

# **Green Links Regional CLIP Database**

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## INTRODUCTION

The Green Links Regional CLIP Database was developed to assist conservation, listed species, green infrastructure, transportation, and land use planning within the Florida panhandle region. The database is a collection of both currently available statewide and regional Geographic Information Systems (GIS) and custom regional analyses created in this project to enhance planning efforts. This work was conducted by the Center for Landscape Conservation Planning at the University of Florida with support from the Florida Natural Areas Inventory and with guidance from a broad advisory committee convened to both assist in development of this database while discussing efforts at coordinated regional planning within the study area. The overall project goal agreed to by the committee was to create a regional Green Infrastructure Plan that was a shared vision among multiple partners (FDOT, FWC, USFWS, NMFS, ACOE, FDoF, FNAI) to achieve the following objectives: 1) strategically protect and manage a network of conservation lands essential for sustaining the area's diverse ecological functions and values; 2) provide a framework for planning future land development activities, including transportation projects; and 3) identify opportunities for locating parks, trails, and other green space to benefit human use.

This project was facilitated by previous development of a regional CLIP GIS database for the Florida Fish and Wildlife Conservation Commission's Cooperative Conservation Blueprint (CCB) (Hector et al. 2012). The latest phase of the CCB involves development of a regional pilot project in south-central and southwest Florida to refine identification of conservation priorities based on the CLIP database (Oetting et al. 2011) combined with more specific regional data as well as identification and development of incentives-based conservation implementation

strategies and opportunities while working with both relevant regional experts and a diverse group of stakeholders. The CCB Regional CLIP database emphasized a combination of both a Regional Ecological Network (REN), which focuses on wide-ranging species, riparian, and landscape connectivity, and a synthesis of other relevant state and regional data and analyses identifying additional conservation priority areas.

In addition, the Green Links project was also enhanced by the ongoing Florida Ecological Greenways Network (FEGN) Update projects (Hector et al. 2000; Hector et al. 2013) and the statewide sea level rise conservation impacts assessment still in progress and being conducted by the University of Central Florida, Florida Natural Areas Inventory, and the University of Florida. Both of these projects contributed data, analyses, or relevant conceptual considerations to the Green Links database.

Therefore, in the Green Links database, we followed similar methods and used many of the same statewide GIS data layers as were used in the CCB Regional CLIP effort as well as the FEGN Update. However, working with the advisory committee, we both modified or added analyses and added new data layers that best represent the ecology and potential conservation priorities of northwest Florida. We also expanded the regional CLIP methodology by adding a new method to further refine identification of the highest conservation priorities, and we added various supplemental data layers that can both enhance current conservation planning efforts or be incorporated into the aggregated priorities when this Database is updated and enhanced in the future.

Finally, it is important to note that the Green Links database and all of its component data layers are intended for planning purposes only. These layers represent a range of resolution,

but they are not sufficient to serve as, or replace, survey quality occurrence or map data. With this stated, however, these data represent a set of consistently collected, objective, defensible, science-based information to serve at least as an important foundation to conservation and other planning efforts within the study area.

## **METHODS**

### **Summary**

We compiled all relevant data sets, and worked with the advisory committee to select, prioritize, and integrate the best available GIS data. Specific steps included:

- 1) Delineating a Regional Ecological Network (REN) that identifies the ecological connectivity and intact, large landscape priorities based on the statewide Florida Ecological Greenways Network, wide-ranging species (in this case, the Florida black bear) habitat and corridors, riparian/riverine buffers and wildlife corridors, and areas important for xeric natural community connectivity;
- 2) Compiling a CLIP and Regional Ecological data Synthesis (RES) to identify other conservation priority areas based on CLIP Rare Species Habitat, CLIP Strategic Habitat Conservation Areas, CLIP Rare Natural Communities and regional natural community priorities, CLIP Functional Wetlands, and a regional analysis of functional buffers for existing conservation lands;
- 3) Combining the REN and RES into the Green Links Regional CLIP priorities data layer;
- 4) Developing a GIS overlay model to further refine identification of conservation priorities within the highest priorities (P1) in the Regional CLIP data layer; and

- 5) Compiled, developed and organized supplemental data layers that can enhance current conservation planning efforts and potentially be incorporated into the Regional CLIP priorities when the Green Links Database is updated and enhanced in the future.

### **Advisory Committee**

The technical advisory committee (TAG) is an essential part of the Green Links database development process providing review and an opportunity to develop technical consensus for selecting, prioritizing, and integrating the best available GIS data. TAG members have relevant scientific or technical expertise in regional conservation assessment, natural resources and ecosystems, relevant natural resource priorities, conservation or land use planning, or

Geographic Information Systems (GIS). The Green Linkage TAG members were:

Jon Oetting, Florida Natural Areas Inventory  
 Tracey Ludyjan-Ybarra, District 3, Florida Department of Transportation  
 Kelly Parker, District 3, Florida Department of Transportation  
 Stacie Blizzard, Federal Highway Administration  
 Terry Gilbert, Florida Fish and Wildlife Conservation Commission  
 Ted Hoehn, Florida Fish and Wildlife Conservation Commission  
 John Himes, Florida Fish and Wildlife Conservation Commission  
 Jessica Graham, Florida Fish and Wildlife Conservation Commission  
 Charlie Marcus, Florida Division of Forestry, Department of Agriculture and Consumer Services  
 David Rydene, National Marine Fisheries Service  
 Andrew Kizlauskas, Army Corps of Engineers  
 Kevin O'Kane, Army Corps of Engineers  
 Mary Mittiga, U.S. Fish and Wildlife Service  
 Vivian Negron-Ortiz, U.S. Fish and Wildlife Service  
 Gail Carmody, U.S. Fish and Wildlife Service (retired)  
 Paul Lang, U.S. Fish and Wildlife Service  
 Wade Reynolds, Bay County Planning Department  
 Mary Gutierrez, West Florida Regional Planning Council

Individuals that expressed interest but were unable to participate:

Laurie MacDonald, Defenders of Wildlife  
 Ann Birch, The Nature Conservancy

Paul Thorpe, Northwest Florida Water Management District  
Brian Branciforte, Florida Fish and Wildlife Conservation Commission

We held six TAG meetings to review available data, develop the REN and Ecological Synthesis criteria, identify additional relevant supplemental GIS data and analyses, and develop an overlay model to further refine the highest priorities. These meetings were held on:

December 15, 2011  
May 16, 2012  
August 16, 2012 (conference call)  
October 29, 2012  
December 12, 2012  
April 24, 2013 (webinar)

### **Study Area and Conservation Lands Data**

Selecting a study area was the first step in development of the Green Links database. Based on input from the TAG, we started with a smaller study centered on Panama City and all or parts of five surrounding counties during early development of the database. However, the TAG decided the project was relevant to a larger northwest Florida area, and selected a final study area boundary incorporating all 10 Florida counties west of the Apalachicola River (Figure 1): Gulf, Calhoun, Jackson, Bay, Washington, Holmes, Walton, Okaloosa, Santa Rosa, and Escambia.

In addition, TAG members provided data and advice for compiling a set of existing and proposed conservation lands used both as primary data in the Green Links database and to support several analyses. These conservation lands data included:

#### **I. Existing Conservation Lands**

- 1) Florida Natural Areas Inventory (FNAI) Managed Areas
- 2) Florida Department of Environmental Protection (DEP) wetland mitigation banks

- 3) Northwest Florida Water Management District DOT mitigation plan sites
- 4) Corps of Engineers mitigation banks

**II. Proposed Conservation Lands**

- 1) FNAI Florida Forever Projects
- 2) Regional General Permit Conservation Units

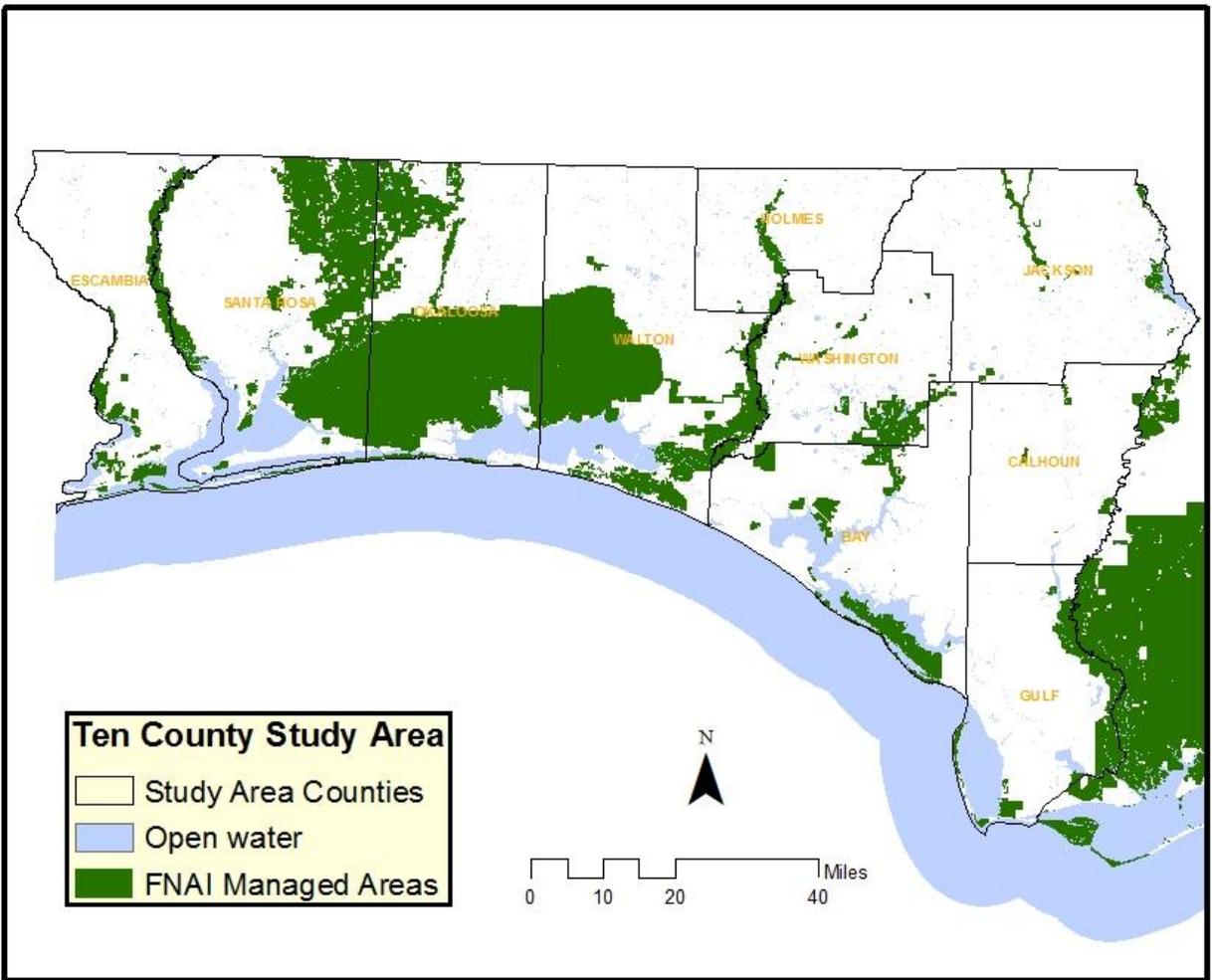


Figure 1. Green Links study area, which includes all Florida counties west of the Apalachicola River.

## **Regional CLIP Components**

The Green Links GIS database includes a variety of data layers identifying conservation priorities in various categories. All of these layers are potentially relevant for addressing specific conservation planning needs. In the statewide CLIP 2.0 database, such layers are referred to as core data layers, and we use this same terminology in the Green Links database. In addition, these core data layers are usually aggregated into Resource Categories such as Biodiversity, Landscape, Water Resources, etc. to organize data into categories of similar resource priorities. Finally some of these Resource Categories are combined into a single data layer representing what are considered to be the most important layers for identifying state or regional conservation priorities. In the Green Links database, the process of creating this final priorities aggregation was conducted in three steps:

- 1) Some core data were combined into a Regional Ecological Network;
- 2) Other priority core data was combined into a CLIP and Regional Ecological Synthesis;
- 3) Then these two intermediate aggregations were combined to create the Green Links Regional CLIP data layer.

Primary data sources developing the Regional CLIP database included CLIP 2.0 (Oetting et al. 2011), Florida Ecological Greenways Network Update (Hoctor et al. 2013), Florida Forever Conservation Needs Assessment (FNAI 2011), Florida Fish and Wildlife Research Institute (Endries et al. 2009), and the Florida Geographic Data Library (FGDL).

## I. Regional Ecological Network

The Regional Ecological Network (REN) combines relevant species, ecological connectivity, and conservation land buffer data to identify the ecological connectivity and intact, large landscape priorities within the study area. Five data layers are incorporated within the Regional Ecological Network:

**A. CLIP Florida Ecological Greenways Network:** identifies opportunities to protect large, intact landscapes important for conserving Florida's biodiversity and ecosystem services, and serves as one of the conservation priority foundations for biodiversity and ecosystem protection efforts in Florida. There are eight priority levels in the FEGN:

- 1) Critical Linkages 1: These Critical Linkages, which are a subset of the original Priority 1 linkages, are critical for completing a connection between existing conservation lands. Critical Linkages 1 are defined as areas with very high ecological significance while also being most threatened by development.
- 2) Critical Linkages 2: These Critical Linkages, which are a subset of the original Priority 2 linkages, are critical for completing a connection between existing conservation lands. Critical Linkages 1 and 2 together would complete a statewide ecological network containing the most important large intact landscapes and best connection opportunities.
- 3) Priority 1: These are the remaining areas of Priority 1 linkages not included within Critical Linkages 1.
- 4) Priority 2: These are the remaining areas of Priority 2 linkages not included within Critical Linkages 2.

- 5) Priority 3: Priority 3 linkages provide significant alternate routes to higher priority linkages.
- 6) Priority 4: Most Priority 4 linkages provide important riparian corridors within Florida and to other states. One Priority 4 linkage is needed to protect the northern half of the St. Johns Florida black bear population.
- 7) Priority 5: Priority 5 linkages represent other regionally significant opportunities to protect large intact landscapes.
- 8) Priority 6: Priority 6 includes all other areas of large intact landscapes that support protection of a statewide ecological network.

**B. Florida Black Bear Habitat and Corridor Priorities:** This layer was created specifically for the Green Links study with several statewide bear habitat priority layers and a bear corridor analysis done specifically for this study. These layers include:

- 1) FWC Florida Black Bear Strategic Habitat Conservation Areas (SHCAs)
- 2) Florida Black Bear Population Priority Conservation Areas (PPCAs): The PPCAs were identified by Tom Hctor as part of the FEGN Update project completed in June 2013. These areas identify the additional habitat conservation priorities based on the habitat protection goals in the State Florida Black Bear Management Plan (FWC 2012)) for each of Florida's seven bear subpopulations.
- 3) Florida black bear habitat quality ranking: Statewide quantitative habitat model created as part of the FEGN Update project and based on an earlier Florida black bear habitat quality model developed for FWC (Hctor 2006).

- 4) Florida Black Bear Corridor: Custom corridor analysis for the Green Links project to identify best area for potential functional connectivity between the Apalachicola and Eglin bear subpopulations (using a 10% slice of ArcGIS corridor function using ranked bear habitat and CLIP 2.0 Landscape Context and large waterbodies added as high cost).

**C. Major River Buffers:** The major river buffer/connectivity analysis, which is part of the FEGN Update project, focuses on Florida's 50 major rivers as identified by FREAC (1990) and used in the riverine corridor modeling in the original delineation of the FEGN in 1997. The goal is to identify both potentially functional buffers around these river systems both for protection of water resources and provision of habitat and to serve as corridors for focal species where possible. This includes provision of various south to north corridors that may be critical for facilitating adaptation to climate change. The steps to create this layer were:

- 1) Identified Major Rivers and Special Outstanding Florida Waters connected to them as the starting point (from FGDL).
- 2) Used the Cooperative Land Cover Data from FNAI to identify natural and semi-natural lands including all natural communities, forest plantations, unimproved pastures/rangelands, etc.
- 3) Identified all areas of natural and semi-natural land adjacent to and connected to these rivers were within 800 meters (approximately ½ mile).
- 4) Deleted any narrow corridors and peripheral areas included in the buffering process by identifying and deleting all narrow areas less than 120 meters wide.

**D. Xeric Habitat Connectivity:** This analysis, which is part of the FEGN Update project, is intended to identify functionally connected patches of primary xeric natural community through surrounding compatible land cover and land use classes on xeric soils. The methods were:

- 1) Included sandhill, scrub, and scrubby flatwoods in patches 100 acres or larger as source xeric natural communities from the CLC data.
- 2) Suitable matrix (areas of potential connectivity between xeric natural communities) defined as any of the three natural communities included in the step above or any other natural or semi-natural vegetation on xeric soils (defined as anything that is moderately well-drained or drier).
- 3) Deleted any narrow connections less than 200 meters wide from the suitable matrix.
- 4) Identified all well connected areas of xeric habitat within 1.5 miles of xeric natural communities.
- 5) Retained only xeric landscapes with two or more xeric habitat patches, which means that retained xeric natural communities have to be well connected by a suitable xeric matrix and within 3 miles of each other.
- 6) Separated these patches into two size classes: 1,000 acres to 4,999 acres; 5,000 acres or larger

**E. Riparian Network:** The riparian network was based on similar methods used in the FWC CCB Regional Pilot Project, but was refined for the Green Links study area. It is intended to identify all additional riparian corridors that form a functionally connected and

buffered surface water network of streams, wetlands, and water bodies, both to provide water quality buffering and a potential wildlife corridor network across the study area.

