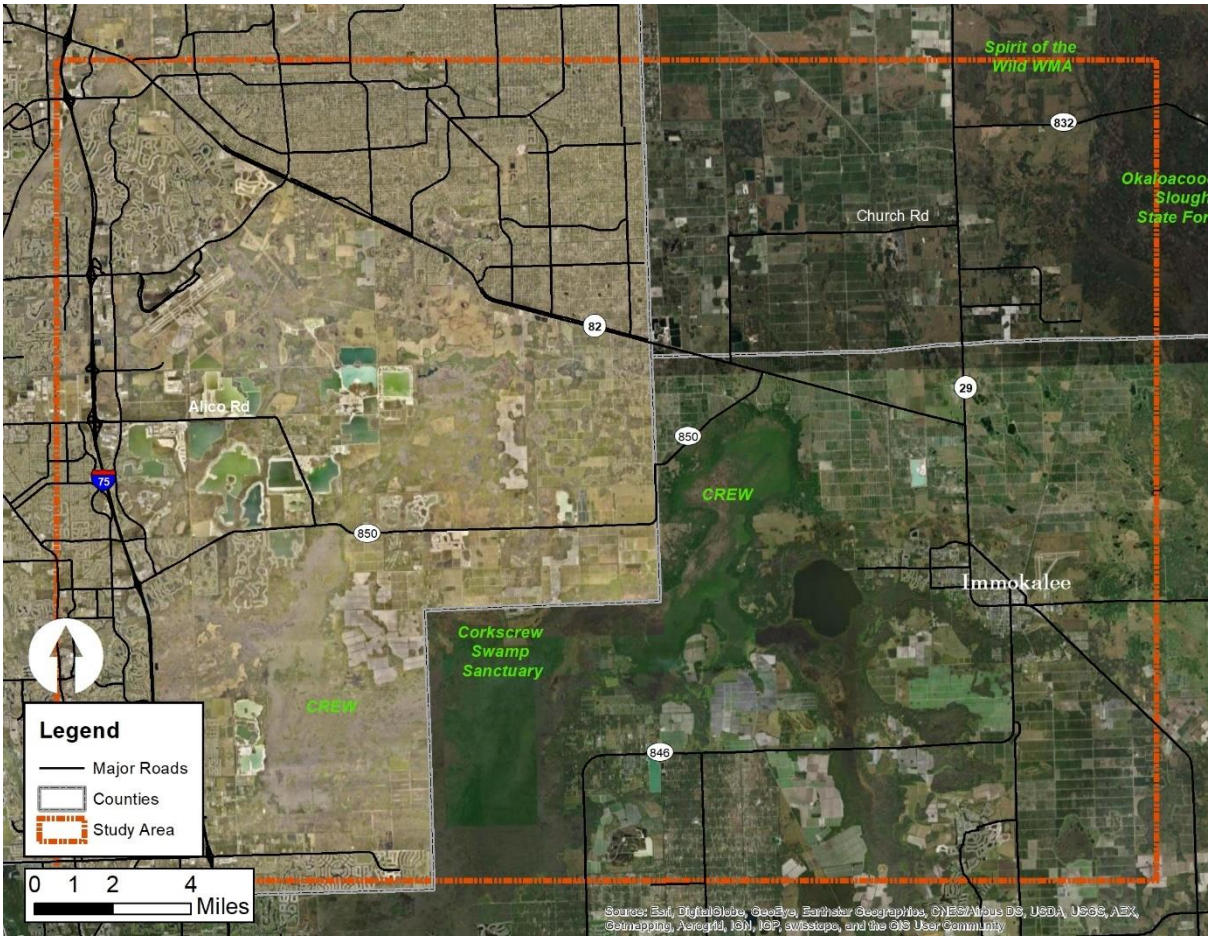

Figure 1. Corkscrew Road (CR 850) Study Area.

GIS Analysis

We used two different analytical tools to evaluate habitat network connectivity for the Florida panther: kernel density estimation and least cost path. Kernel Density Models estimate the probability density function of a random variable to generate a smoothly tapered surface representing the probability distribution of a set of data points (ArcGIS Online).

We performed this on two sets of panther telemetry data collected by FWC. The first dataset included 5 individual panthers tracked via GPS collars with locations collected from 4 to 6 times each day. Depending on the individual, the data was collected anywhere from 4 to 12 months in years 2007, 2008, 2010, 2011 and 2012. The second dataset involved VHF data collection where locations were recorded approximately 3 times per week for 12 individual panthers for 15 years from 1989 and 1998 to 2016.

Using the kernel density tool in ArcGIS 10.8 we generated KDEs using the default planar method with a 10m output cell size and one-half standard deviation intervals for the contours.

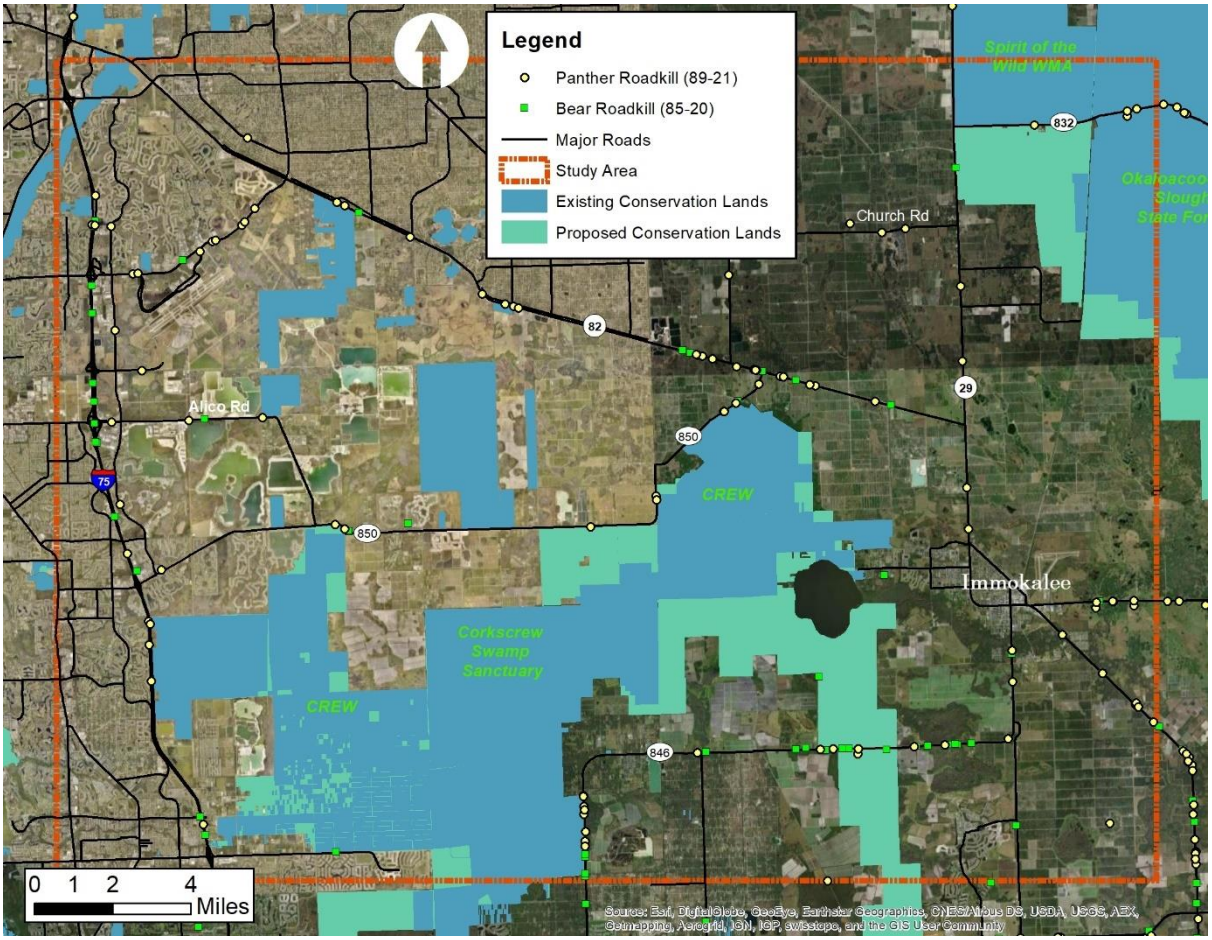

Figure 2. Corkscrew Road (CR 850) Study Area including major existing and proposed conservation lands.

To perform the Least Cost Path (LCP) analysis, we used the most recent FWC v3.4 land cover data layer. First, we performed manual revisions to update land use changes in the study area that occurred up to the Fall of 2021. Second, we used the US Fish and Wildlife Service's 2012 Habitat Assessment Methodology Classification for calculating Panther Habitat Unit (PHU) valuations to lump land cover classes for use in the LCP model. We adapted the original FWC land cover classes (97 found within the study area) to fit into 17 classes based on the FWS methodology classification (Table 1). In addition, special designations were made for wildlife crossing structures (raw score=1.0) and wildlife fencing (raw score=40).

We wanted to evaluate potential pathways that panthers are likely to use under existing and proposed future land use conditions. To do this we created another land cover layer that incorporated proposed changes within the Collier HCP (the north corridors) and the SW Hendry and Rodina Sector Plans that include natural resource districts meant to enhance the connection from CREW to Spirit of the Wild WMA (Spirit) and OK Slough SF (fig. 4).