The methods were:

- 1) Identified all wetlands and freshwater bodies connected to streams (the surface water network) using CLC data.
- 2) Identified all natural and semi-natural land use within 300 meters (app. 1000 feet) and connected to surface water network.
- 3) Prioritized the identified riparian network using the CLIP Surface Water Priorities where: CLIP Surface Water P1 = P1; CLIP Surface Water P2-P3 = P2; CLIP Surface Water P4-P7 = P3

These layers are all prioritized and combined to create the REN. The REN combined priorities are:

Priority 1: FEGN Critical Linkages, Florida black bear PPCAs and SHCAs, the bear corridor; Major River buffers, and P1 Riparian Network

Priority 2: FEGN P1-P5, other bear habitat priorities, Xeric Connectivity patches 5,000 acres or larger, P2 Riparian Network

Priority 3: FEGN P6, Xeric Connectivity patches 1,000 - 4,999 acres, P3 Riparian Network

## **II. CLIP and Regional Ecological Data Synthesis (CRES)**

Because the Regional Ecological Network (REN) focuses on regional landscape conservation priorities, we wanted to incorporate additional natural resource priorities that might not be addressed. Such additions might include important resources that fall outside of the REN, either because they are spatially distant from priority corridors or large, intact landscapes, or

important small-patch resources not picked up by the landscape-level analysis. For this step we relied primarily on CLIP 2.0 data; however, several regional datasets and analyses were also used in this synthesis. Six data layers are incorporated within the Regional Ecological Network:

- A. **CLIP FNAI Rare Species Habitat:** This layer is intended to show areas that have a high statewide priority to protect habitat for Florida's rarest plant and animal species. It identifies overlapping habitat priorities for many different vertebrate, invertebrate, and plant species across the state. Priorities are based on a combination of the G ranks (Global rarity rank) of the species and the amount of overlap across the species habitat models.
- B. **CLIP FWC Strategic Habitat Conservation Areas:** This layer identifies statewide habitat conservation needs for meeting viability goals for a set of focal vertebrate species. Priorities are based on the G ranks of the species.
- C. **CLIP FNAI Rare Natural Communities:** This layer identifies a combination of under-represented natural communities determined at a statewide scale and other important coastal natural communities. They are ranked based on each natural community's G rank. The natural communities within this layer found in the Green Links study area include: Upland Glade (G1), Scrub (G2) (includes scrubby flatwoods), Seepage Slope (G2), Sandhill (G3), Sandhill Upland Lake (G3), Coastal Uplands (G3), Upland Hardwood (G5), Pine Flatwoods (G4), and Coastal Wetlands (G5).
- D. **CLIP FNAI Functional Wetlands:** This layer prioritizes all wetlands in Florida based on both the intensity of land uses surrounding each wetland and potential natural community ranks.

- E. **Regional Natural Community Priorities:** This layer is based on the Cooperative Land Cover (CLC) data layer, where all additional G1 and G2 natural communities not included in the CLIP Rare Natural Communities layer are identified. The natural communities identified include: alluvial stream, beach dune, coastal dune lake, coastal grassland, coastal interdunal swale, maritime hammock, river floodplain lake, seepage slope, seepage stream, sinkhole, slope forest, spring-run stream, terrestrial cave, upland pine, and wet prairie.
- F. **Conservation Buffers:** This layer identifies potentially functional buffers around all existing conservation lands used in this study. CLC Land uses were separated into four categories:
- High compatibility (natural and semi-natural land cover)
  - Moderate compatibility (improved pasture and other low intensity agriculture or rural land use)
  - Low compatibility (other more intensive agricultural and moderate intensity land uses such as golf courses)

These land use compatibility categories were then combined with buffer distances from existing conservation lands to result in the following values:

P1 = ¼ mile high land use compatibility

P2 = ¼ mile moderate compatibility

P3 = 1 mile high compatibility

P4 = 1 mile moderate compatibility

P5 = ¼ mile low compatibility

P6 = 1 mile low compatibility

The CRES was then created by combining the priorities from these six layers into three priority levels:

Priority 1: CLIP FNAI Rare Species Habitat P1-P2, CLIP FWC SHCAs P1, CLIP Rare Natural Communities G1-G3, CLIP Wetlands P1, Green Links Conservation Buffers P1-P2

Priority 2: CLIP FNAI Rare Species Habitat P3, CLIP FWC SHCAs P2-P3, CLIP Rare Natural Communities G4, CLIP Wetlands P2-P4, Green Links Conservation Buffers P3

Priority 3: CLIP FNAI Rare Species Habitat P4-P6, CLIP FWC SHCAs P4-P5, CLIP Rare Natural Communities G5 rare plus all other regional natural communities ranked G1-G2, CLIP Wetlands P5-P6, Green Links Conservation Buffers P4-P5

### **III. Regional CLIP**

The Regional CLIP priorities data layer was created by combining the Regional Ecological Network (REN) and the CLIP and Regional Ecological Data Synthesis (CRES). The combination method is based on a maximum rule, where any particular location is assigned the highest priority from either the REN or the CRES. For example, if the priority level for the REN was P3 and the priority level for the CRES was P1, the Regional CLIP priority would be P1 at that location. One the two layers are combined with this method there are still three potential priority levels where P1 = high priority, P2 = moderate-high priority, P3 = moderate priority. Portions of the study area not within these three priority levels are either no priority or low priority. It should be considered that these priorities are assigned based only on the input data,

and it is possible that other sources of data (including field surveys) may identify additional conservation priorities not included in this version of the Regional CLIP.

### **Overlay Model**

The Overlay Model (OM) was created based on discussion with the TAG and future considerations for potential refinement of the statewide CLIP database. The goal of the OM was to provide an additional prioritization of the Regional CLIP priorities and especially the highest priority level (P1).

The OM uses a combination of both the same maximum rules based approach used to create the Regional CLIP with an overlay approach where appropriate data layers are averaged to identify areas with high or higher priorities for multiple resources. The OM methods included:

- Only layers used in the synthesis were used in the OM.
- Data was separated into Resource Categories: Species, Natural Communities, Landscape, Surface Water.
- Re-ranked all data on a 9 to 1 priority scale, where 9 represents the highest priority.
- Used averaging within a Resource Category and the maximum rule method when combining the Resource Categories to create the final OM.
- FNAI Rare Natural Communities and other natural community priorities combined with the maximum rule method to create the natural community resource category.

- In the Landscape Resource Category, combined all other connectivity or landscape model types (xeric, major river, conservation buffers) using maximum approach then averaged with FEGN.
- The Species and Natural Communities were combined using the maximum rule prior to combination with the Landscape and Surface Water resource categories.
- Natural Breaks reclassification resulted in these groupings:
  - Values 8-9 = high (L1)
  - Values 6-7 = moderate (L2)
  - Values 1-5 = low (L3)
- These three priority categories were then combined with the Regional CLIP P1 to create these new priority levels:
  - Regional CLIP P1L1 (high-highest priority)
  - Regional CLIP P1L2 (high-high priority)
  - Regional CLIP P1L3 (high-moderate priority)

Figure 2 provides a flow chart of the OM's hierarchical organization. Appendix A includes the tables documenting the reclassification of the core data layers values into a 9 to 1 priority scale.

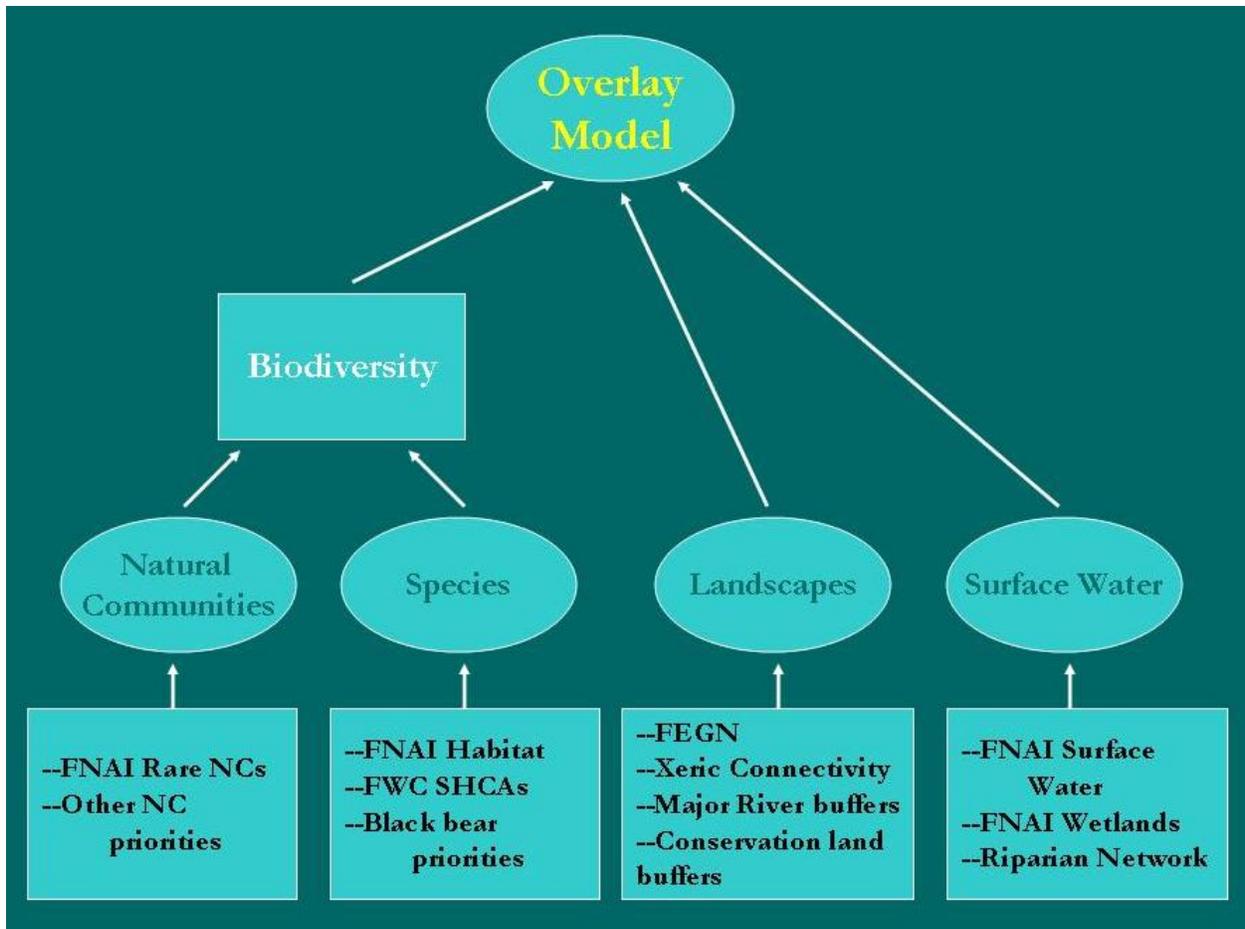


Figure 2. Overlay Model for further prioritizing the Regional CLIP P1 areas

## **Regional CLIP Resource Categories**

For the purposes of organizing the Regional CLIP core data with the Green Links Database and to follow the Overlay Model methodology, we organized the core data layers used in the REN, CRES, and Regional CLIP into the following categories:

- Species
  - Black bear habitat and corridors
  - FNAI Rare Species Habitat
  - FWC SHCAs
- Natural Communities
  - FNAI Under-represented Natural Communities
  - Other G1-G2 ranked natural communities
- Landscape
  - Florida Ecological Greenways Network
  - Major River Buffers/Corridors
  - Xeric Connectivity
  - Conservation Buffers
- Surface Water
  - FNAI Surface Water Protection
  - FNAI Wetlands
  - Riparian Network

## Supplemental Data and Analyses

Through the process of developing the Regional CLIP other layers were developed and considered for potential inclusion. These supplemental data layers that can enhance current conservation planning efforts and potentially be incorporated into the Regional CLIP priorities when the Green Links Database is updated and enhanced in the future. The following sections provide descriptions of each of these supplemental data layers organized into similar resource categories as the Regional CLIP core data.

### A. Ecosystem Services

#### 1) CLIP Storm Protection

More information about the CLIP Storm Protection layer can be found at:

<http://www.fnai.org/clip.cfm>. The layer is a combination of coastal natural communities from FNAI, coastal high hazard areas from FEMA, and an identification of areas of higher human population density using U.S. Census data. The values are:

Value 1 = FNAI high priority coastal natural communities in FEMA High Velocity or COBRA Zones within 2.5 miles of higher human population density

Value 2 = FNAI high priority coastal natural communities in FEMA High Velocity or COBRA Zones within 5 miles of higher human population density

Value 3 = FNAI high priority coastal natural communities in FEMA High Velocity or COBRA Zones beyond 5 miles of higher human population density

Value 4 = Other non-water natural or semi-natural cover in FEMA High Velocity or COBRA Zones within 2.5 miles of higher human population density

Value 5 = Other non-water natural or semi-natural cover in FEMA High Velocity or COBRA Zones within 5 miles of higher human population density

Value 6 = Other non-water natural or semi-natural cover in FEMA High Velocity or COBRA Zones beyond 5 miles of higher human population density

## **B. Groundwater**

### **1) CLIP FNAI Groundwater Priorities**

More information about the CLIP Groundwater Priorities layer can be found at:

<http://www.fnai.org/clip.cfm>. The Groundwater Priorities are based on a statewide aquifer recharge model as well as areas within Springs Protection Areas and in proximity to public water supply wells. The values are:

Value 1 = P1

Value 2 = P2

Value 3 = P3

Value 4 = P4

Value 5 = P5

Value 6 = P6

## **C. Landscape**

### **1) Green Links Smokeshed Buffers**

The smokeshed buffer priorities were created by buffering all existing and proposed conservation lands (see conservation lands section above), and pyrophilic listed plant sites provided by the USFWS. All CLC natural, semi-natural, and agricultural land cover or land use was considered compatible with prescribed fire on adjacent or nearby conservation lands or pyrophilic sites. Combined these two mile buffers with two land use categories from CLC. All residential, commercial, and industrial development was considered to be generally incompatible with nearby prescribed burning. These various land covers and land use were combined with distance increments up to 2 miles to create the following priorities:

Value 0 = Not within 2 miles of conservation lands or plant site

Value 1 = P1 = compatible within  $\frac{1}{4}$  mile (includes conservation lands and plant sites)

Value 2 = P2 = compatible within  $\frac{1}{2}$  mile

Value 3 = P3 = compatible within 1 mile

Value 4 = P4 = compatible within 2 miles

Value 5 = within 2 miles and NOT compatible

## D. Species

### 1) Green Links FNAI Focal Species Habitat

This layer includes all of the FNAI habitat models for panhandle species found in the FNAI Rare Species Habitat Model. The layer is vector and can be queried for multiple attributes including scientific name, common name, global rarity rank, state rarity rank, federal listing status, state listing status, and general species category (whether a plant, mammal, bird, etc.). The final field (NWGI\_score) in the shapefile table is a ranking that could be used for summary priority use of this dataset, based on both the focal species lists created for this project and listing status. The values for that field are:

9 = Federal listed, candidate, petitioned species

8 = Other state listed species

7 = Other Green Links focal species habitat

1 = All other species habitat used in the FNAI Rare Species Habitat model that are NOT Green Links focal species

### 2) FWC Rare and Imperiled Freshwater Fish Basins

More information about the FWC Rare and Imperiled Freshwater Fish basins can be found at: [http://fwcg.myfwc.com/docs/Rare\\_Fish\\_Guidelines\\_Hoehn.pdf](http://fwcg.myfwc.com/docs/Rare_Fish_Guidelines_Hoehn.pdf). This dataset identifies watersheds that contain rare fish species across Florida for the purpose of planning and management considerations that might affect watershed health and the rare fish species they contain. For the Green Links project we created two value-added datasets to assist use of these data in the study area:

- a. Riparian Network within Rare Fish Basins: this layer identifies where areas identified as part of the Riparian Network within the study area are within or outside Rare Fish Basins where:

Value 0 = Not within the Riparian Network in Rare Fish Basins

Value 1 = Riparian Network in Rare Fish Basins

- b. FNAI FWC Rare Fish Surface Water Protection Submodel: More information about this model can be found in the technical documentation for the Florida Forever Conservation Needs Assessment at <http://www.fnai.org/FlForever.cfm>. This model identifies stream and other waterbody features that are potentially most important for protecting rare freshwater fish species based on FWC's Rare and Imperiled Freshwater Fish basins. The values are:

Value 0 = Not a priority

Value 1 = P1 (highest priority)

Value 2 = P2

Value 3 = P3

Value 4 = P4

Value 5 = P5

Value 6 = P6

Value 7 = P7

Value 8 = P8

Value 9 = P9

Value 10 = P10 (lowest priority)

### **3) Panama City Crayfish**

The Florida Fish and Wildlife Conservation Commission provided this layer of surveyed Panama City Crayfish sites. It includes survey dates, habitat type, and relevant notes for each location.