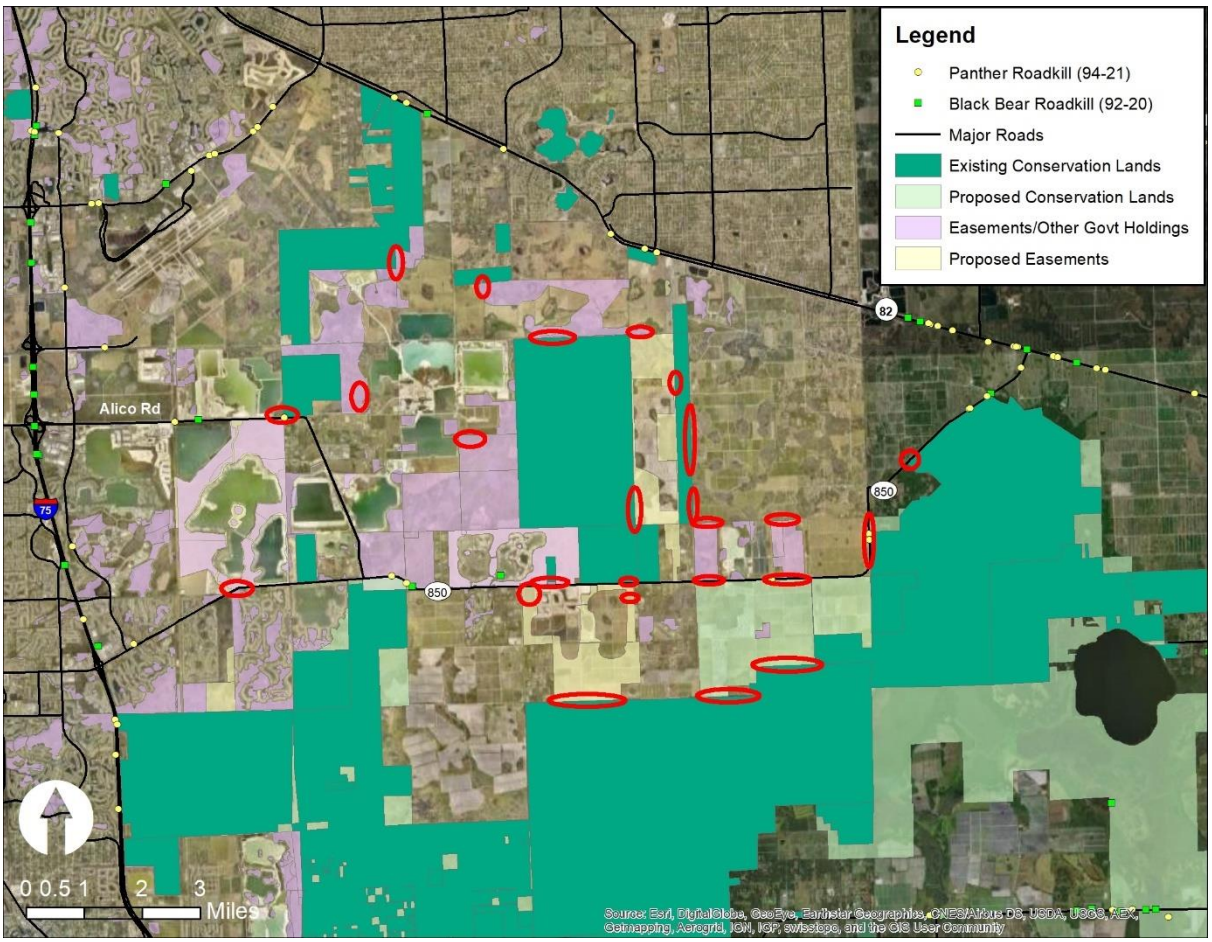

Figure 3. Proposed camera trap monitoring locations based on telemetry, roadkill and observation data, and strategic locations for habitat connectivity between protected conservation lands.

Unfortunately, these proposed resource districts are not continuous between CREW and Spirit/OK Slough SF, several gaps consisting of agricultural lands remain. As an optional exercise, we decided to create yet a third land cover layer that "closes" these gaps by establishing a continuous natural habitat corridor. The resulting aim was to run LCP models on the three scenarios: 1) existing land cover, 2) proposed land cover, and 3) modified proposed land cover.

The LCP analysis was performed using ArcGIS 10.8. The **first step** was to create the previously described cost surface scenarios from the manually updated FWC existing land cover and the proposed- and modified proposed-land cover layers. The original polygons were converted to raster at 10 m resolution. Next, the raster layers were reclassified based on the values in Table 1 and converted to integers by multiplying by 10. The result was the base (original) cost surface layers consisting of values (x) ranging from 1 to 400 (Note that the value zero cannot be processed in the algorithm so it was changed to the value 1).

Table 1. Valuations of land cover classes for use in least cost path analysis.

Category Rank	Raw Score	Description
1	0.0	Pinelands
2	0.3	Forested Wetlands
3	0.5	Upland Hardwood Forests
4	3.2	Dry Prairie
5	3.8	Rural Semi-forested/Unimproved Pasture/Tree Plantation/Mine Reclamation
6	4.0	Shrub/Brush Lands
7	4.3	Rural Open/Imp Pasture
8	4.4	Mining/Utilities Open
9	4.6	Orchards/Groves/Trees/Vineyards
10	4.8	Non-forested Wetlands/Natural Streams and Rivers
11	5.0	Xeric Scrub
12	6.5	Barren/Grass/Open Space/Urban Parks/Coastal/Exotic
13	8.5	Row and Field Crops/Seasonal Rotation/Sod Farms
14	9.5	Lo Intensity Built Env/Institutional/Industrial Ag/Artificial Water Features
15	12.5	Med-Hi Intensity Built Env/Mining
16	15.0	Open Water
17	20.0	Roads

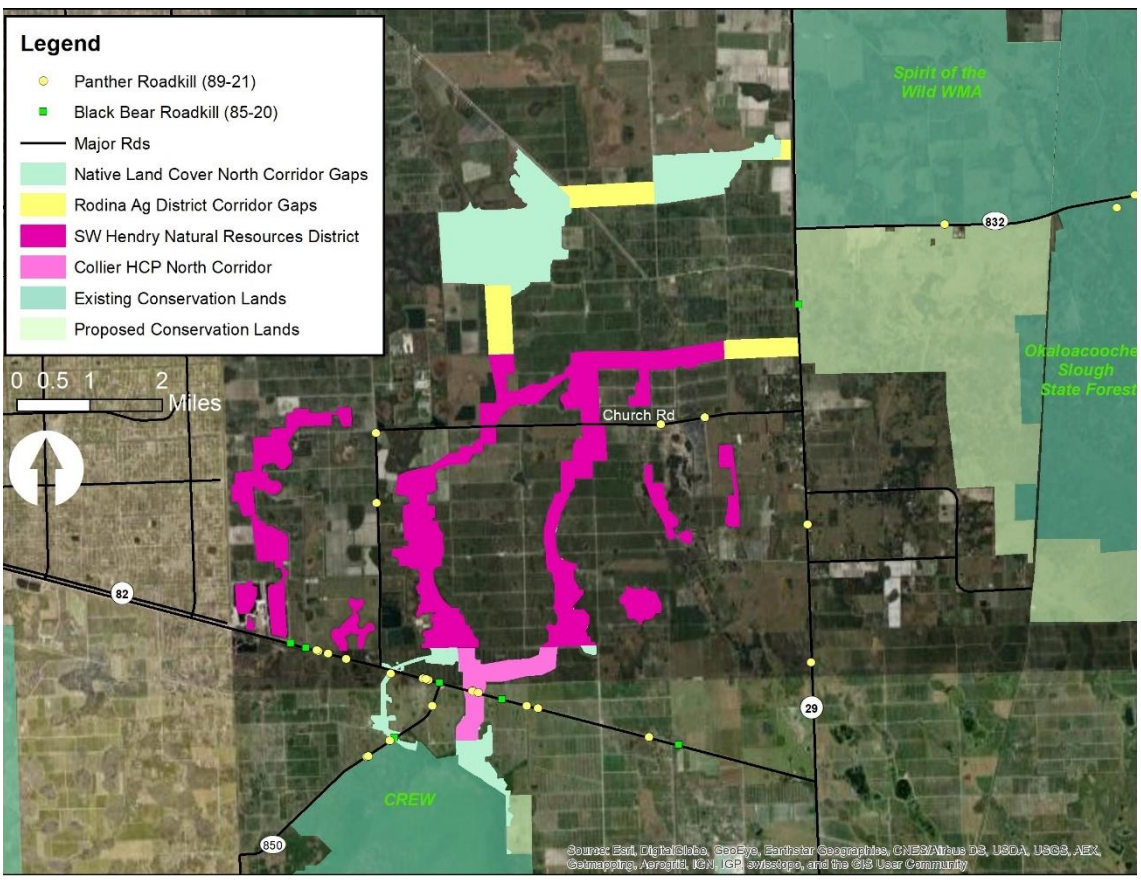

Figure 4. Proposed North Corridor linking CREW to Spirit/OK Slough SF including gaps (shown in yellow) in continuous native habitat types.

We also created a second set of cost surface layers consisting of the inverse (1/x) of the base values. The two cost surface algorithms (x; 1/x) generate somewhat different results that are useful in evaluating "alternative" pathways that panthers might select. Two factors interplay in determining the least cost path –habitat quality and distance between target locations that the pathway is plotted. The base cost surface layers consisting of integer values places somewhat greater emphasis on higher quality habitat while the inverse function (a floating decimal value) places somewhat greater emphasis on shorter distance. We ran both algorithms on each of the three land cover scenarios.

The **second step** was to identify source and destination target locations to plot least cost pathways. We identified 19 target locations concerning the potential habitat network (Table 2; fig. 5). These included larger conservation reserve areas where panther offspring have been repeatedly produced as well as smaller "stepping-stone" conservation areas and linkages that establish a functional network. Location of each target area polygon within conservation areas was partially selected based on current panther observations and telemetry data (known presence of panthers).