### **4) USFWS Critical Habitat**

Critical habitat layers were obtained from the USFWS for all relevant listed species found in the study area. All files were converted to raster grid format and combined into a final Critical Habitat grid with the following values:

Value 0 = Not Critical Habitat

Value 1 = Critical Habitat

## **E. Surface Water**

### **1) Green Links 100 Year Floodplain Land Use**

This data layer is a combination of 100 year floodplain data (a combination of new DFIRM and older FEMA data depending on availability by county) obtained from FGDL and CLC land use data with the following values:

Value 0 = Not 100 year floodplains or 100 year floodplains in more intensive land uses

Value 1 = P1 = Natural 100 year floodplains

Value 2 = P2 = Seminatural (mainly tree plantations) 100 year floodplains

Value 3 = P3 = Pasture 100 year floodplains

Value 4 = P4 = Other Agriculture 100 year floodplains

### **2) FNAI Springs Buffer Submodel**

More information about this model can be found in the technical documentation for the Florida Forever Conservation Needs Assessment at <http://www.fnai.org/FlForever.cfm>. This model identifies buffers around springs that might be significant for protecting their water quality. The values are:

Value 0 = Not a priority

Value 1 = P1 (highest priority)

Value 2 = P2

Value 3 = P3

Value 4 = P4

Value 5 = P5

Value 6 = P6

Value 7 = P7 (lowest priority)

### **3) Green Links Wetlands Regional CLIP Priorities**

This data layer clips the Green Links Regional CLIP data layer to wetlands (identified using the FNAI/CLIP Functional Wetlands) with the following values:

Value 1 = Wetlands within Regional CLIP P1

Value 2 = Wetlands within Regional CLIP P2

Value 3 = Wetlands within Regional CLIP P3

### **4) GL Wetlands Overlay Model Priorities**

This data layer clips the Green Links Final Overlay model to wetlands (identified using the FNAI/CLIP Functional Wetlands) with the following values:

Value 9 = P1 (highest priority wetlands)

Value 8 = P2

Value 7 = P3

Value 6 = P4

Value 5 = P5

Value 4 = P6

Value 3 = P7 (the lowest ranked wetlands)

## **F. Sustainable Forestry**

### **1) FNAI Forest Aquifer Recharge Areas**

More information about this model can be found in the technical documentation for the Florida Forever Conservation Needs Assessment at <http://www.fnai.org/FlForever.cfm>. This model combines all natural and semi-natural pinelands with the P1, P2, and P3 priorities from the FNAI/CLIP Groundwater Priorities model. The values are:

Value 0 = Not a priority

Value 1 = Pinelands in higher priority areas for aquifer recharge/groundwater protection

### **2) FNAI Sustainable Forestry Priorities**

More information about this model can be found in the technical documentation for the Florida Forever Conservation Needs Assessment at <http://www.fnai.org/FlForever.cfm>. This model identifies existing and potential areas for sustainable forestry based on current natural versus plantation pinelands, acreage, distance to market, and hydrology (with mesic preferred).

The values are:

Value 0 = Not a priority

Value 1 = P1 (highest priority)

Value 2 = P2

Value 3 = P3

Value 5 = P5 (lowest priority)

## RESULTS

We have only included primary results in this section including the Regional Ecological Network, CLIP and Regional Ecological Synthesis, Regional CLIP, and the Overlay Model maps and statistics. Maps of core and supplemental data are included in Appendix B.

### Regional CLIP Components

#### I. Regional Ecological Network

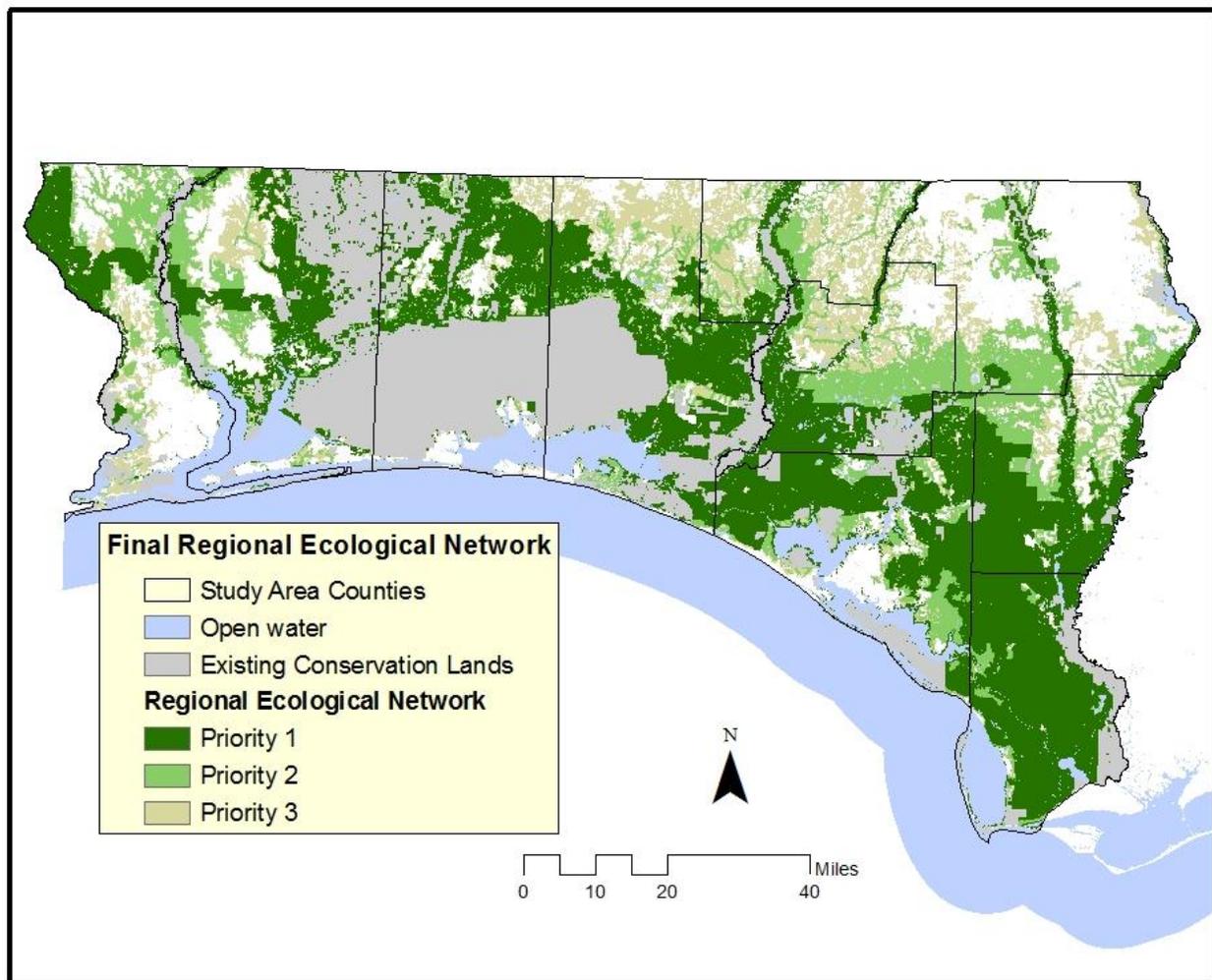


Figure 3. Regional Ecological Network map result

#### II. CLIP and Regional Ecological Data Synthesis (CRES)

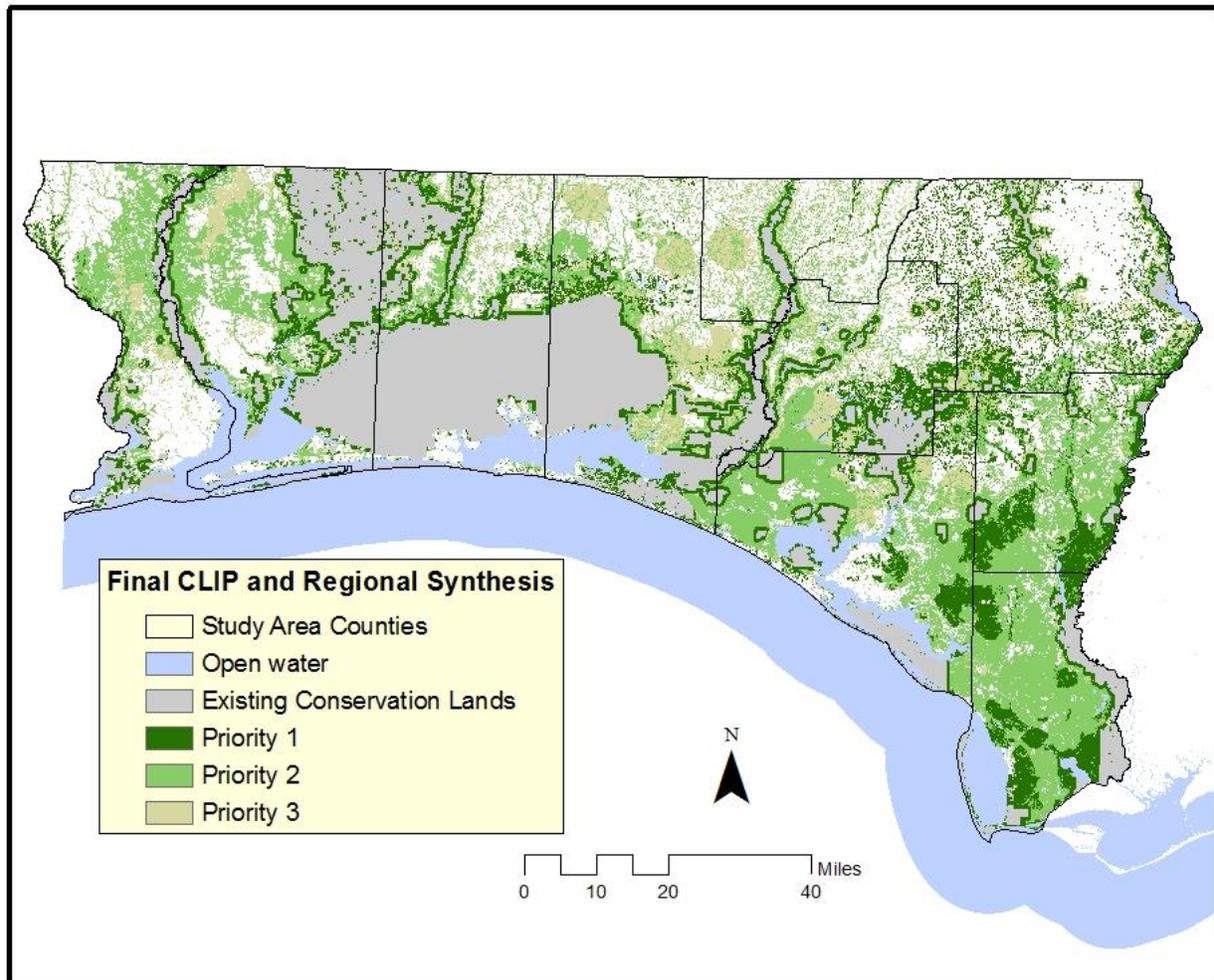


Figure 4. Clip and Regional Ecological Data Synthesis map result

### III. Regional CLIP

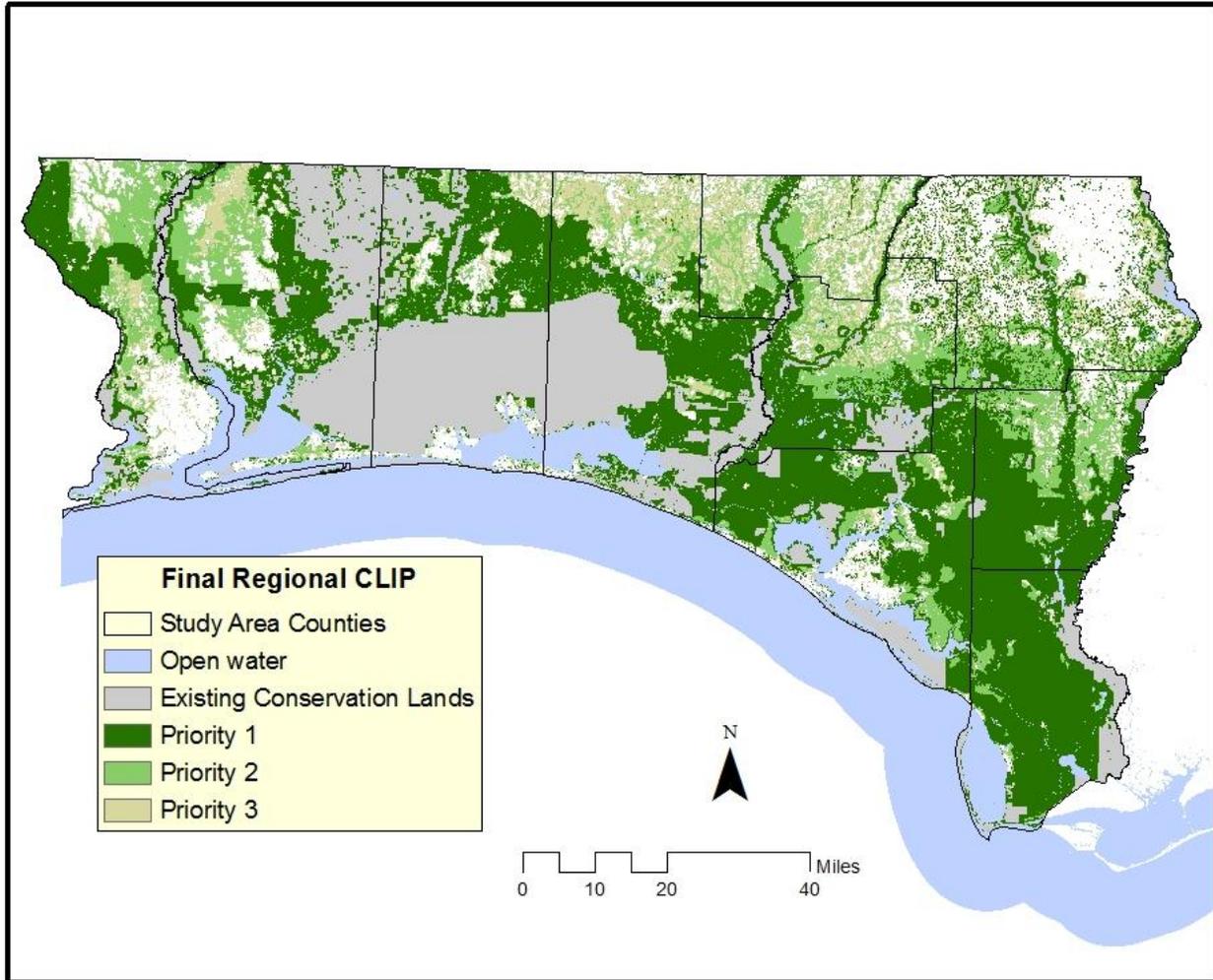


Figure 5. Regional CLIP map result

Table 1. Regional CLIP land use category statistics

<b>Regional CLIP Priorities</b>	<b>Landuse Category</b>	<b>Acres</b>	<b>Percent</b>
P1	Open water	378,897	11.5%
P1	Existing Conservation	1,052,621	31.9%
P1	Florida Forever-GPEMA	251,728	7.6%
P1	Other wetlands	481,458	14.6%
P1	Other floodplains	250,491	7.6%
P1	Other private	881,753	26.7%
	Total acres	3,296,948	100.0%

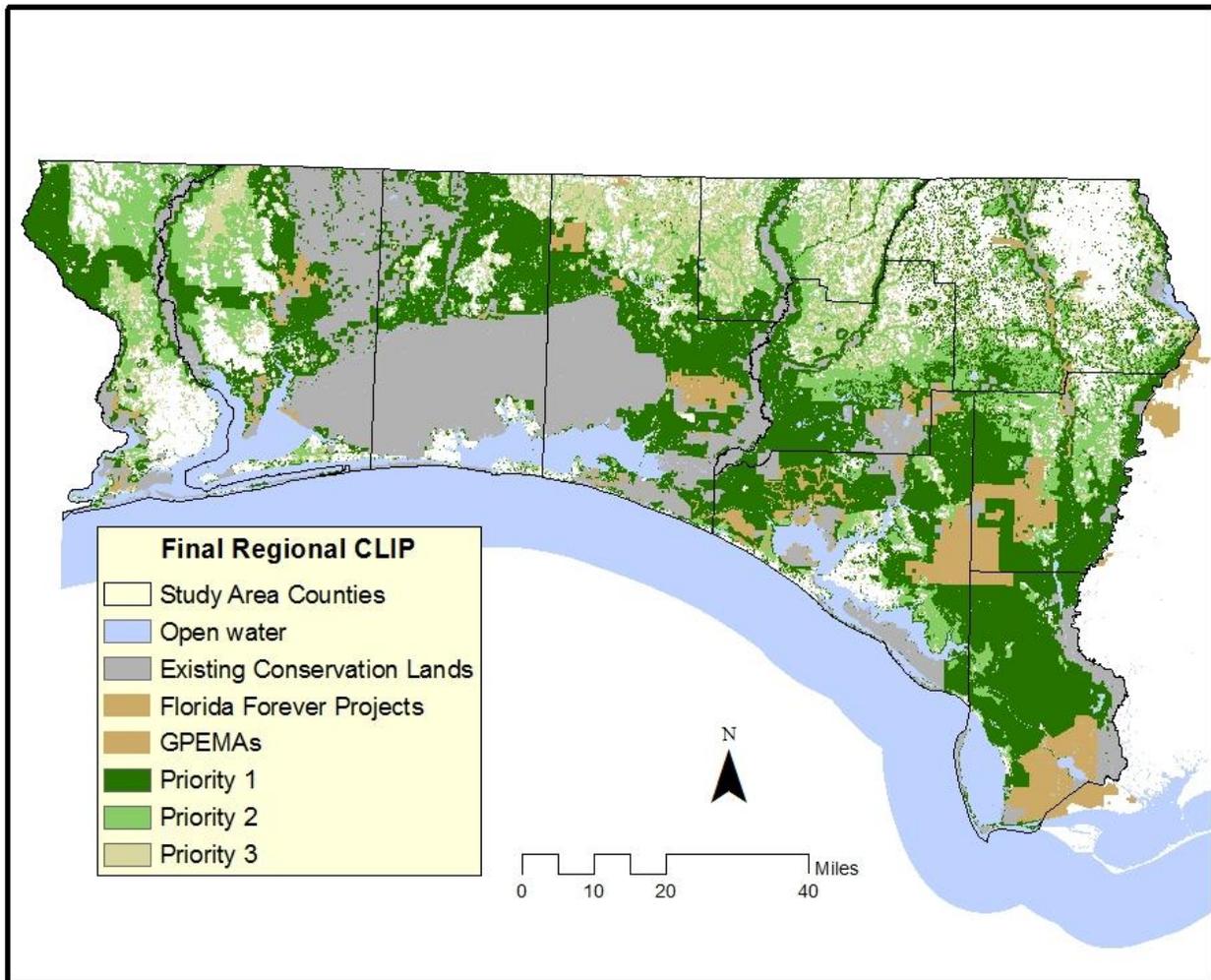


Figure 6. Regional CLIP map result with both existing and proposed conservation lands

### Overlay Model

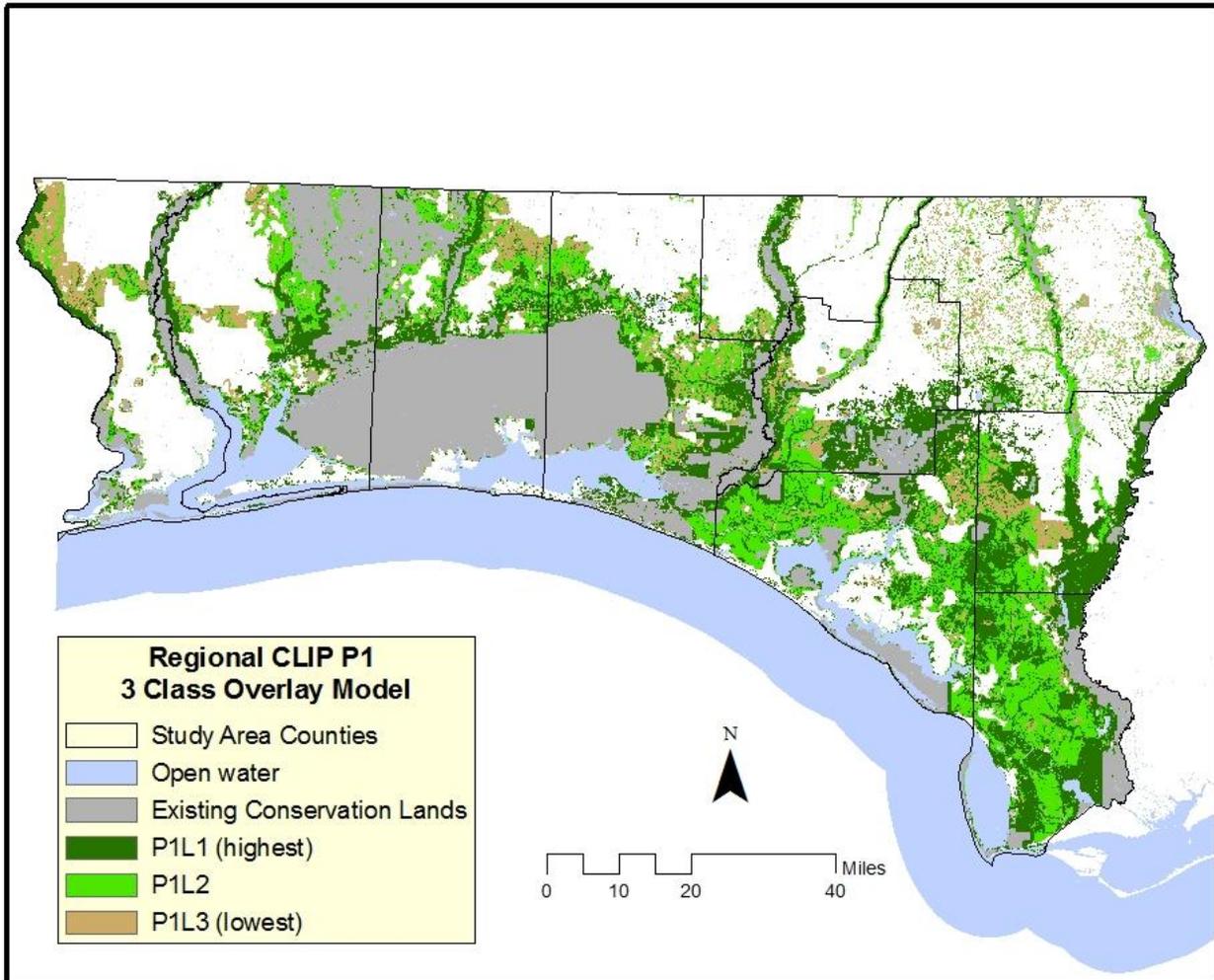


Figure 6. Overlay model result clipped to Regional CLIP Priority 1 (P1)

Table 2. Regional CLIP P1 Overlay Model Priorities Land Use Category Statistics

<b>REGIONAL CLIP P1 OVERLAY MODEL PRIORITIES</b>	<b>LANDUSE CATEGORY</b>	<b>ACRES</b>	<b>PERCENT</b>
1	OPEN WATER	50,156	2.6%
1	EXISTING CONSERVATION	1,006,502	52.4%
1	FLORIDA FOREVER	130,586	6.8%
1	OTHER WETLANDS	336,992	17.5%
1	OTHER FLOODPLAINS	97,958	5.1%
1	OTHER PRIVATE	299,117	15.6%
	P1L1 TOTAL ACRES	1,921,310	
2	OPEN WATER	327,382	30.9%
2	EXISTING CONSERVATION	42,879	4.1%
2	FLORIDA FOREVER	100,511	9.5%
2	OTHER WETLANDS	125,648	11.9%
2	OTHER FLOODPLAINS	128,824	12.2%
2	OTHER PRIVATE	333,282	31.5%
	P1L2 TOTAL ACRES	1,058,527	
3	OPEN WATER	6,478	1.8%
3	EXISTING CONSERVATION	17,465	4.8%
3	FLORIDA FOREVER	24,033	6.6%
3	OTHER WETLANDS	25,325	7.0%
3	OTHER FLOODPLAINS	27,093	7.5%
3	OTHER PRIVATE	261,270	72.2%
	P1L3 TOTAL ACRES	361,664	

## DISCUSSION

### Purpose of the Green Links Database

The Green Links Regional CLIP Database was developed to assist conservation, listed species, green infrastructure, transportation, and land use planning within the Florida panhandle region. The database is a collection of both currently available statewide and regional Geographic Information Systems (GIS) and custom regional analyses created in this project to enhance planning efforts. The Green Links Database provides a detailed state and regional GIS data framework for various conservation planning applications including conservation reserve design, future visioning, future land use planning, transportation planning, and natural resource management.

### Potential Future Updates and Enhancements

The Green Links database is complete in its current form. However, through discussions with the Green Links technical advisory group and other GIS data in development, we recognize various opportunities to update and enhance the Green Links Database in the future if funding and the opportunity exists. Potential updates and enhancements could include:

- 1) **Incorporation of update CLIP data:** the CLIP database is currently under development for a version 3.0 with funding from the USFWS Peninsular Florida Landscape Conservation Cooperative, and further development in a 4.0 version is under discussion through additional USFWS funding. CLIP 3.0 should be complete by January 2014, with updates to core data layers including the Florida Ecological Greenways Network and the following enhancements: landscape context analysis., conservation strategy analysis, sea level rise impacts to listed species critical habitat, coastal to inland ecological

connectivity assessment, and a water restoration priorities assessment. Many of these new data layers are potentially relevant to further Green Links Database development.

- 2) **Completion of the Statewide Sea Level Rise Impact Assessment:** The statewide sea level rise conservation impacts assessment is currently being conducted by the University of Central Florida, Florida Natural Areas Inventory, and the University of Florida. Results will include GIS data layers identifying impacts to specific focal species and natural communities, impacts to ecological connectivity priorities, and priority areas for addressing sea level rise impacts. This project will be completed in two phases; a initial report will be completed January 2014 with a final report with additional species analysis due in July 2014.
- 3) **Additional Focal Species data development:** We discussed additional focal species data needs with the Green Links TAG and selection of focal species and additional data options coincided with the completion of this initial version of the Green Links Database. In the current Database, species are incorporated in the Regional CLIP process through the Florida black bear priorities, CLIP FNAI Rare Species Habitat, and CLIP FWC Strategic Habitat Conservation Areas. In addition, various species data layers including USFWS Critical Habitat, Green Links Focal Species habitat based on FNAI species habitat models, FWC Rare Fish Basins, and Panama City Crayfish data. We discussed potential additions in the future including incorporation of FWC Vertebrate Species Richness, FWC focal species habitat models, development of Species Assemblage or “Guild” habitat models, estuarine/marine species data, and new data for Red-cockaded Woodpecker (from Katie

NeSmith, FNAI). Future enhancements could include incorporating some of the existing or future supplemental species data within a revised Regional CLIP data layer.

- 4) **Adding current Supplemental Data to the Regional CLIP data layer:** Various Supplemental Data layers could be incorporated in the Regional CLIP layer in the future. Leading candidates include various focal species data, an updated FNAI floodplain priorities layer, the Storm Protection layer, and possibly the Smokeshed layer. FNAI's CLIP Floodplain priorities layer is currently in major revision and was not available for this version of the Green Links Database.
- 5) **Coastal Aquatic Ecosystems:** As mentioned above regarding potential estuarine/marine focal species data, estuarine/marine ecosystems are not directly addressed in any detail in the current version of the Green Links database. We could work with relevant staff from FWC's Fish and Wildlife Research Institute and the National Marine Fisheries Service to identify additional data sources or analyses to better address coastal aquatic ecosystems.
- 6) **Overlay Process:** We consider the overlay model used to further refine the Regional CLIP Priority 1 (P1) areas to be sufficient but also a starting point for similar work planned for further development of the statewide CLIP database. Florida Natural Areas Inventory and the University of Florida plan to include additional work on overlay modeling to refine the CLIP Aggregated Priorities, and this research could result in modifications to the overlay process that would also be relevant to the Green Links Database.

- 7) **Comparison to other priorities or projections:** A potential next step would include developing comparisons between Green Links conservation priorities and future development projections such as the Florida 2060 assessment (Zwick and Carr 2006) or an updated development projection (such as currently under development for the state sea level rise impact assessment, transportation priorities, sea-level rise projections (also soon to be available from the statewide sea level rise project. Such comparisons could be part of a future visioning effort within the study are to being assessing potential conflict (Carr and Zwick 2007) and developing strategies to enhance compatibility, avoid and minimize impacts, and identify mitigation priorities.

### **Green Links Database**

It should be clear to readers of this report that the Green Links Database is much more than the Regional CLIP priorities data layer. All of the core data, combined priorities data, and supplemental data in the Database are potentially useful for various planning purposes and in some cases provide much more specific data to address specific questions compared to a layer that aggregates many various data. We encourage all users to explore all parts of the database and to use the aggregated priority layers as well as the core and supplemental layers that best address your applications. The Green Links Database includes all of the GIS data with complete metadata, a database guide document and Powerpoint, and a map image library. All of these items can be obtained by request from the Panama City Office of the USFWS.

### **Green Links Database Usage Caveats**

Finally, it is important to note that the Green Links database and all of its component data layers are intended for planning purposes only. These layers represent a range of resolution,

but they are not sufficient to serve as, or replace, survey quality occurrence or map data. With this stated, however, these data represent a set of consistently collected, objective, defensible, science-based information to serve at least as an important foundation to conservation and other planning efforts within the study area.

## LITERATURE CITED

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Hoctor, T., J. Oetting, and M. O'Brien. 2012. Regional assessment of Critical Lands and Waters (Regional CLIP) for the Cooperative Conservation Blueprint Pilot Project. Final Report to the Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.

Hoctor, T., M. Carr, and P. Zwick. 2000. Identifying a linked reserve system using a regional landscape approach: the Florida ecological network. *Conservation Biology* 14(4): 984-1000.

Oetting, J., Hoctor, T., and B. Stys. 2011. Critical Lands and Waters Identification Project (CLIP) - Version 2.0 Technical Report.

Zwick, P. D. and M. H. Carr, 2006. Florida 2060, a population distribution scenario for the state of Florida. Report to 1000 Friends of Florida, University of Florida, Gainesville, Florida.

## APPENDIX A: OVERLAY MODEL PRIORITY RECLASSIFICATIONS

### Species Layer and Original Priorities

### OM Priority

#### **CLIP Rare Species Habitat**

Priority 1	9
Priority 2	9
Priority 3	8
Priority 4	7
Priority 5	6
Priority 6	5
All other areas	1

#### **CLIP SHCAs**

Priority 1	9
Priority 2	9
Priority 3	8
Priority 4	8
Priority 5	7
All other areas	1

#### **Florida Black Bear Habitat Priorities**

P1	9
P2	7
All other areas	1

### Natural Community Layer and Original Priorities

### OM Priority

#### **CLIP Under-represented Natural Communities**

Priority 1	9
Priority 2	8
Priority 3 and other CLC NWGI Focal Natural Communities	7

#### **CLC Generalized Cover Types**

Natural Cover Types	5
Semi-natural Cover Types	3
All other areas	1

<b><u>Landscape Layer and Original Priorities</u></b>	<b><u>OM</u></b>
<b>CLIP Florida Ecological Greenways</b>	<b>Priority</b>
<b>Network</b>	
Priority 1 Strategic Linkages	9
Priority 2 Strategic Linkages	9
Priority 1	7
Priority 2	7
Priority 3	7
Priority 4	7
Priority 5	5
Priority 6	5
All other areas	1
<b>Xeric Connectivity</b>	
Priority 1	9
Priority 2	8
All other areas	1
<b>Major Rivers Buffers/Connectivity</b>	
Major Rivers Buffers/Connectivity	9
All other areas	1
<b>Conservation Land Buffers</b>	
Priority 1	9
Priority 2	8
Priority 3	7
All other areas	1

**Surface Water Layer and Original  
Priorities**

**OM  
Priority**

**CLIP Surface Water Model**

Priority 1	9
Priority 2	8
Priority 3	7
Priority 4	6
Priority 5	5
Priority 6	4
Priority 7	3
All other areas	1

**CLIP Wetlands Model**

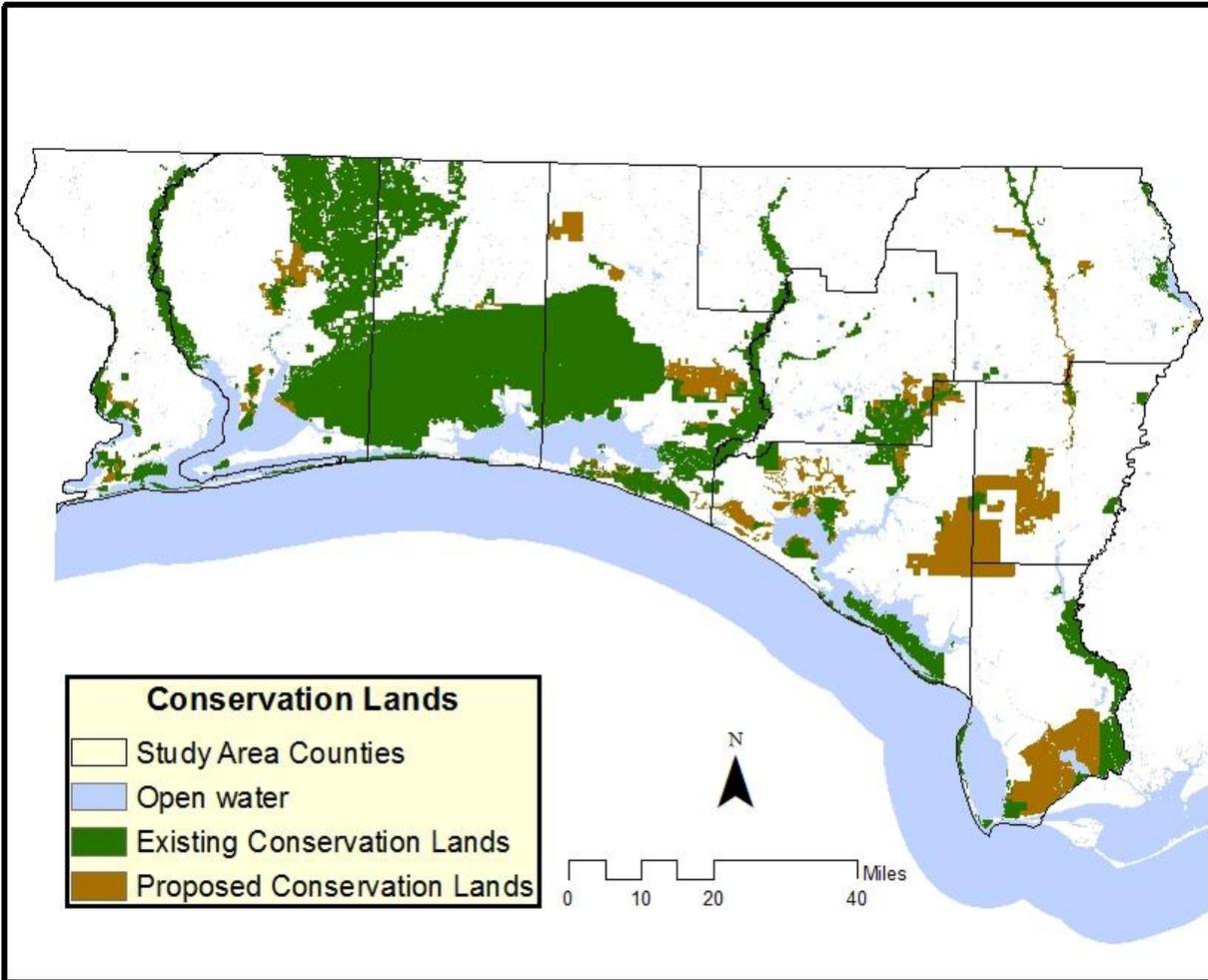
Priority 1	9
Priority 2	8
Priority 3	7
Priority 4	6
Priority 5	5
Priority 6	4
All other areas	1