Table 2. Source/Destination Target Locations for LCP Models.

Id	Target Location
1	Ok Slough State Forest
2	Panther Walk Preserve
3	Camp Keais Strand
4	Crew South
5	Crew North
6	Corkscrew Swamp East
7	Corkscrew Swamp West
8	CREW West
9	CREW Central West
10	Imperial Marsh Green Meadows
11	Wild Turkey Strand North
12	Wild Turkey Strand South
13	Airport Mit. Bank North
14	Airport Mit. Bank South
15	Imperial Marsh Preserve
16	Horsepen Strand
17	Corkscrew Swamp South
18	Spirit of the Wild WMA
19	Edison Farms Preserve

In the **third step** of the LCP process, we created cost backlink and cost distance rasters and ran the cost path polyline tool to plot potential connections between the various target areas.

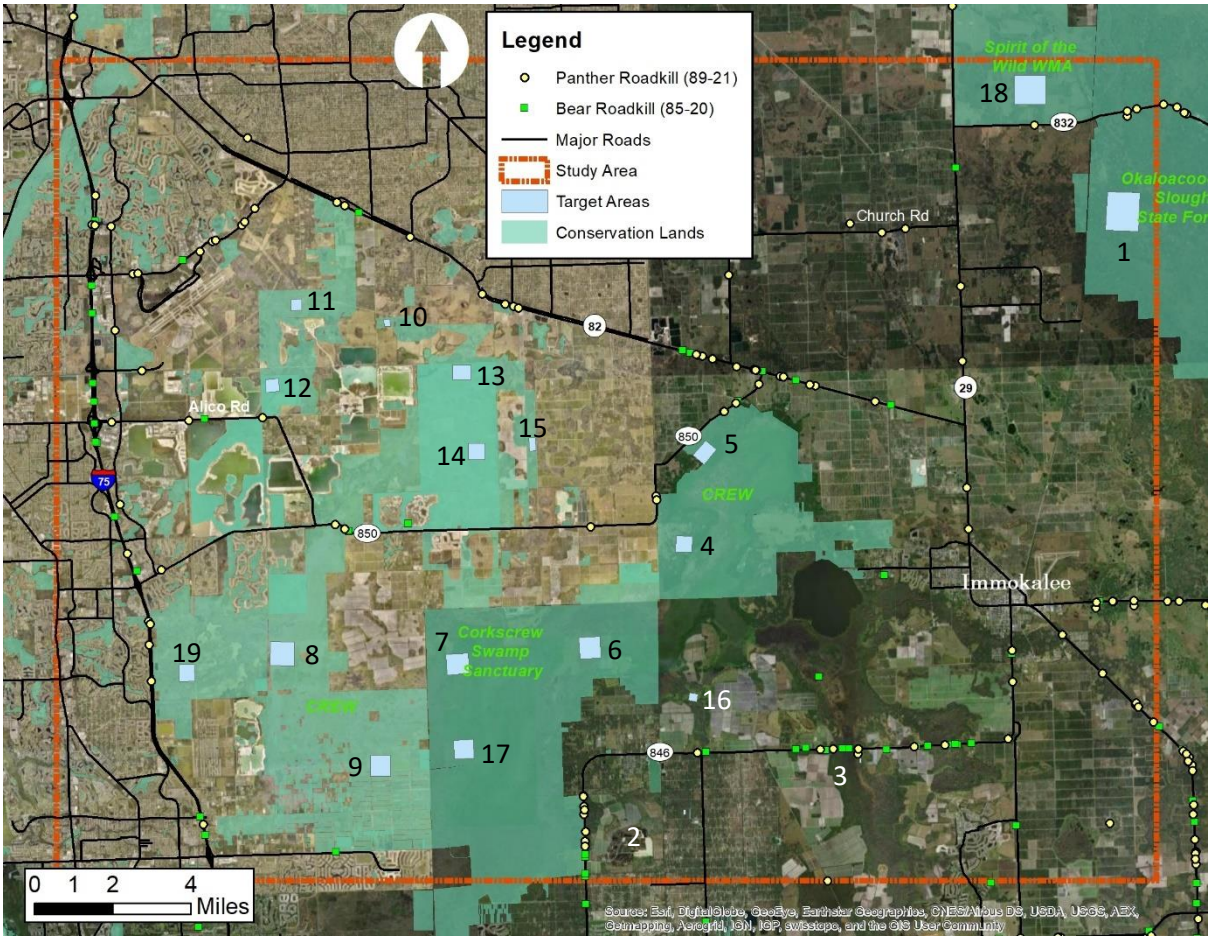

Figure 5. Location of target areas used for least cost path modeling (refer to table 2 for target area descriptions).

Results and Discussion

Camera traps and observations

Our success in deploying camera traps was unfortunately limited. We were unable to obtain approval for several of the proposed locations on public and private lands and along Lee County rights-of-way. Construction activities in Verdana also precluded our ability to set up cameras there and some sites were too wet to gain access. Although we had permission from Corkscrew Swamp Sanctuary, we opted to not set those up because they were to be paired for comparison with other deployments on certain Lee County parcels and other private lands that we were unable to obtain permission for.

We did deploy 6 cameras to new areas of CREW from December 2021 to August 2022 that supplemented other camera trap survey locations on CREW. We also set up 10 cameras on the Galloway and Green Meadows tracts of Imperial Marsh Preserve. Cameras were out from December 2021 until June 2022. For all cameras we collected approximately 100,000 images. Many of these were negatives or vegetation. Notably, we captured images of panthers and deer at all three of these areas. Other species caught on camera included bobcat, coyote, wild turkey, marsh rabbit, raccoon, Virginia opossum, people, dogs, cattle, and vehicles.

Since we were only able to deploy cameras at a fraction of the locations intended, we consolidated sightings from our cameras with those by other entities to create a broader picture of panther observations across the area (fig. 6). Contributions are included from Lee County 20/20, CREW, FWC and Audubon. We recognize that this represents only officially reported sightings and that many more observation accounts are absent from this report.

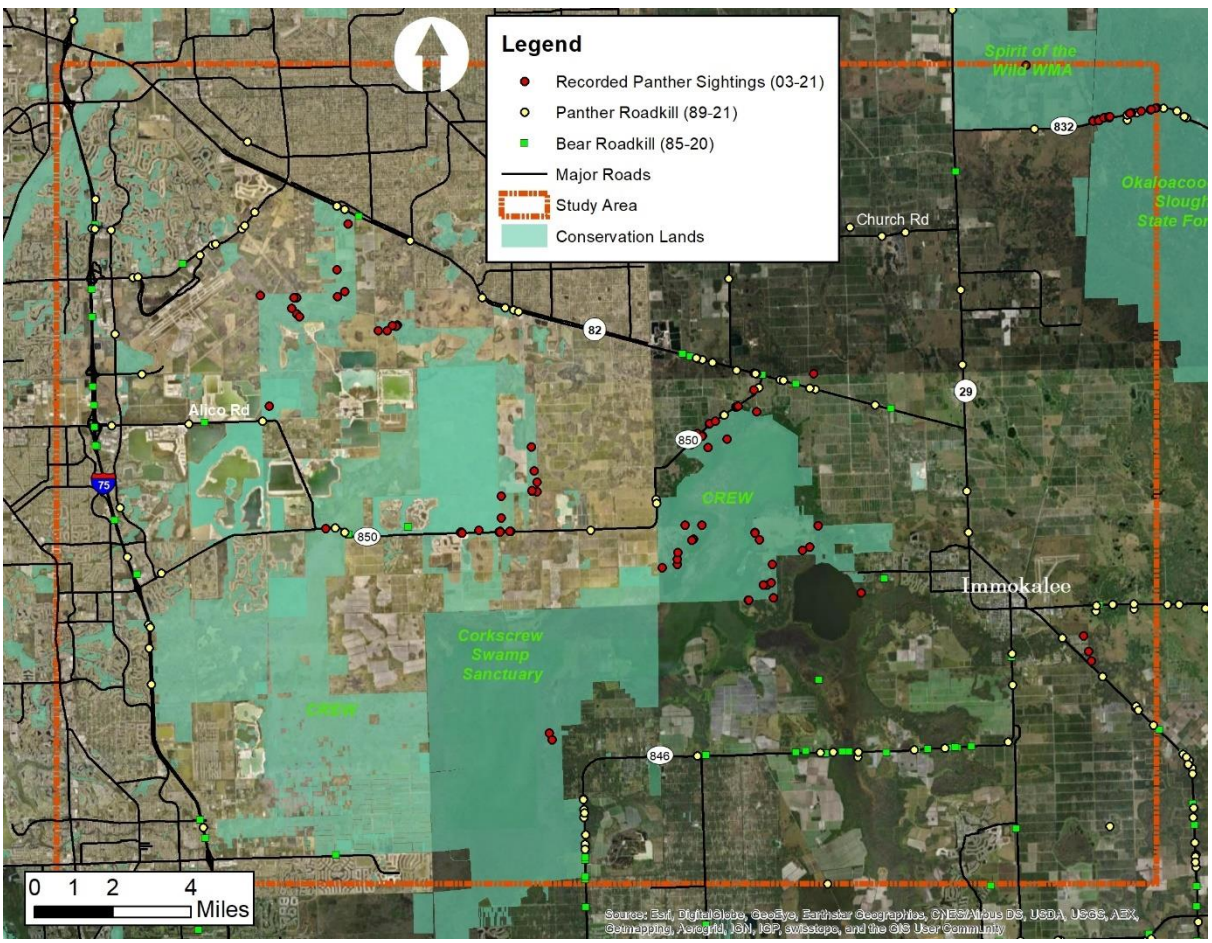

Figure 6. Panther observations from cameras and other sources (FWC/FNAI) in the study area from 2003 to 2021 (this excludes telemetry data and non-road mortality reports).