**Riparian Surface Water Network**

Priority 1	9
Priority 2	8
Priority 3	7
All other areas	1

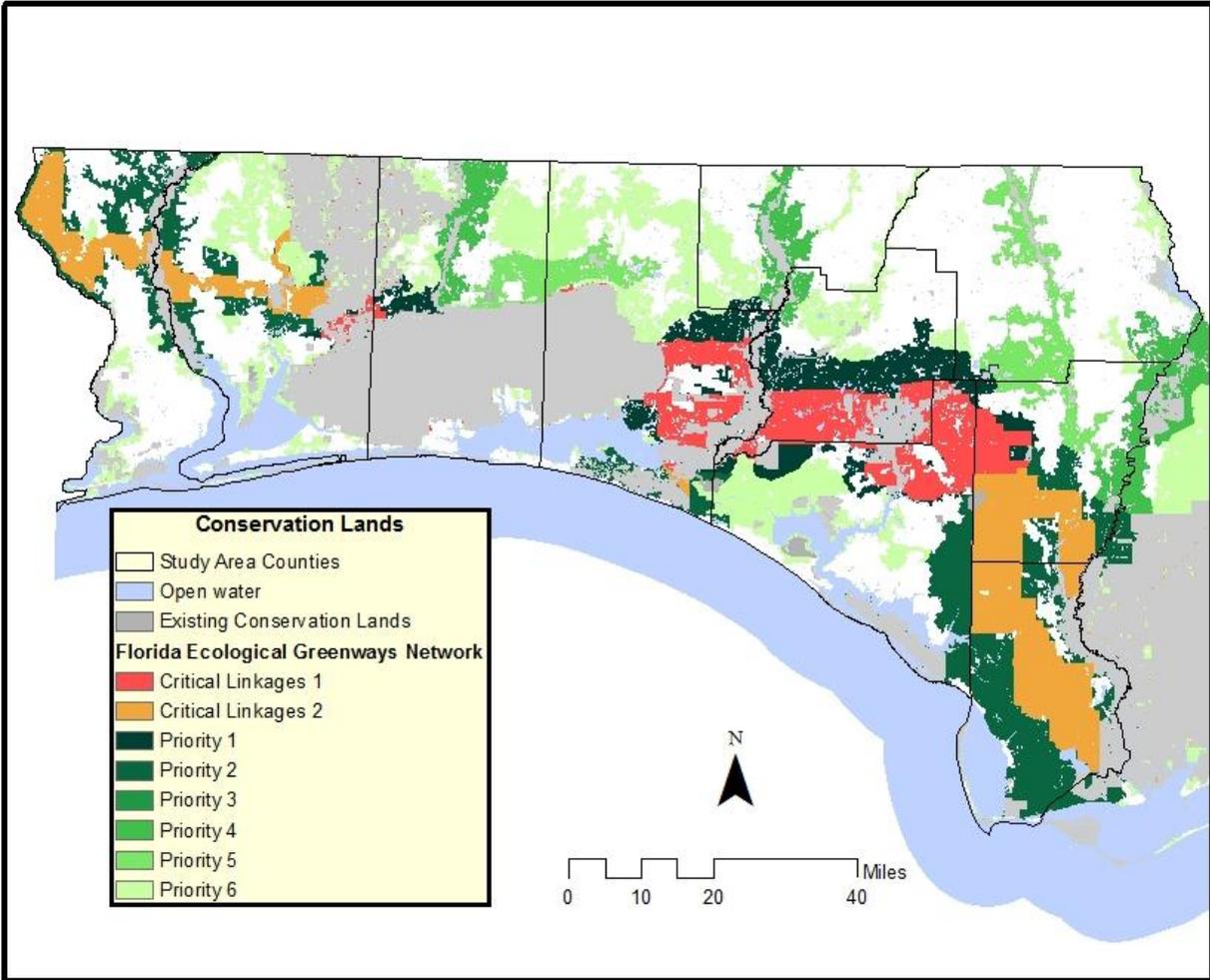
## APPENDIX B: REGIONAL CLIP CORE AND SUPPLEMENTAL DATA RESULTS

### Conservation Lands Data

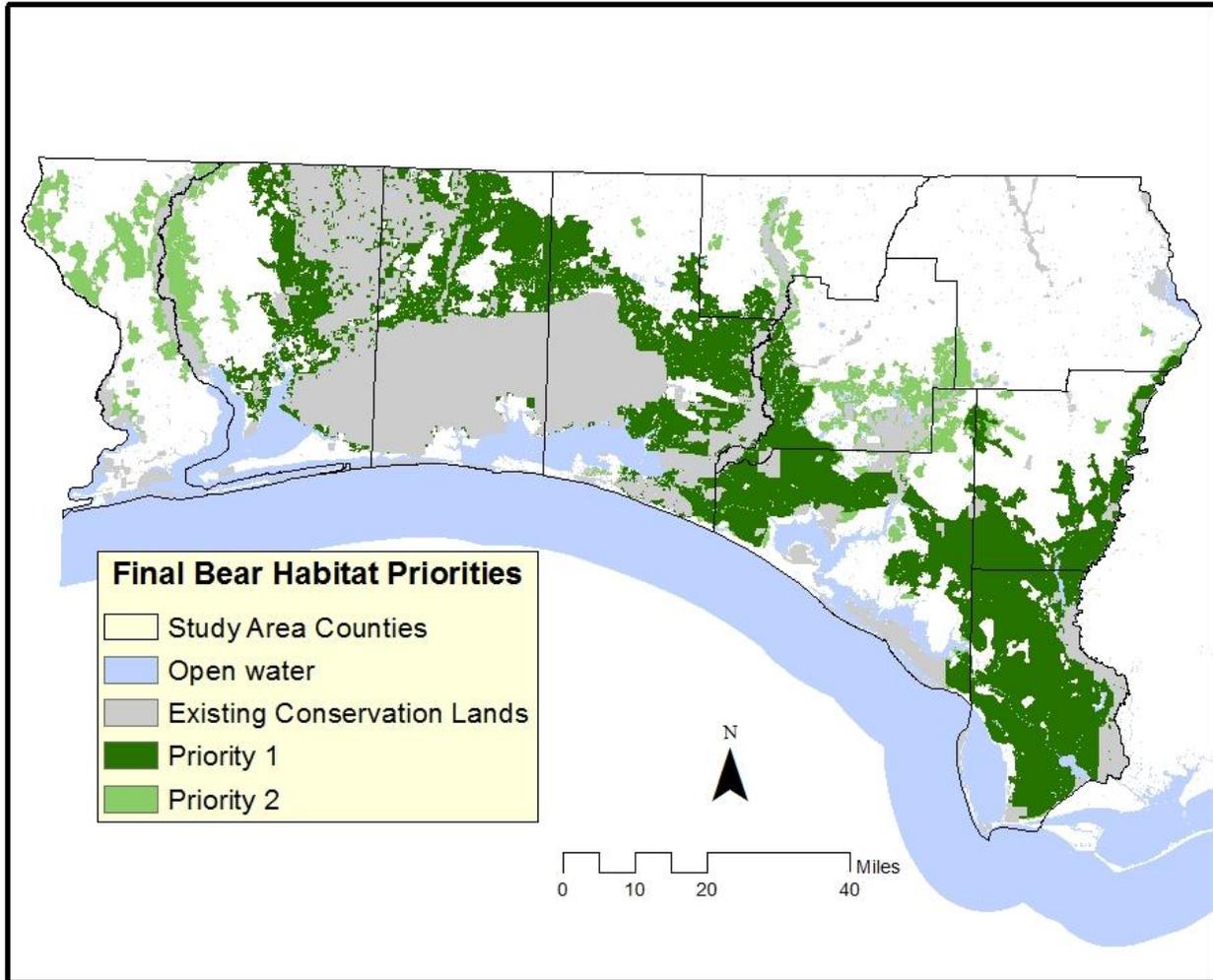


**Regional CLIP Components**

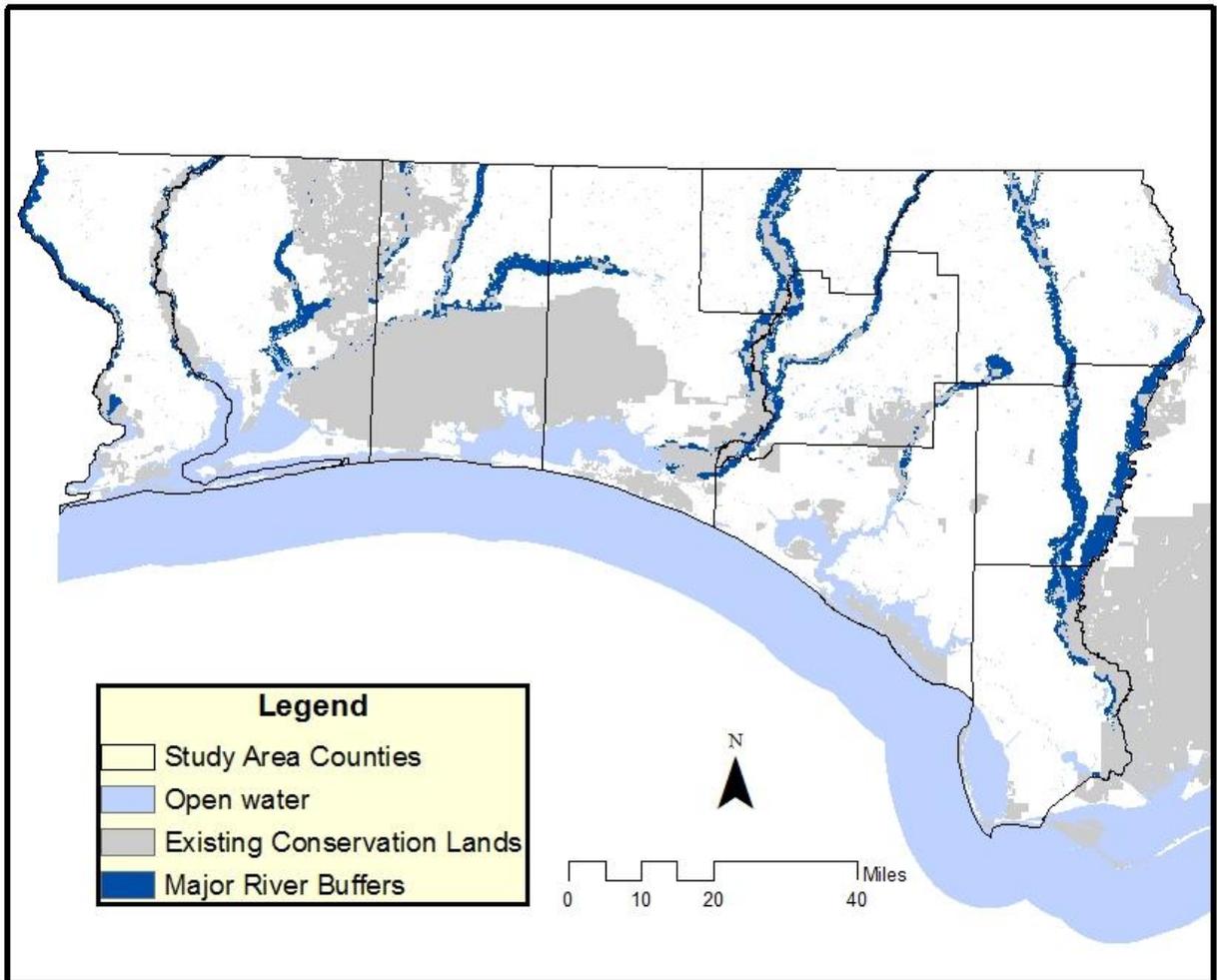
**CLIP Florida Ecological Greenways Network**



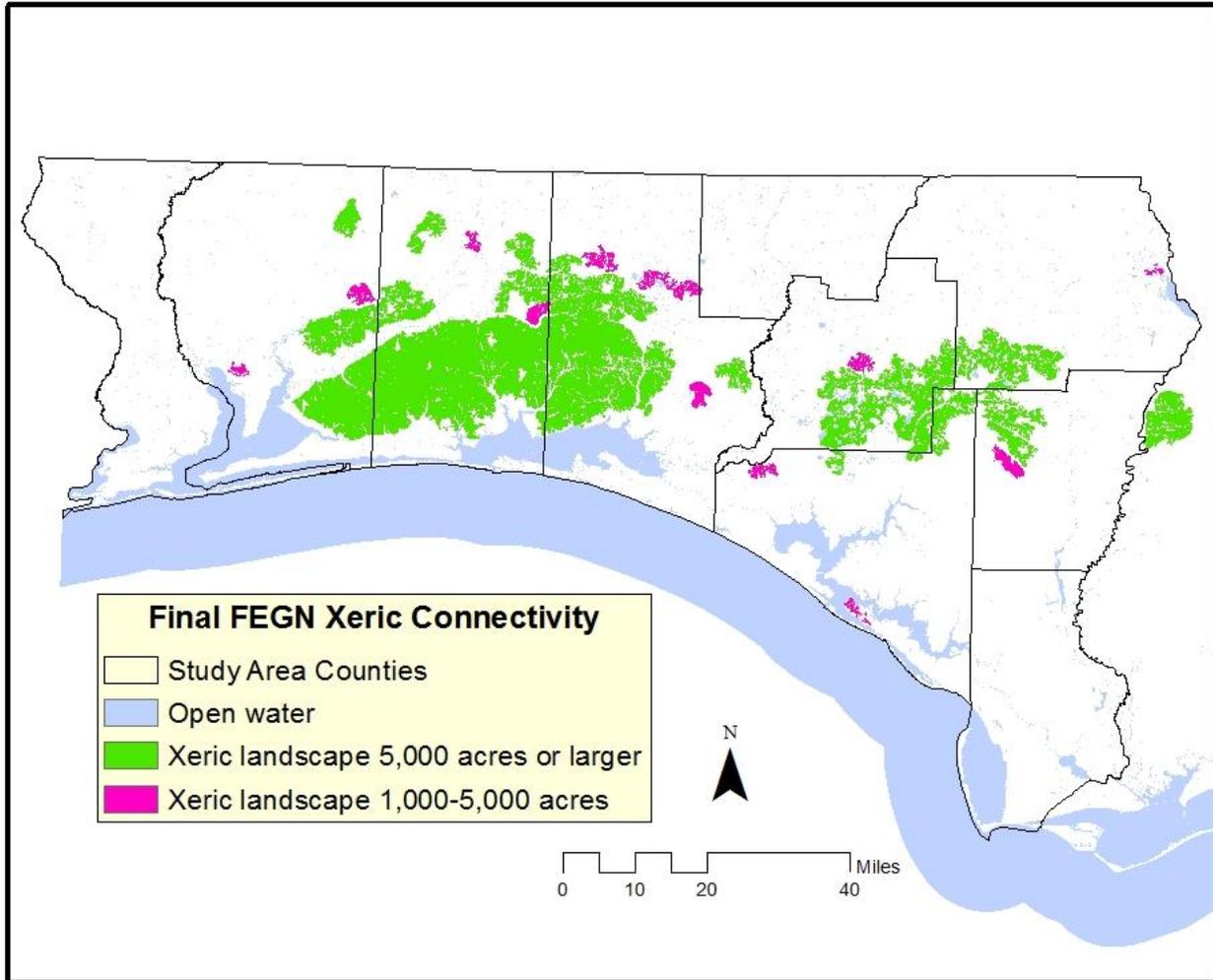
### Florida Black Bear Habitat and Corridor Priorities



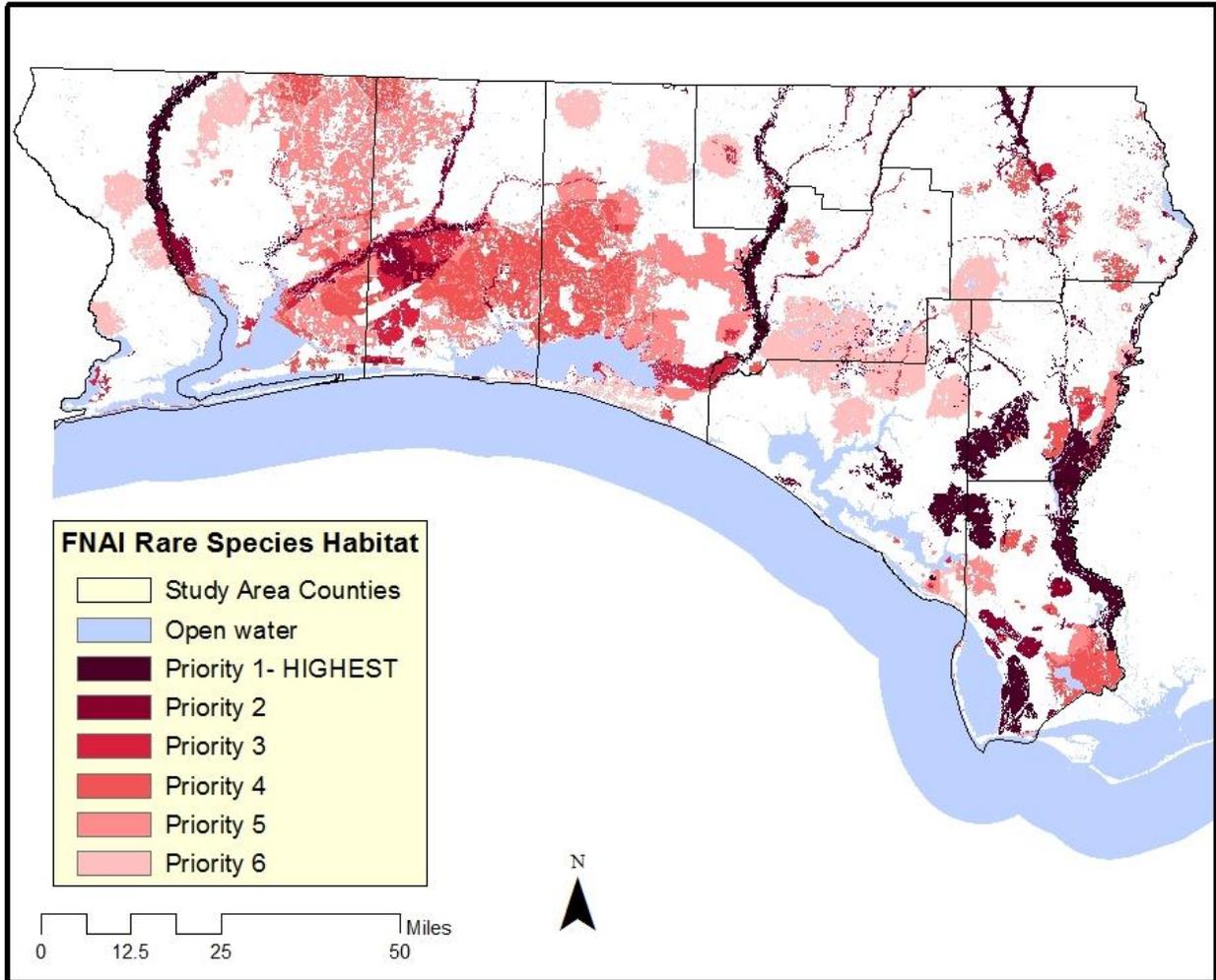
### Major River Buffers



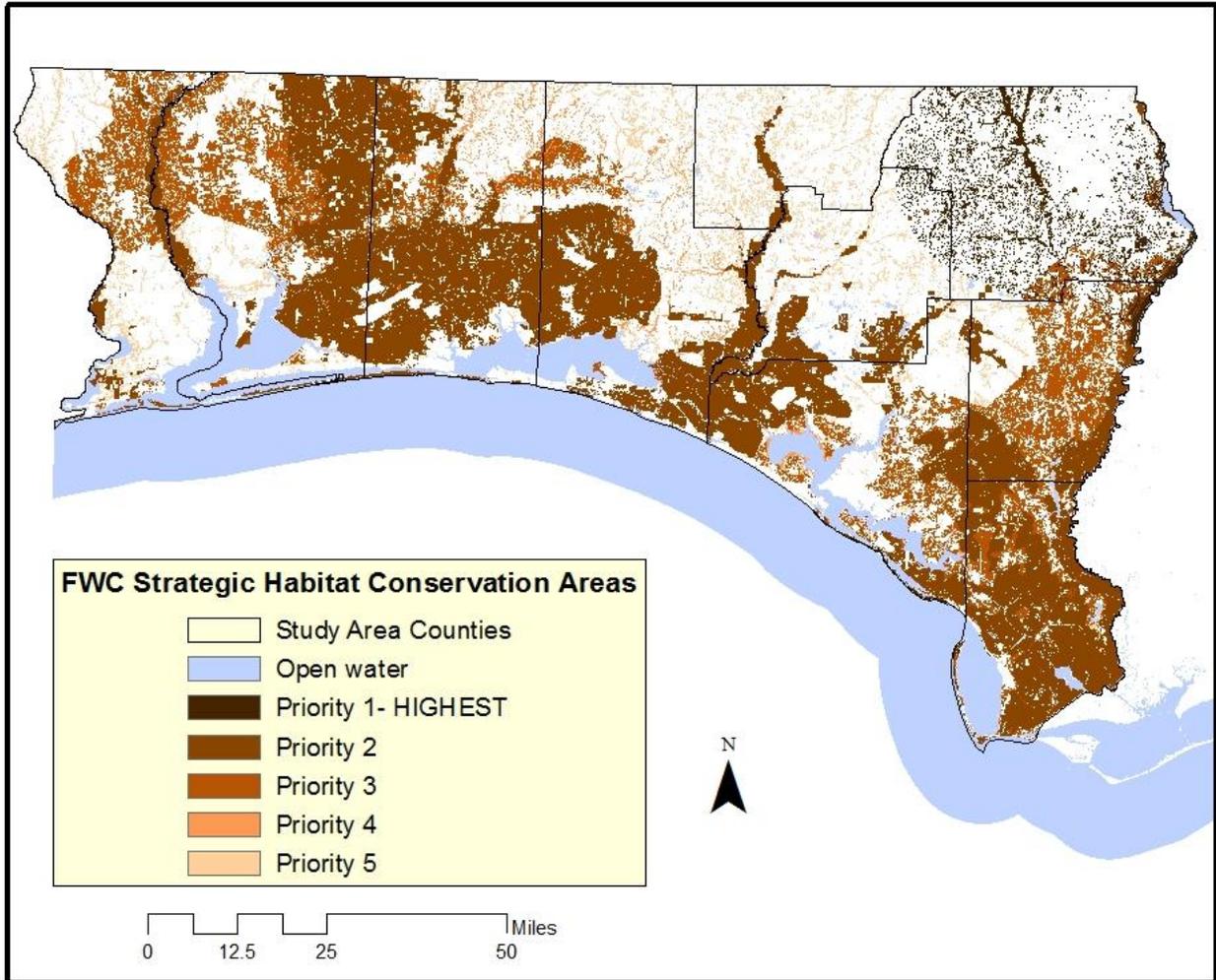
### Xeric Habitat Connectivity



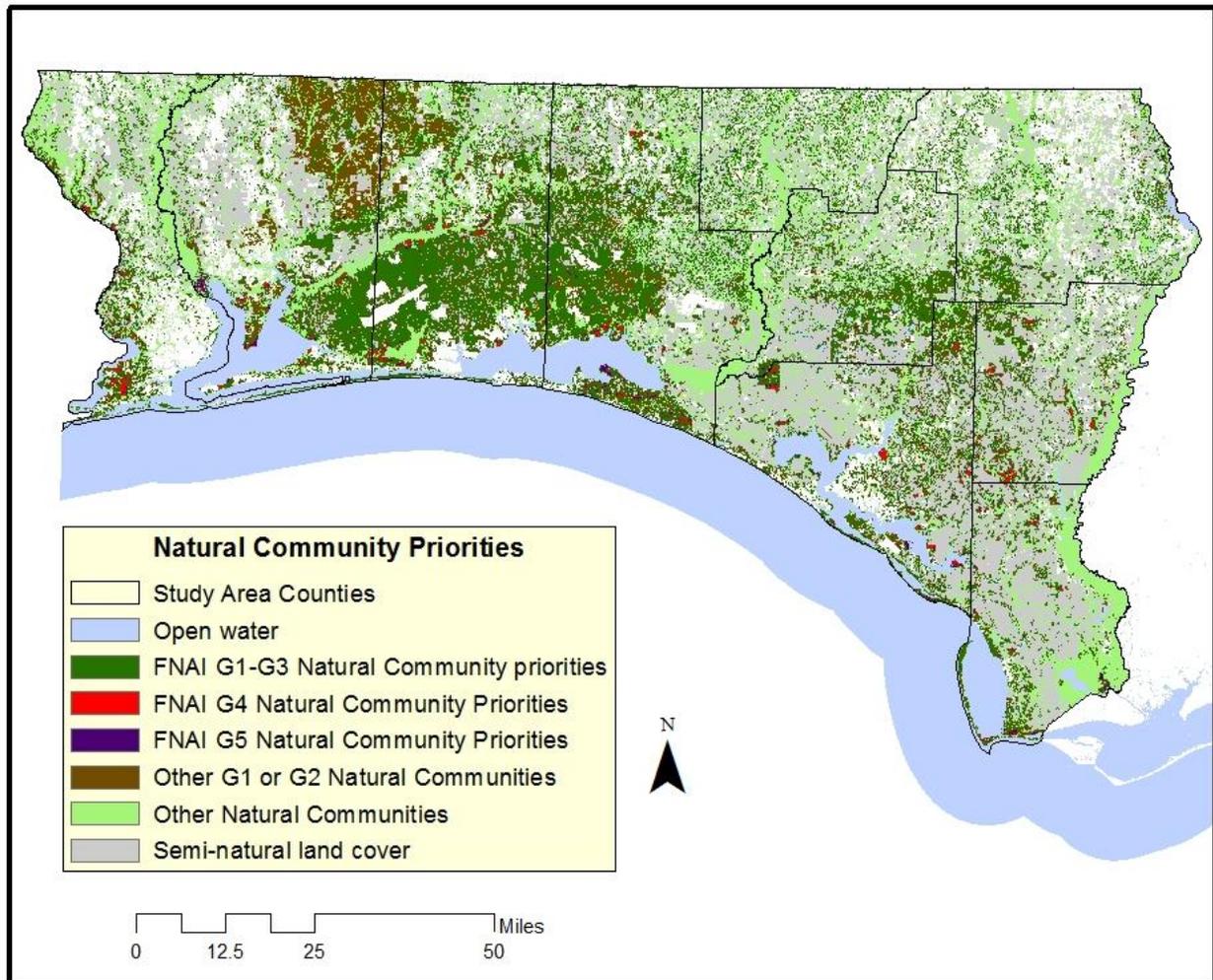
### CLIP FNAI Rare Species Habitat



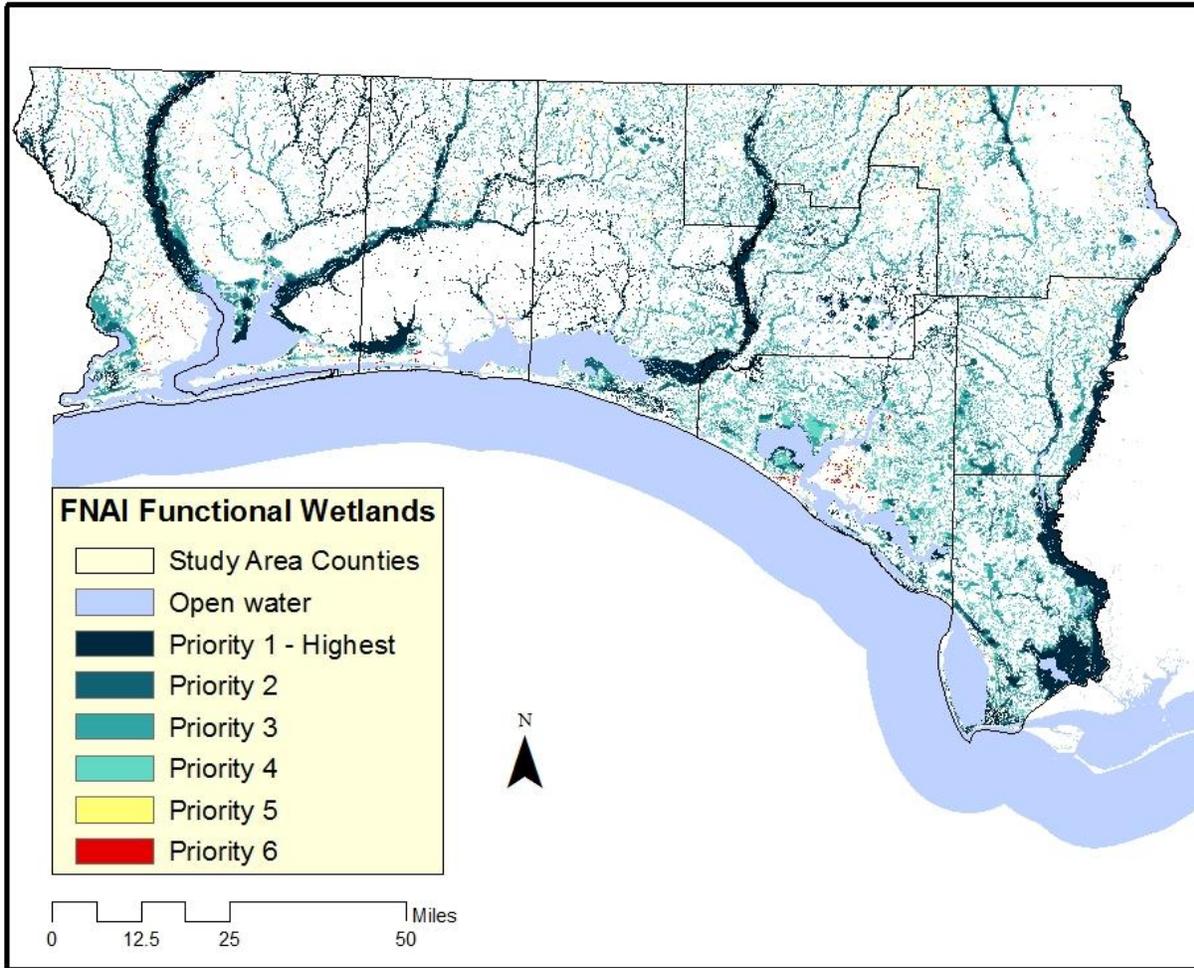
### CLIP FWC Strategic Habitat Conservation Areas



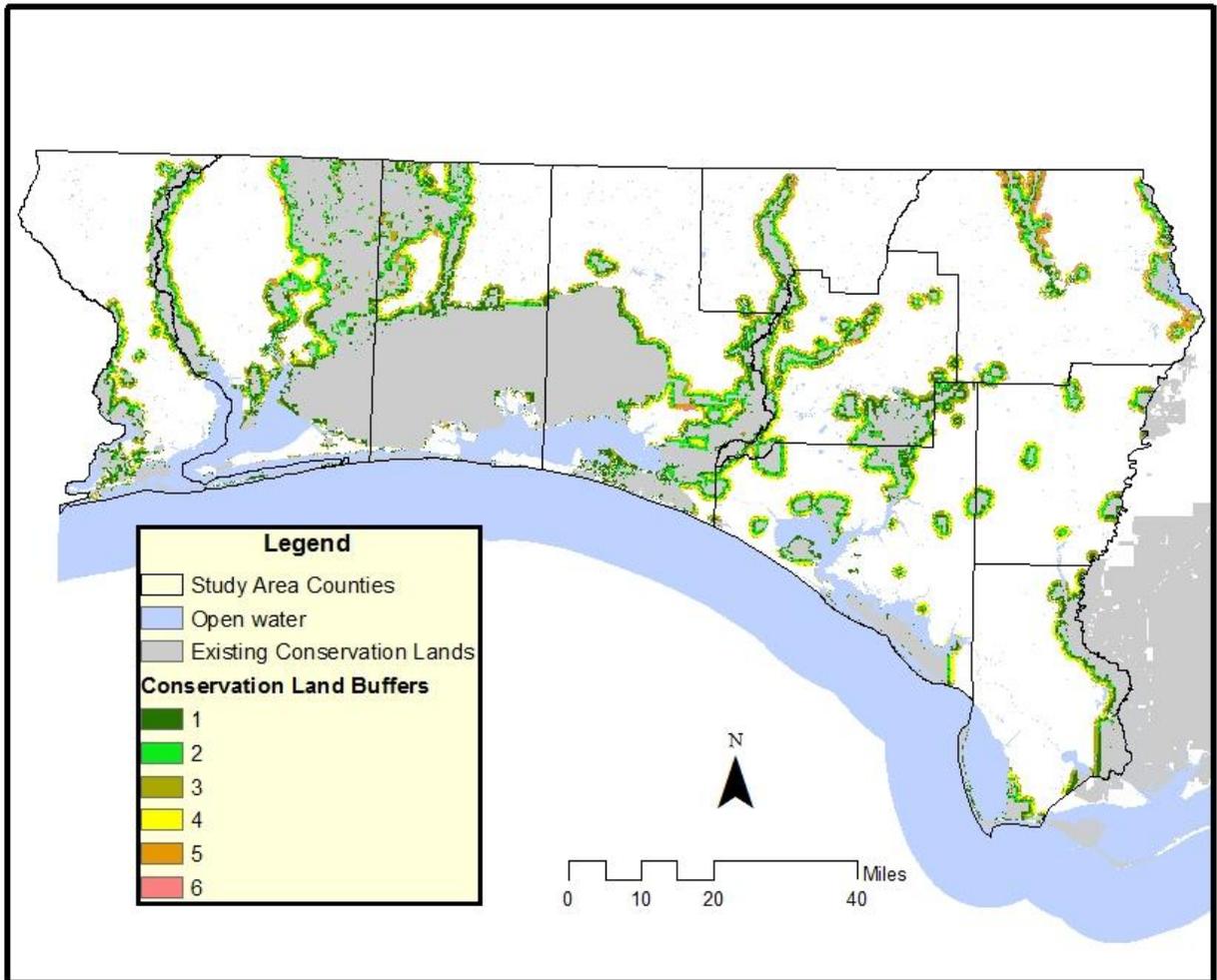
### CLIP FNAI Rare Natural Communities and Regional Natural Community Priorities