Our intent with the camera traps was two-fold: 1) to document sustained presence at the larger conservation areas, and 2) to document movements across roads and open spans of non-conservation lands (separating protected conservation areas) where they had previously been undocumented. We were successful in the first case and only partially successful in the second case. We obtained confirmed accounts of breeding females with kittens in CREW, Corkscrew Swamp Sanctuary, and Wild Turkey Strand Preserve. Though we were unable to gain any new records of observations under item #2, records of telemetry and road-kill locations still indicate movement across the road segments and non-conservation land areas of interest (fig. 7).

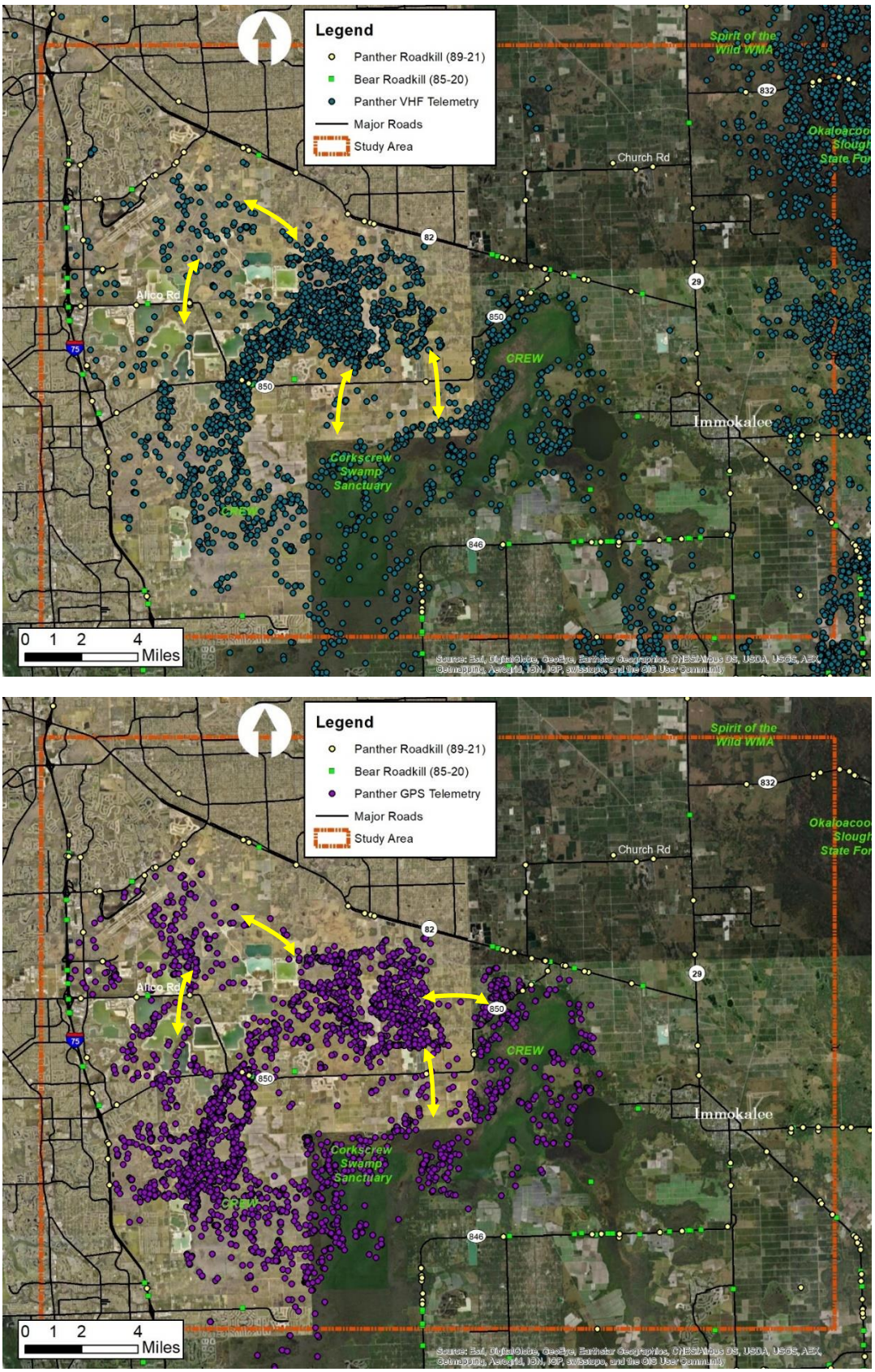

Figure 7. Panther VHF telemetry locations, 1989 and 1998 to 2016 (upper) and GPS telemetry locations, 2007-8 and 2010-12 (lower). Yellow lines indicate possible travel paths.

Kernel density models

We performed composite kernel density estimates for like types of telemetry data (VHF and GPS). The composite KDE models of VHF data from 12 panthers spanning from 1989 and 1998 to 2016 (n=1857) and GPS data separated by panthers that were tracked over the same time interval (i.e., two panthers from 2007-08 [n=2447] and three panthers from 2010-12 [n=1641]) did provide a distinctive pattern showing concentrations of activity and general movement pathways within the Corkscrew Road Study Area (figs. 8 and 9).

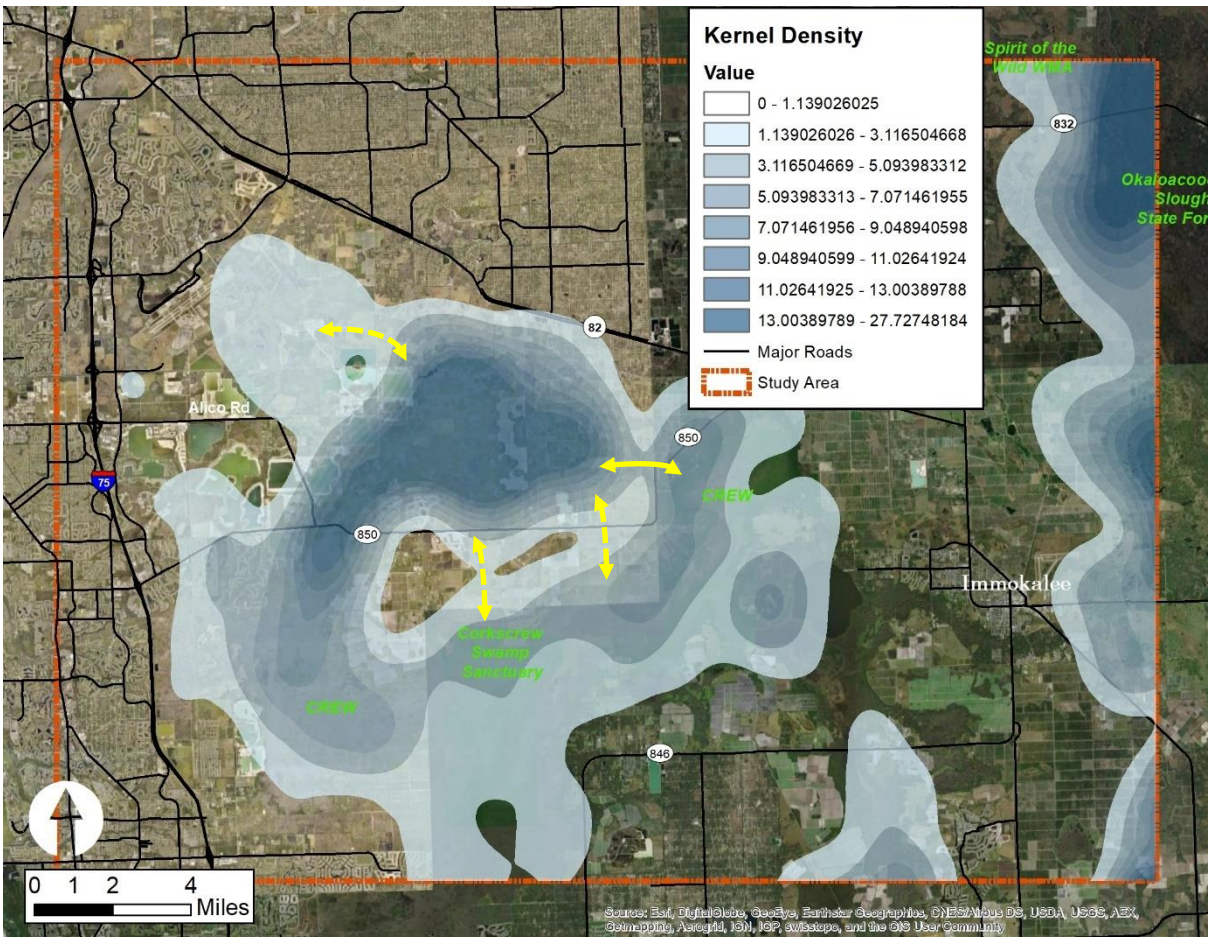

Figure 8. Kernel Density Estimate of VHF telemetry locations of 12 panthers from 1989 to 2016 (darker blue shades indicate stronger relationships; solid yellow lines indicate a stronger link than dashed lines).

The KDE model of VHF telemetry data presents long-term patterns of data from 12 individuals collected with long intervals between locations, while the KDE model of GPS telemetry data has short intervals between locations, but also over a much shorter time and from fewer individuals (2 and 3 each). Strong overlap occurs with use of the Airport Mitigation Bank and Imperial Marsh-Galloway and wetlands in the groves to the east. Core areas are shown in CREW and Corkscrew Swamp Sanctuary. The consistent use of the corridor and wildlife crossing just east of the Alico Road intersection with Corkscrew Road is evident in all exhibits. This demonstrates the effectiveness of wildlife crossings.

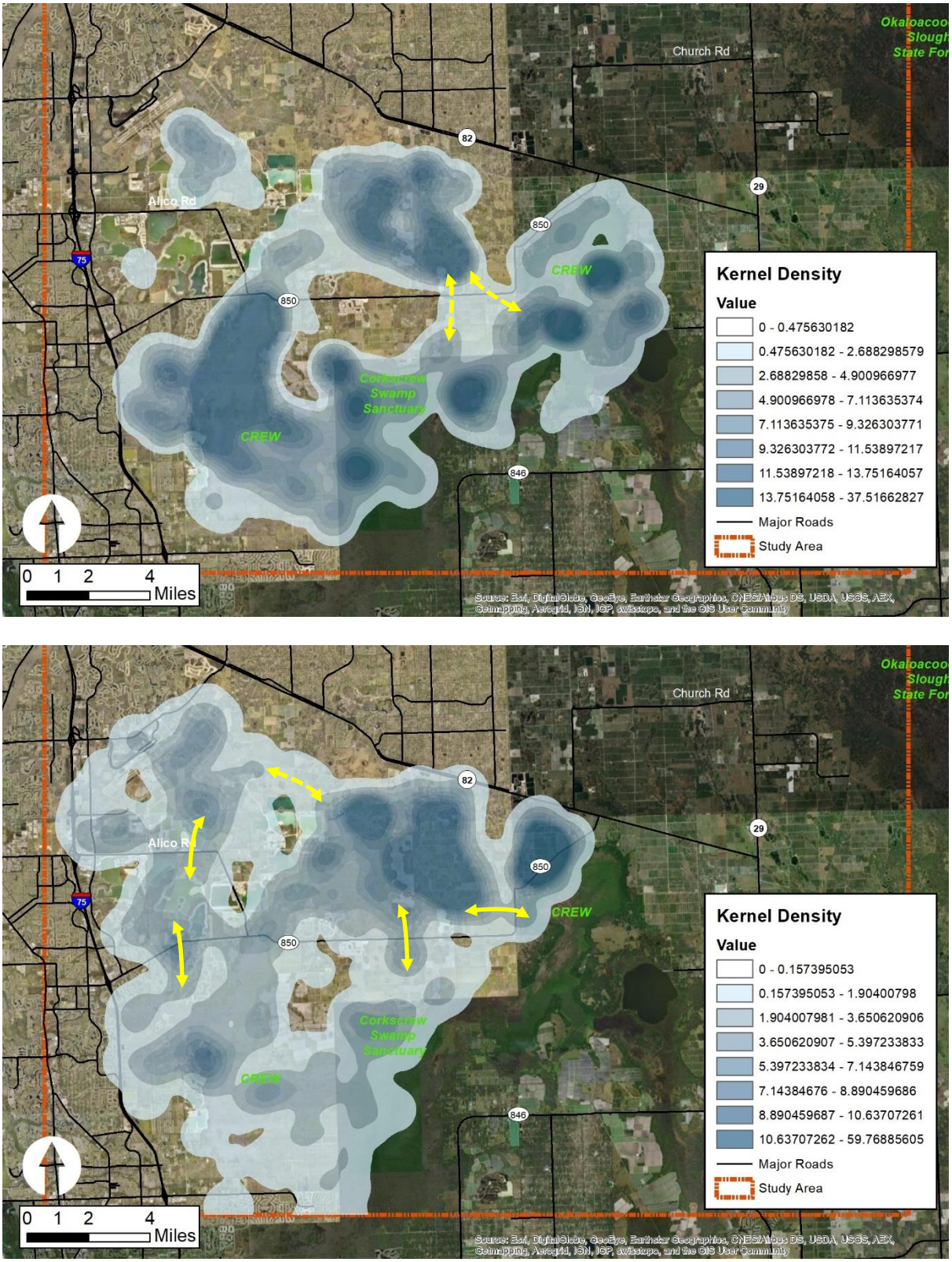

Figure 9. Kernel Density Estimate of GPS telemetry locations of panthers from 2007-8 (upper) and 2010-12 (lower) (darker blue shades indicate greater point densities; solid yellow lines indicate a stronger link than dashed lines).

Less significant, but secondary movement pathways are indicated by the yellow lines linking certain areas (figs. 8 and 9)—Wild Turkey Strand to Imperial Marsh-Green Meadows; Wild Turkey Strand to Edison farms/CREW; CREW and Corkscrew Swamp Sanctuary to Imperial Marsh-Galloway and adjacent grove wetlands; and Corkscrew Swamp Sanctuary to Corkscrew Mitigation Bank. Use of these areas was likely lower because of less desirable land uses such as citrus, turfgrass and other agricultural and mining activities.

Least Cost Path Models

We ran cost paths for three different land cover scenarios (existing, proposed and modified proposed) using two different algorithms, base cost values (x) and inverse cost values (1/x). The modified proposed was only performed for connections between CREW and Spirit/OK Slough SF and CREW to Imperial Marsh Preserve-Galloway.

Existing land cover. A comparison of the original integer values and inverse values for the existing land cover scenario is shown in fig. 10. We calculated the gamma index of connectivity and alpha index of circuitry for both cost path algorithms under each land cover scenario (where L = # of linkages, V = # of nodes):

1. Existing Habitat/Land Cover
    a. original values:
        i. connectivity = L/3(V-2) = 26/51 = **0.51**
        ii. circuitry = (L-V+1)/(2V-5) = 8/33 = **0.24**
    b. inverse values:
        i. connectivity = L/3(V-2) = 26/51 = **0.51**
        ii. circuitry = (L-V+1)/(2V-5) = 8/33 = **0.24**
2. Existing Protected Areas
    a. original values:
        i. connectivity = L/3(V-2) = 16/51 = **0.31**
        ii. circuitry = (L-V+1)/(2V-5) = (16-19+1)/33 = **-2/33** <--- negative circuitry
3. Proposed Habitat/Land Cover
    a. original values:
        i. connectivity = L/3(V-2) = 28/51 = **0.55**
        ii. circuitry = (L-V+1)/(2V-5) = 10/33 = **0.3**
    b. inverse values:
        i. connectivity = L/3(V-2) = 27/51 = **0.53**
        ii. circuitry = (L-V+1)/(2V-5) = 9/33 = **0.27**

Network connectivity is the extent that all nodes (target locations) are connected by linkages. Network circuitry represents the level to which alternate linkages occur (Dramstad et al. 1996). Numerically the two existing land cover alternatives are the same. From visual comparison, one can see that although there may be the same number of linkages, the spatial arrangement is different between the representations generated using original integer values and inverse values (fig 10). Some differences are subtle while others are dramatic. We also made these calculations for existing protected areas; values were considerably lower demonstrating the number of unprotected gaps between existing conservation lands.

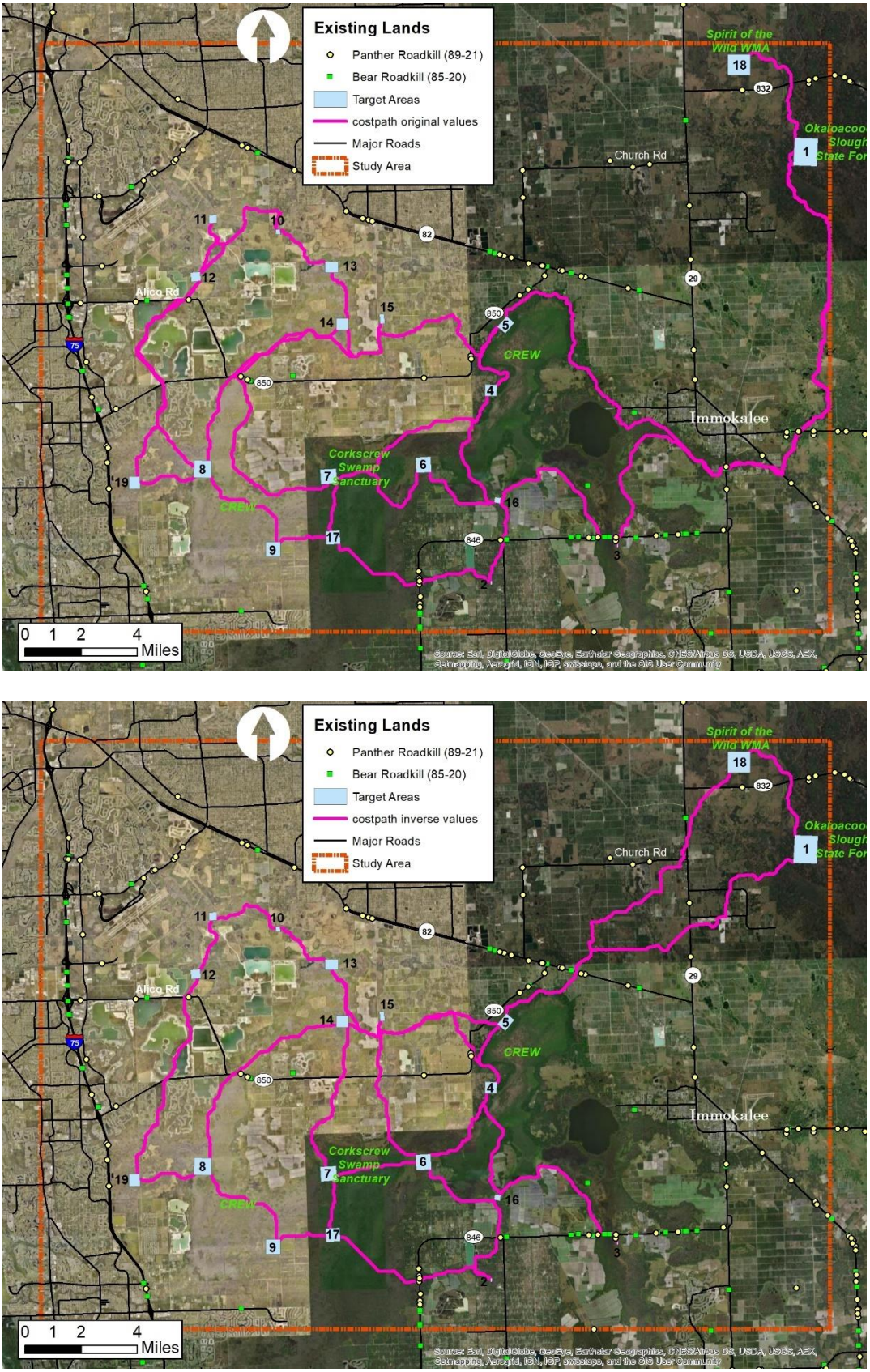

Figure 10. Cost Pathways for existing land cover using original base integers (upper) and inverse values (lower). Key to target area numbers can be found in Table 2.