### CLIP FNAI Functional Wetlands



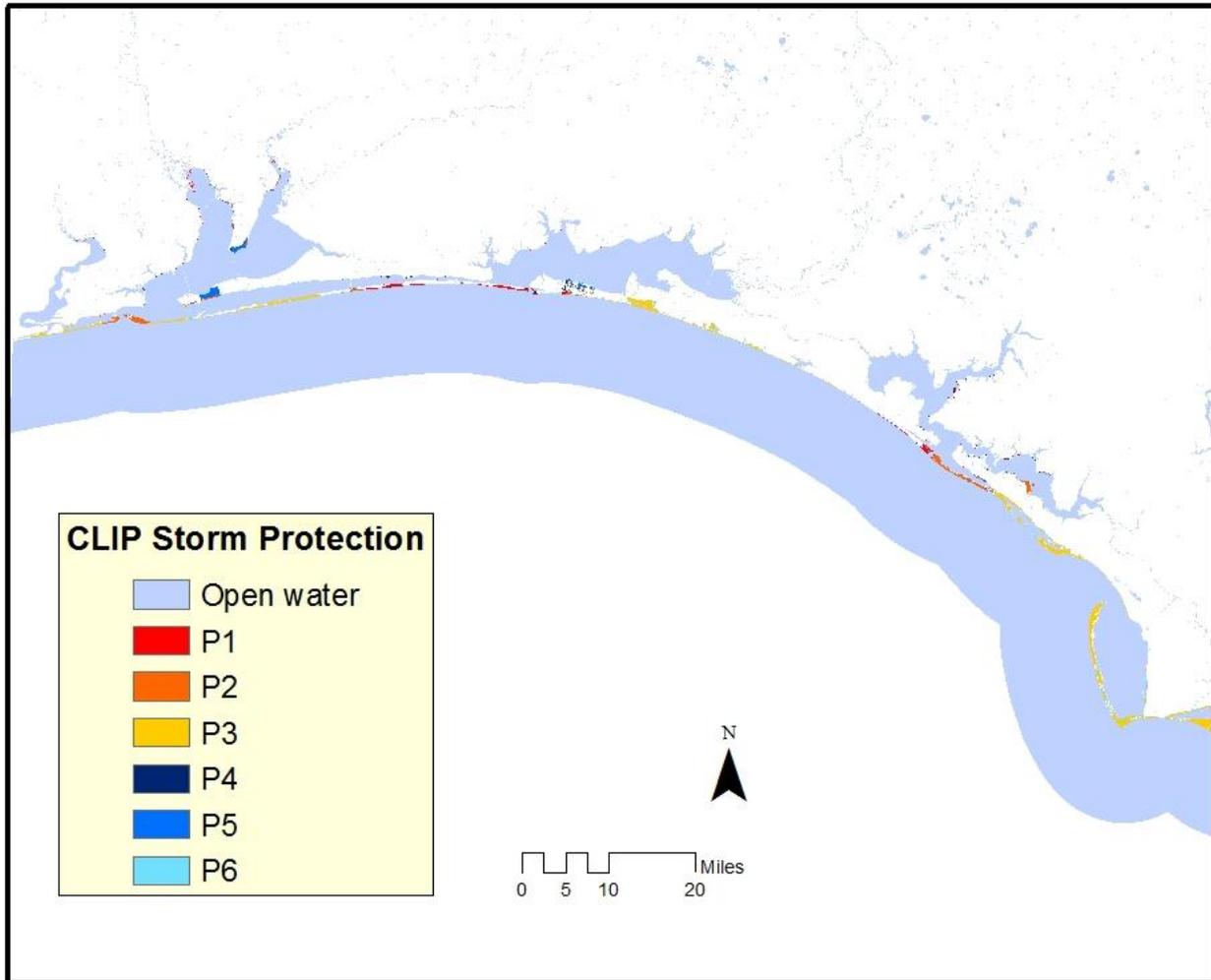
### Conservation Buffers



## Supplemental Data and Analyses

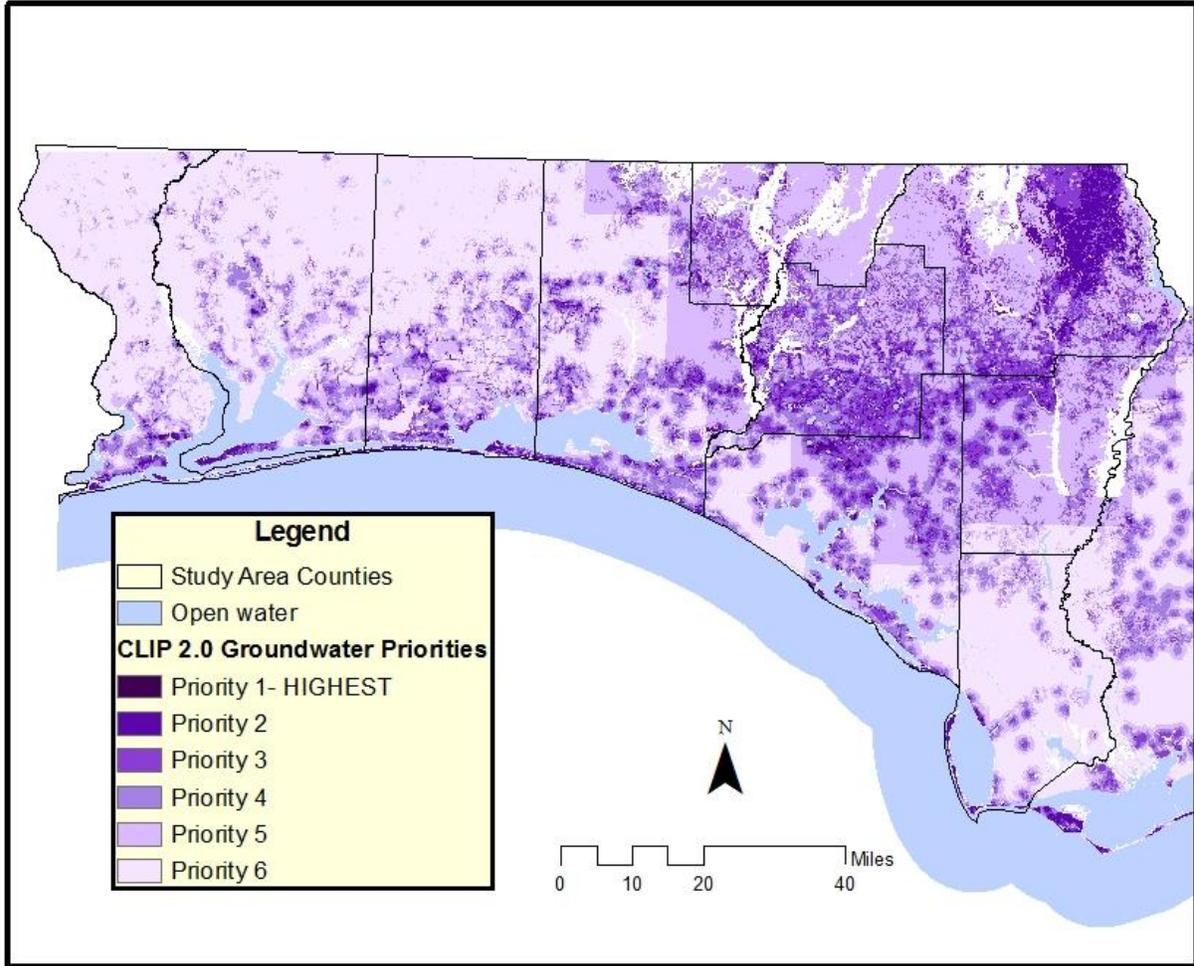
### A. Ecosystem Services

#### 1) CLIP Storm Protection



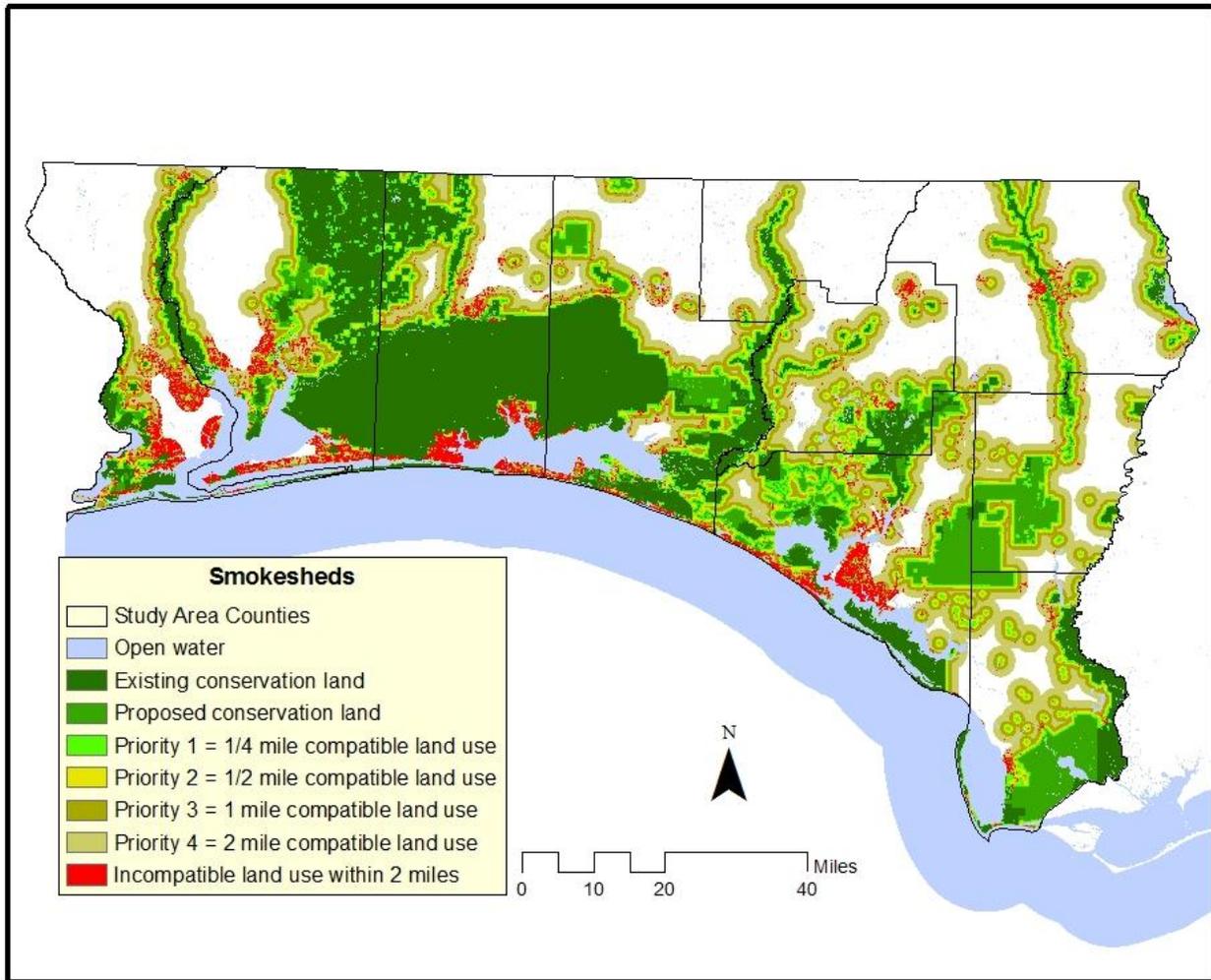
**B. Groundwater**

**1) CLIP FNAI Groundwater Priorities**



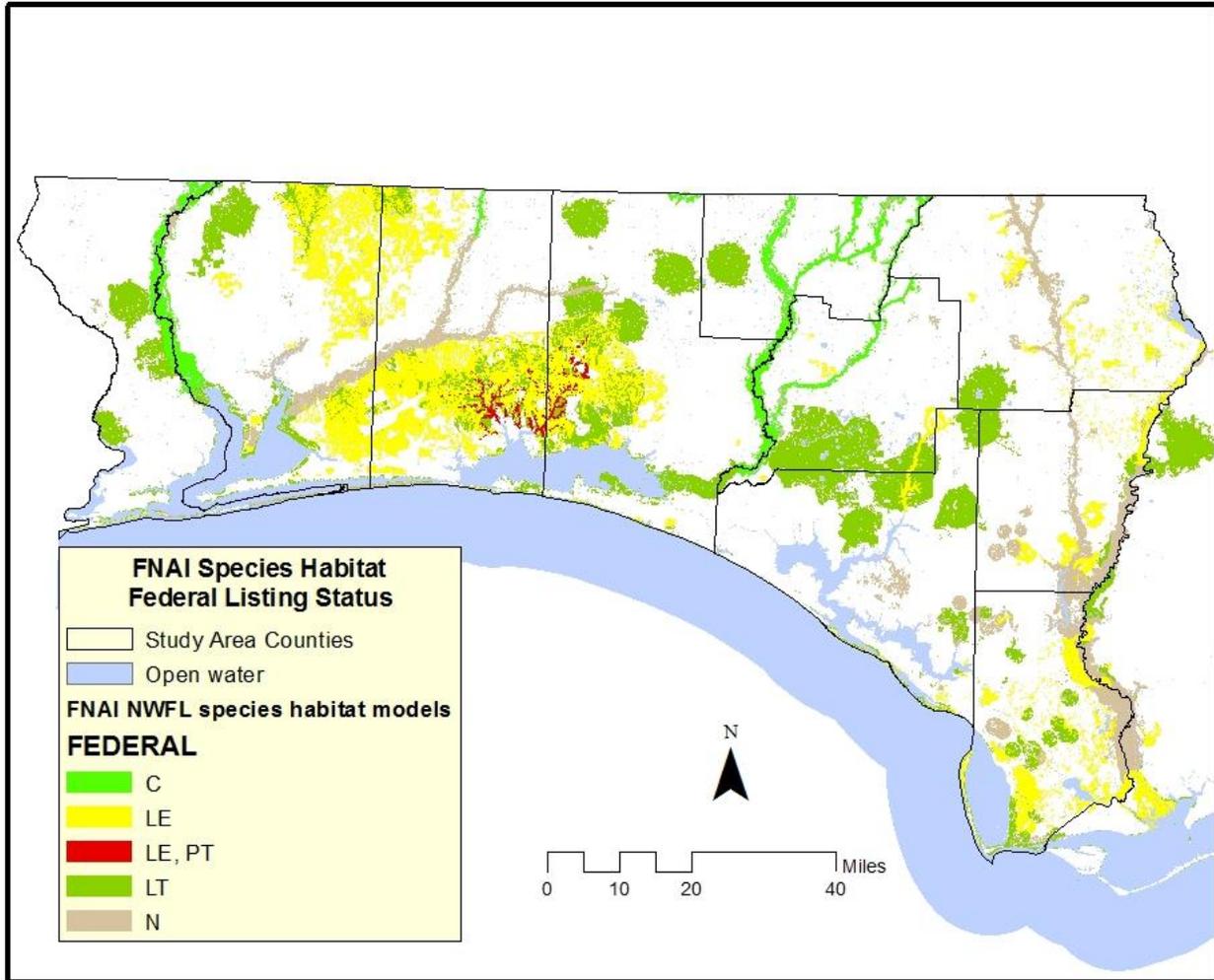