Most notable are the different pathways between CREW (5) and Spirit/OK Slough SF (18,1). The cost surface of original integer values routed the pathway around Lake Trafford and along a natural drainage feature characterized by forested communities and south of Immokalee before turning north along the Study Area boundary. This certainly isn't ideal, but telemetry data does indicate this creek drainage is used by panthers and roadkills have occurred on the roads where the cost path crosses. This alternative intentionally avoided crossing the extensive agricultural lands north of CREW—a more direct route. The cost surface of inverse values chose to connect CREW and Spirit/OK Slough SF across this expanse of agricultural lands, a much shorter distance and one less road crossing.

The other difference to discuss is the connections between Corkscrew Swamp Sanctuary (6,7) and Airport Mitigation Bank/Imperial Marsh Preserve-Galloway (14,15). In this case, the original value cost surface formed these linkages by either using the existing wildlife crossing to the west or connecting indirectly via the CREW south target node. These are much longer routes than was selected using the cost surface of inverse values. The latter established two separate direct linkages crossing Corkscrew Road in new locations. These paths cross through abandoned groves and a forested residential community along Carter Road. Coincidentally we recorded panther approaching Corkscrew Road at the Carter Road intersection and telemetry points indicate occasional presence in this rural residential area.

Proposed land cover. As a reminder the "proposed" land cover scenario takes the existing land cover and revises it to include proposed land use changes as projected in the Future Land Use Plans from the respective counties. This includes creation of habitat corridors and some habitat restoration, yet gaps in habitat connectivity remain (note: the calculations included the Troyer Bros. mine reclamation/restoration plan that is now uncertain). The results of the proposed land cover scenario can be found in Fig. 11.

Performing the connectivity and circuitry index calculations for the original base values and inverse values for proposed land cover are only slightly different when compared. However, they do demonstrate a slight improvement over the values generated for the existing land cover scenario.

Regarding spatial arrangement of the linkages there is a striking similarity between the original and inverse value alternatives. As with the existing land cover scenario some differences exist regarding the cost paths that connect CREW (5) and Spirit (18). With both cases, the plotted paths include a troubling crossing near paved road intersections (Church Road and SR 29, SR 29 and CR 832).

Modified proposed land cover. The modified version of the proposed land cover includes distinct changes associated with two linkages CREW to Spirit and CREW to Imperial Marsh Preserve-Galloway Tract. The CREW to Spirit linkage (fig. 4) is a modification that addresses habitat corridor gaps associated with the SW Hendry and Rodina Sector Plans. These gaps (shown in yellow, in the proposed north corridor linkage) negatively influenced cost path selection that resulted in high-risk road crossing locations and encroachment into residential areas. The modified proposed land cover scenario includes recommendations for continuous native habitat corridors (includes restoring the "gaps" – from strips of agriculture to native habitat types) between CREW and Spirit/OK Slough SF.

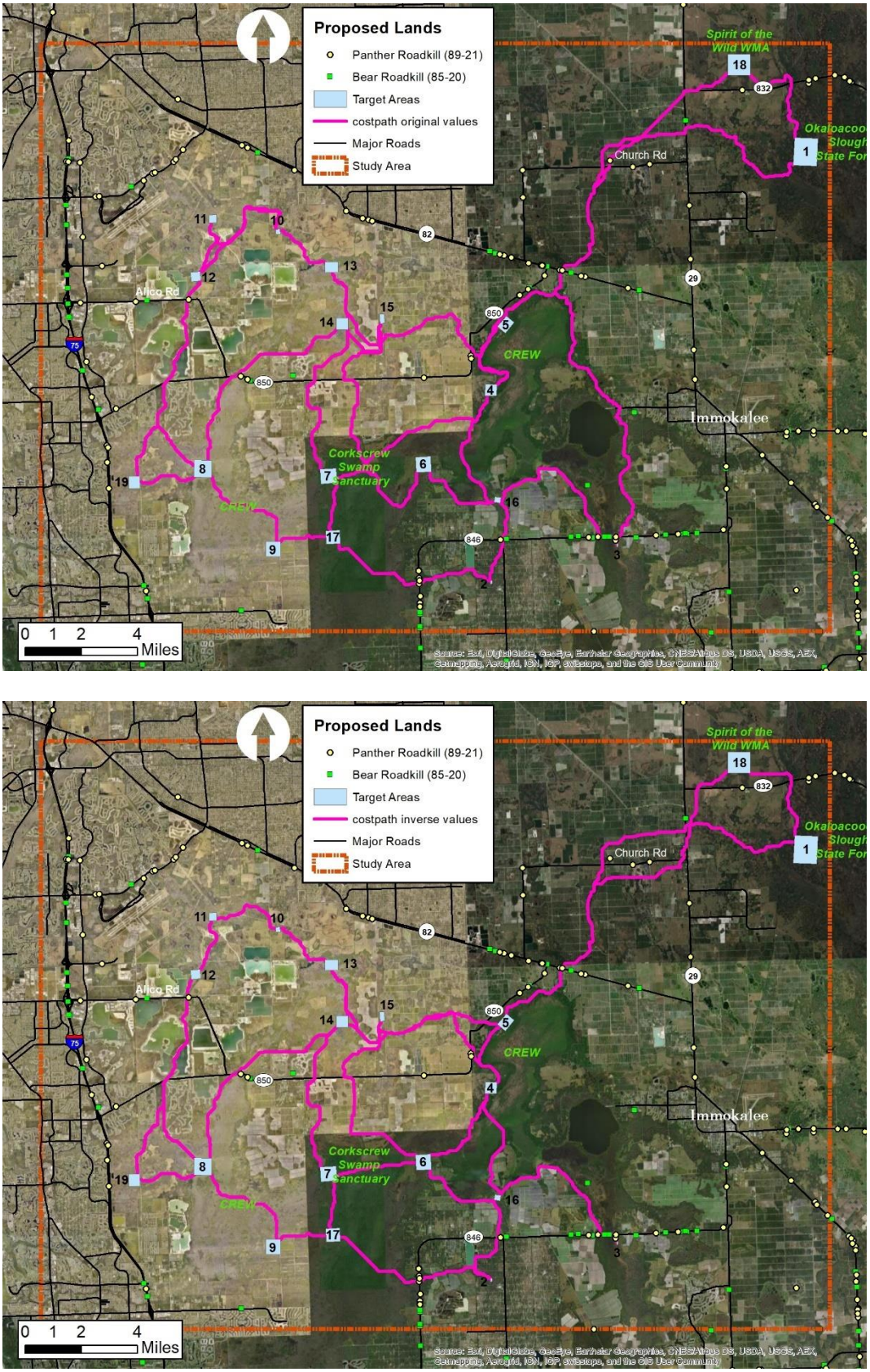

Figure 11. Cost Pathways for proposed land cover using original base integers (upper) and inverse values (lower). Key to target area numbers can be found in Table 2.

We similarly proposed two alternative restored habitat linkages between CREW and Imperial Marsh Preserve-Galloway Tract. Both alternatives correspond to existing panther telemetry and roadkill data locations. The first alternative partially overlaps with a Florida Forever proposal and a recent panther roadkill occurred just to the west of where the corridor would cross Corkscrew Road (fig. 12a). This conceptual corridor has only two private landowners accounting for 60% (255 ac) of the area highlighted.

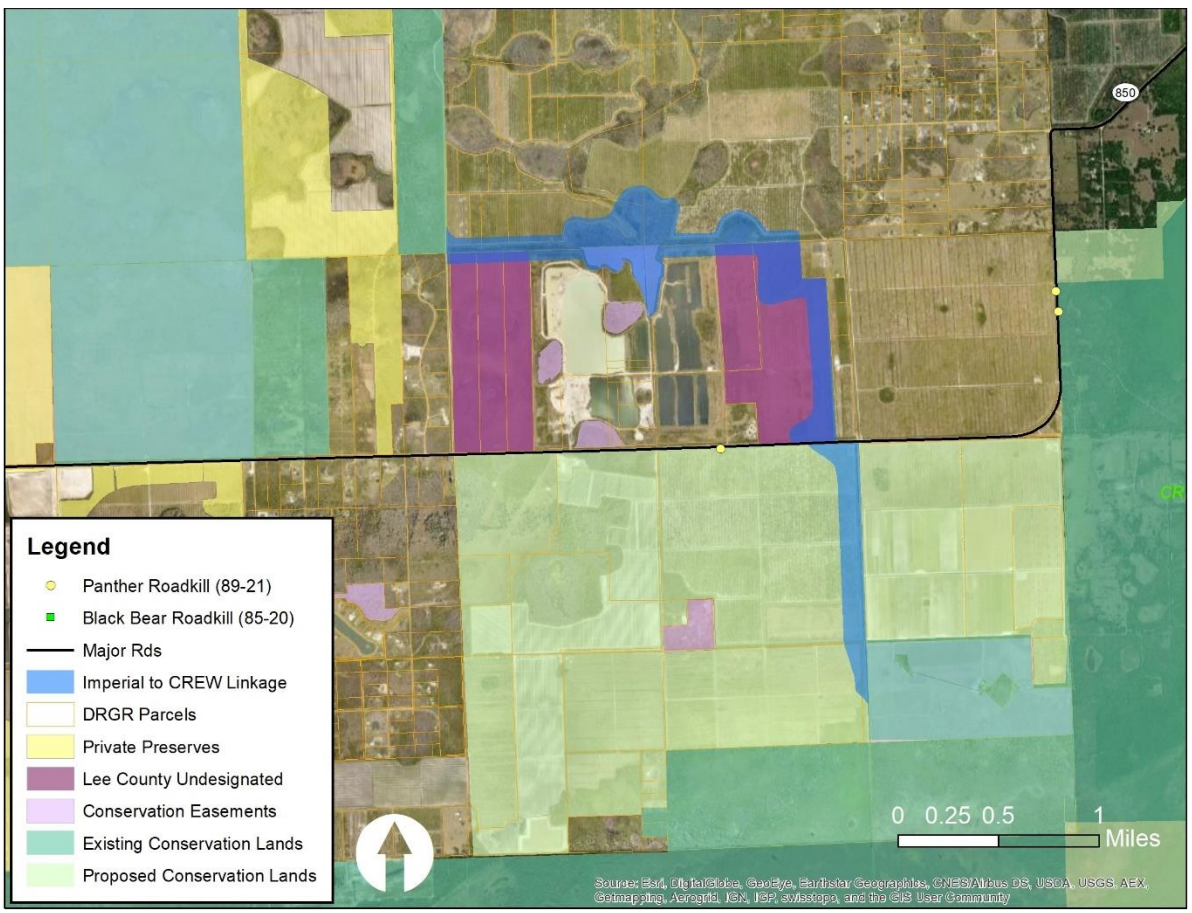

Figure 12a. A conceptual proposed north/south linkage between CREW and Imperial Marsh Preserve-Galloway Tract (minimum width of 600 ft and incorporates several forested wetland patches).

The second alternative for a conceptual linkage between CREW and Imperial Marsh Preserve-Galloway Tract is oriented east to west connecting to CREW where two panther road mortalities indicate previous attempts to cross Corkscrew Road (fig. 12b). This linkage also would involve only two private landowners. The proposed connection takes advantage of existing public lands and conservation easements, and wetland systems to enhance the width of the habitat connection.

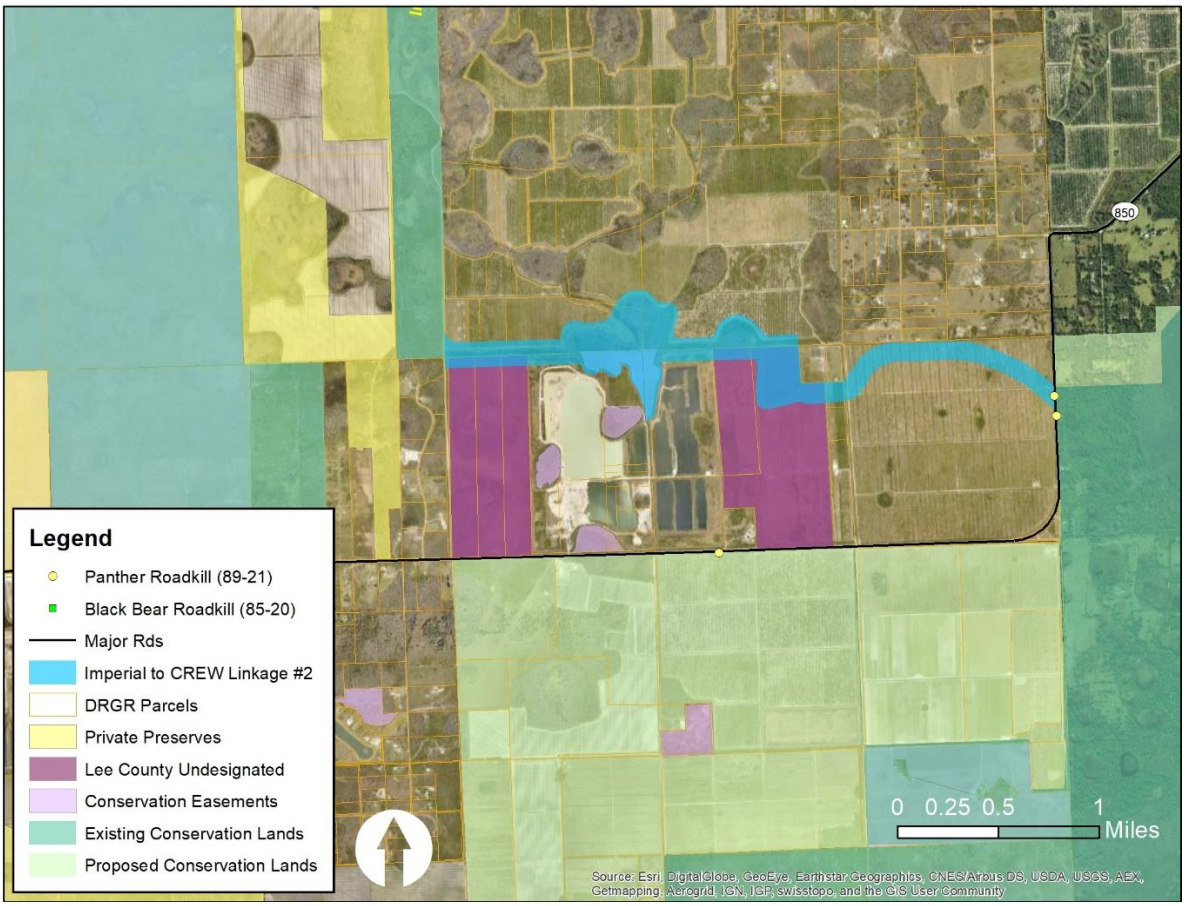

Figure 12b. A conceptual proposed east/west linkage between CREW and Imperial Marsh Preserve-Galloway (minimum width of 600 ft and incorporates several forested wetland patches).

The inclusion of the above proposed continuous habitat corridors generated more desirable results in the cost path models for these linkages (fig. 13 and 14). Most notable with CREW (5) to Spirit (18) is fewer road crossings and avoidance of intersections and residential areas.

In fig. 13 we display the outcome of the cost paths generated using the original base integer values of the cost surface. Note that while this did produce a more functional and safer pathway between CREW and Spirit, no change was evident for the path selected between Imperial Marsh Preserve (15) and CREW (4). The chosen path in this case is the same as with the proposed land cover scenario and makes use of several stepping stone, forested patches along the north boundary of the King Ranch groves and multiple private parcels that have unimproved pasture and other low to moderate cost land uses.

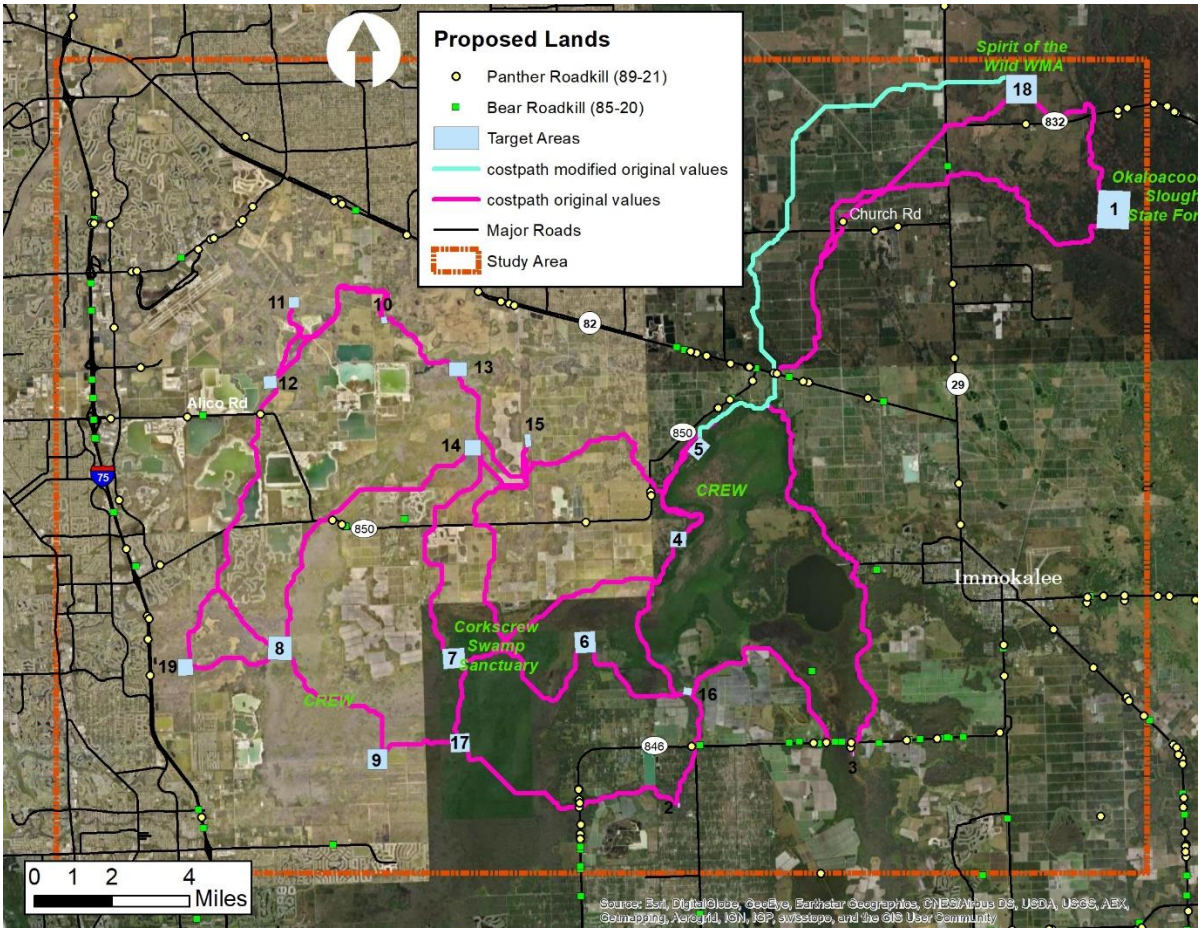

Figure 13. Modified proposed land cover that includes provision for continuous habitat linkages between CREW (5) and Spirit of the Wild WMA (18) and Imperial Marsh Preserve (15) and CREW (4). This depiction reflects plotted paths based on original integer values. Also see fig. 4 for the proposed habitat linkages.

The cost paths produced for the modified proposed land cover using the inverse cost values was very similar between the CREW (5) and Spirit (18) nodes (fig. 14). Yet, the chosen path between Imperial Marsh Preserve (15) and CREW (4) this time fell within the first conceptual alternative linkage (figs. 12a and 14). This almost certainly is a result of designating the area within the modified corridor as restored native habitat classes of greater value to panthers than the current citrus groves. We conclude that similar results would have occurred if modeled using restored habitat classes with the second conceptual alternative linkage (fig. 12b).

One final suggestion is included in this section of the report that addresses the current gaps in continuous suitable habitat for panthers between Wild Turkey Strand Preserve and Wild Blue (to the south) and Imperial Marsh Preserve-Green Meadows (to the east). Figure 15 illustrates two key sites needed to solidify and help sustain continued use by panthers of Wild Turkey Strand Preserve. The site at the southern end is needed to establish a wildlife crossing under Alico Road. The site to the east, near the transmission line corridor is currently improved pasture and should be restored to a mix of native wetlands and uplands.

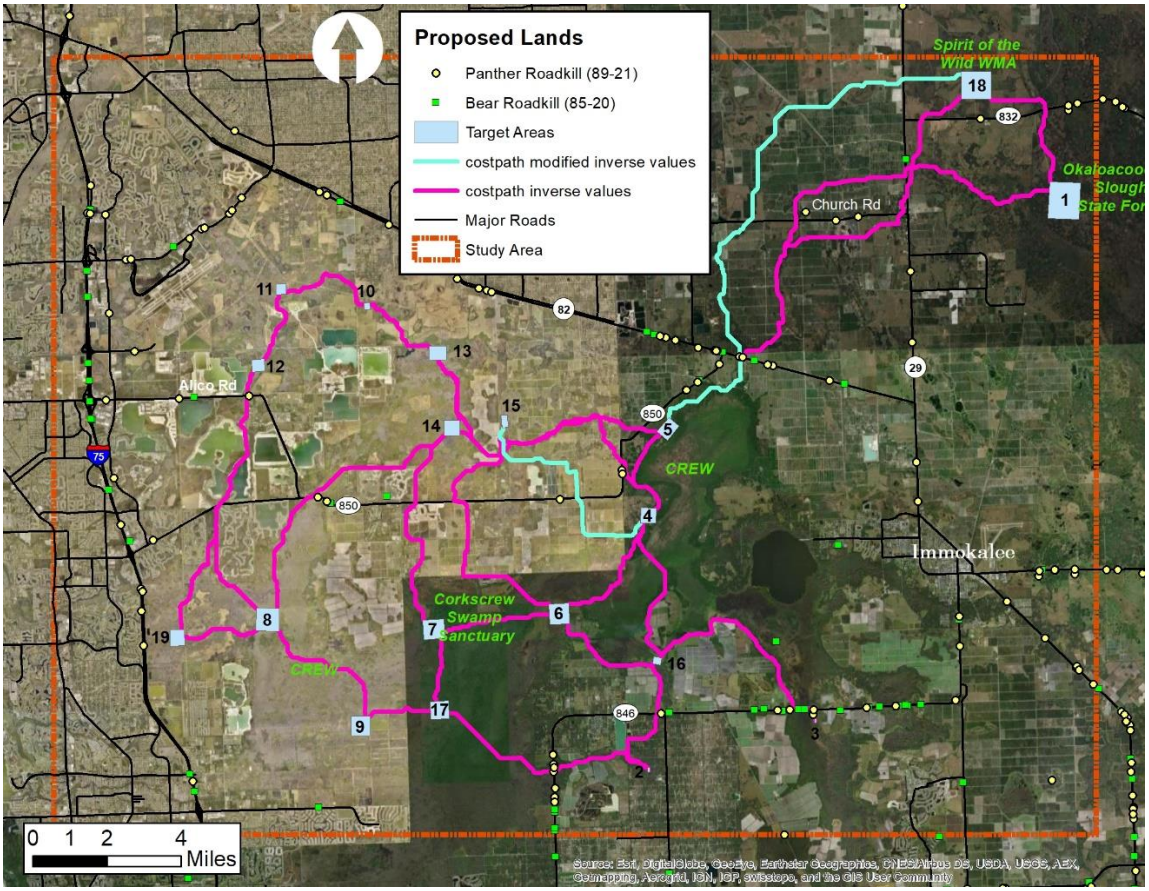

Figure 14. Modified proposed land cover that includes provision for continuous habitat linkages between CREW (5) and Spirit of the Wild WMA (18) and Imperial Marsh Preserve (15) and CREW (4). This depiction reflects plotted paths based on inverse cost values. Also see fig. 4 for the proposed habitat linkages.

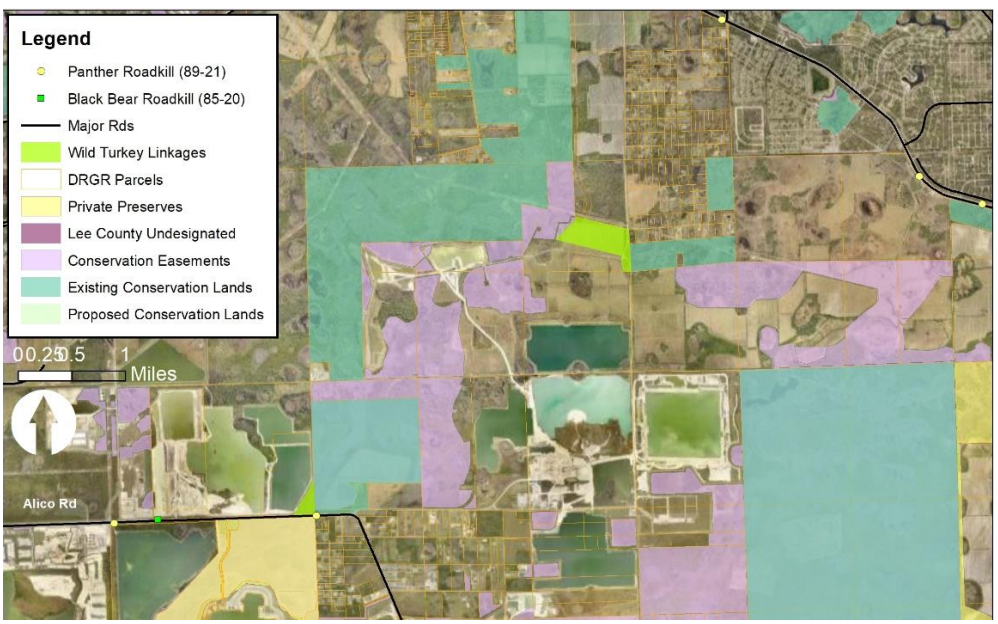

Figure 15. Habitat corridor gaps (in light green) between Wild Turkey Strand Preserve and Imperial Marsh Preserve-Green Meadows and Wild Blue.

The eastern site should be a priority and include a wildlife crossing structure should the proposed Alico Road extension move forward near this location. The consequences of not addressing the impacts of the road extension could be significant and further isolate Wild Turkey Strand Preserve.

Conclusions

The KDE and Least Cost Path results presented in this report explore current and potential spatial patterns based on existing panther telemetry, roadkill, observation and land use data. The findings of our analyses provide several alternative pathways and is meant to illustrate the need to further strengthen habitat linkages in this area under conditions of rapid growth and land use change. Due to large-scale transformation of native habitat types to residential, agricultural and mining uses in the area, the need for some habitat restoration may be necessary to satisfy habitat connectivity needs.

We think we have identified viable and sustainable planned linkages based on current panther habitat use and movement patterns and is reflective of mounting constraints we can expect in the future. In our opinion, these actions are needed to establish a functional local-regional habitat network in the Corkscrew Road area that will foster and ensure sustained presence by and breeding habitat for panthers, bears and other wildlife species. Our recommendations and conclusions are meant to stimulate discussion and engage stakeholders to further formulate workable solutions to conservation needs as well as development needs.

Because of Covid-19 and other issues we were unable to collect the field data we had anticipated using in this study. The camera trap data would have enhanced our study and filled in gaps not covered by the existing data available. To this end, we recommend a concerted effort by resource agencies and land managers to either conduct in-house or contract out more long-term field data collection on species abundance, diversity and spatial distribution to evaluate the effectiveness of habitat management actions.

The results of this study can be used to develop a more formal and generally accepted wildlife habitat conservation and connectivity plan for the Corkscrew Road area. We offer to consult with the planning agencies and other interested parties to help create such a plan that is practical from a land use and development perspective and functionally sustainable from a wildlife habitat protection perspective.

Literature Citations

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