## C. Landscape

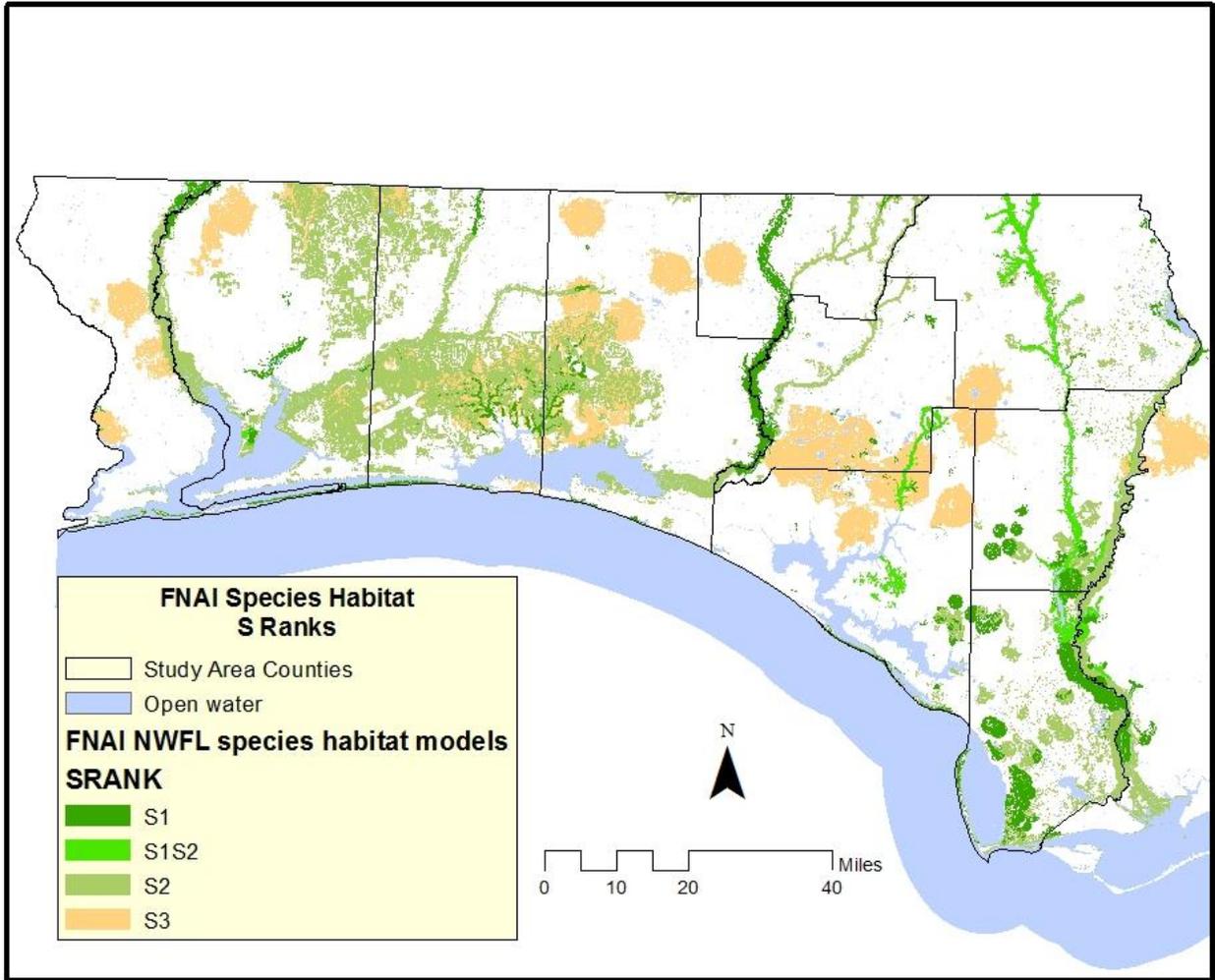
### 1) Green Links Smokeshed Buffers



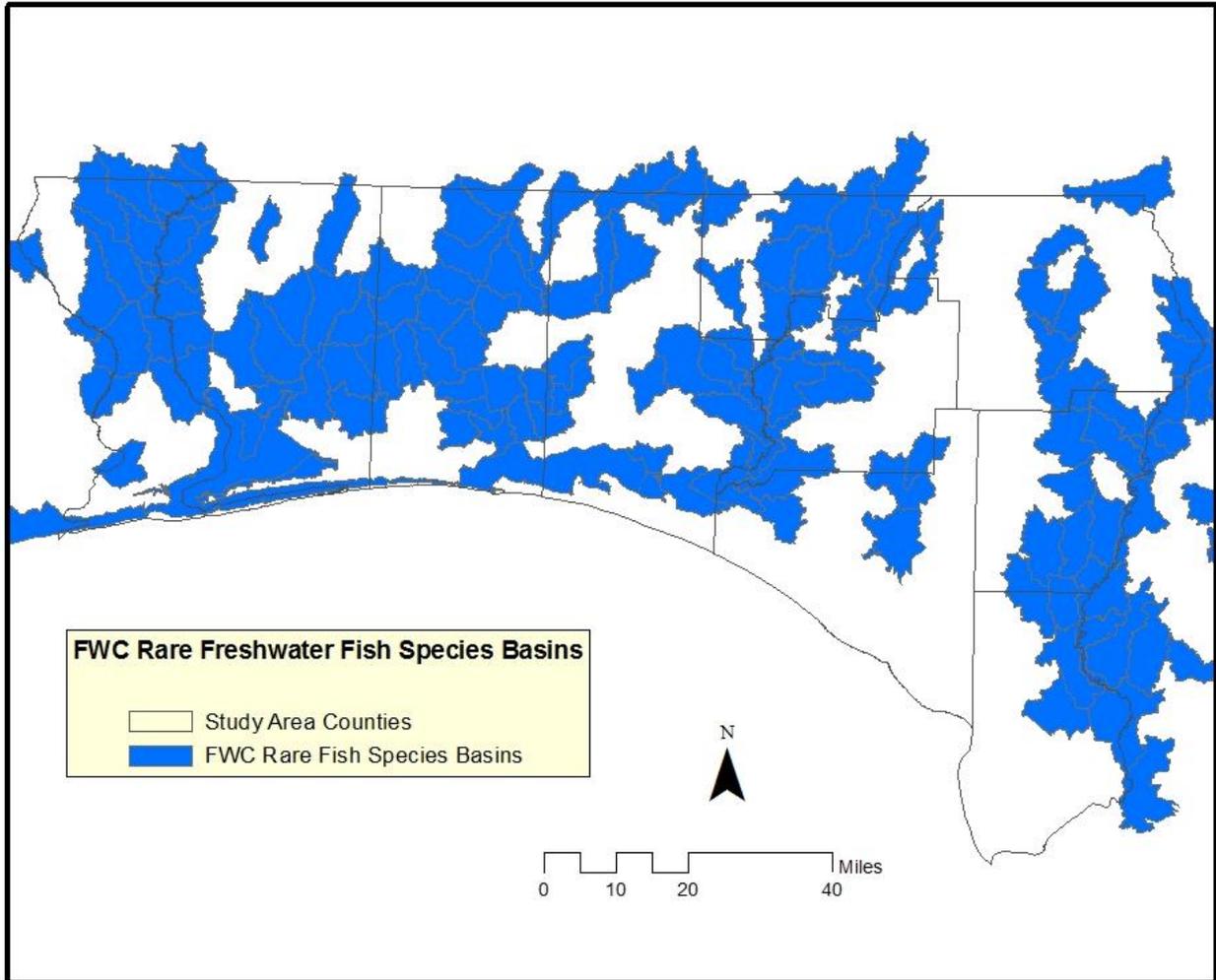
### D. Species

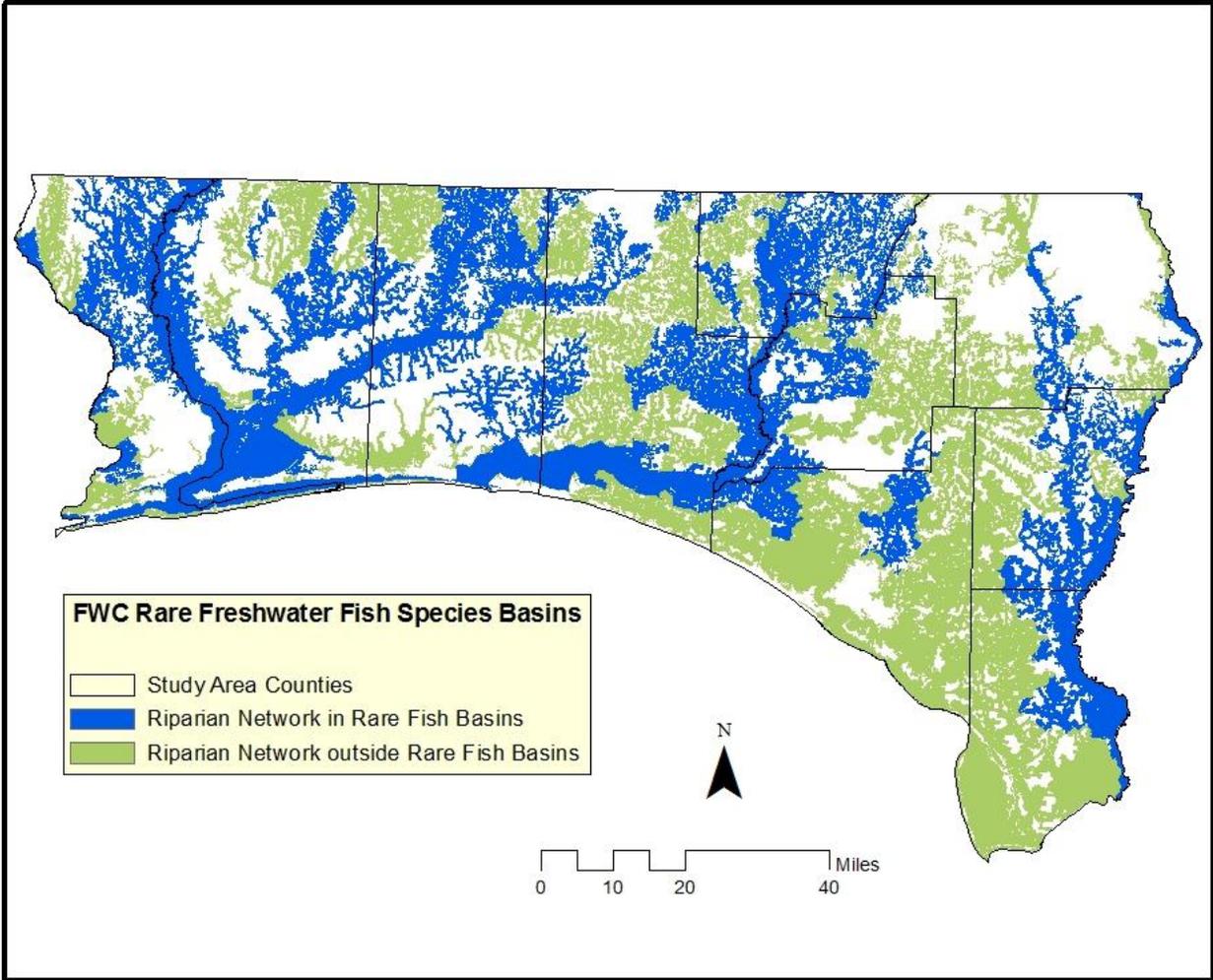
#### 1) Green Links FNAI Focal Species Habitat

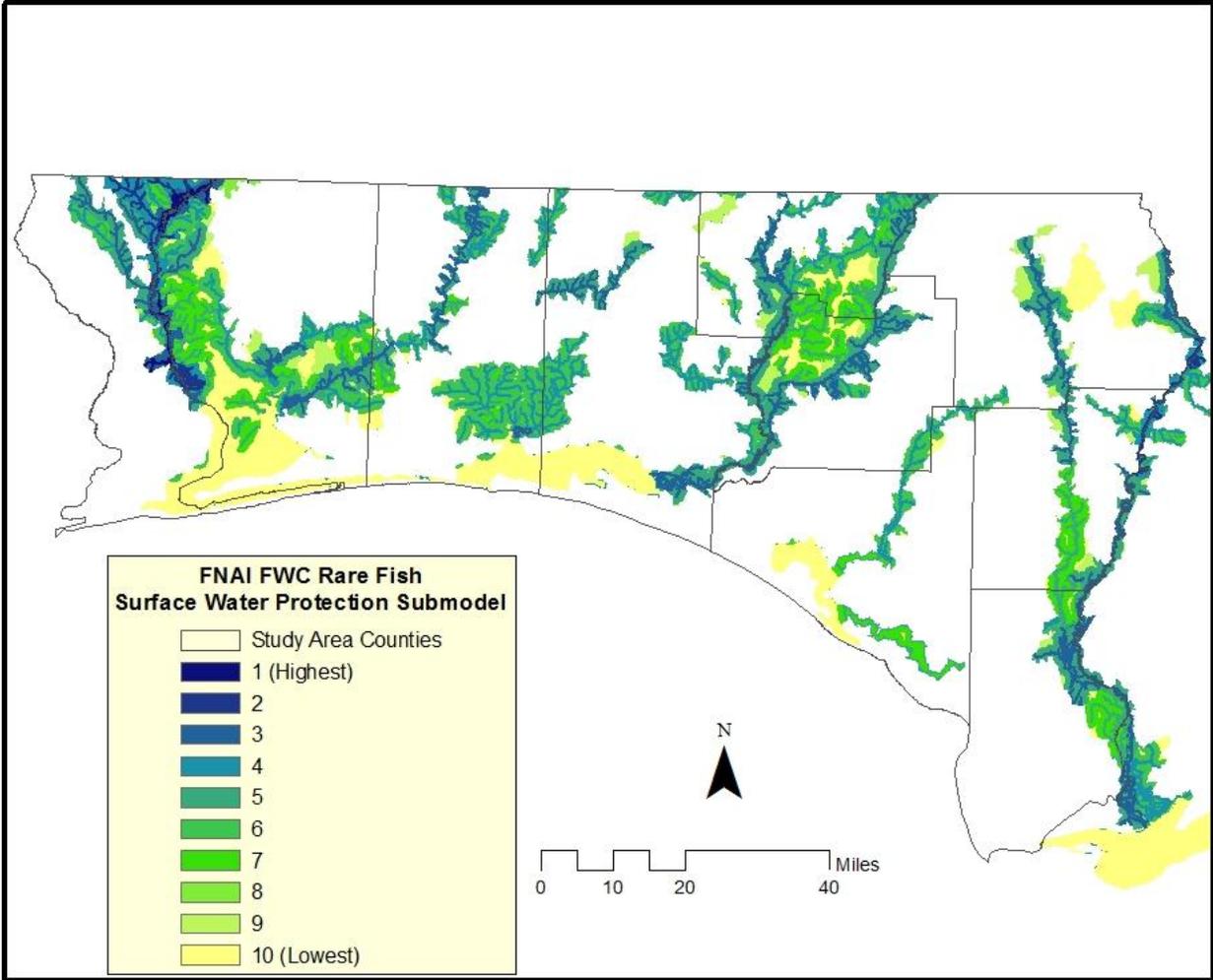




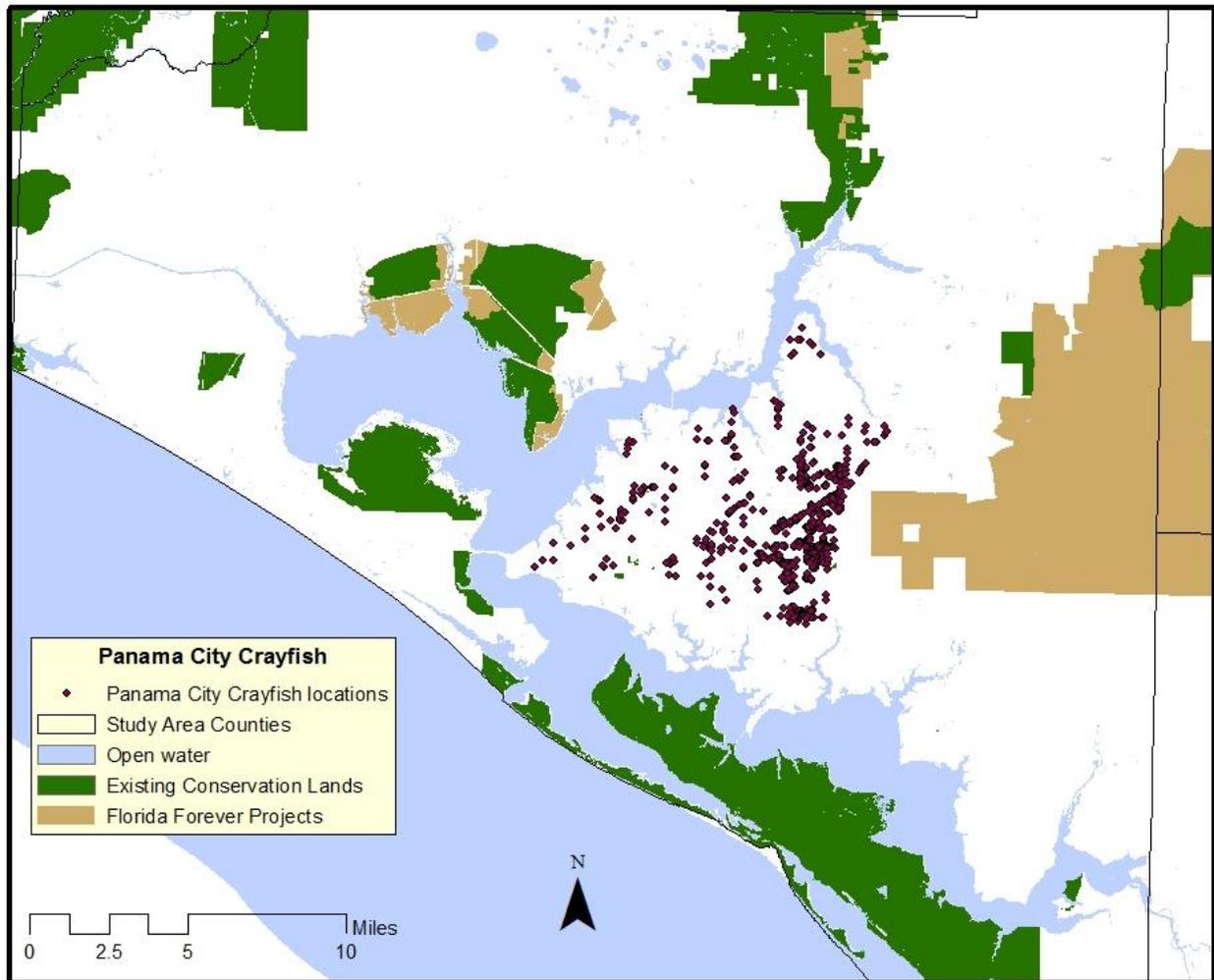
## 2) FWC Rare and Imperiled Freshwater Fish Basins



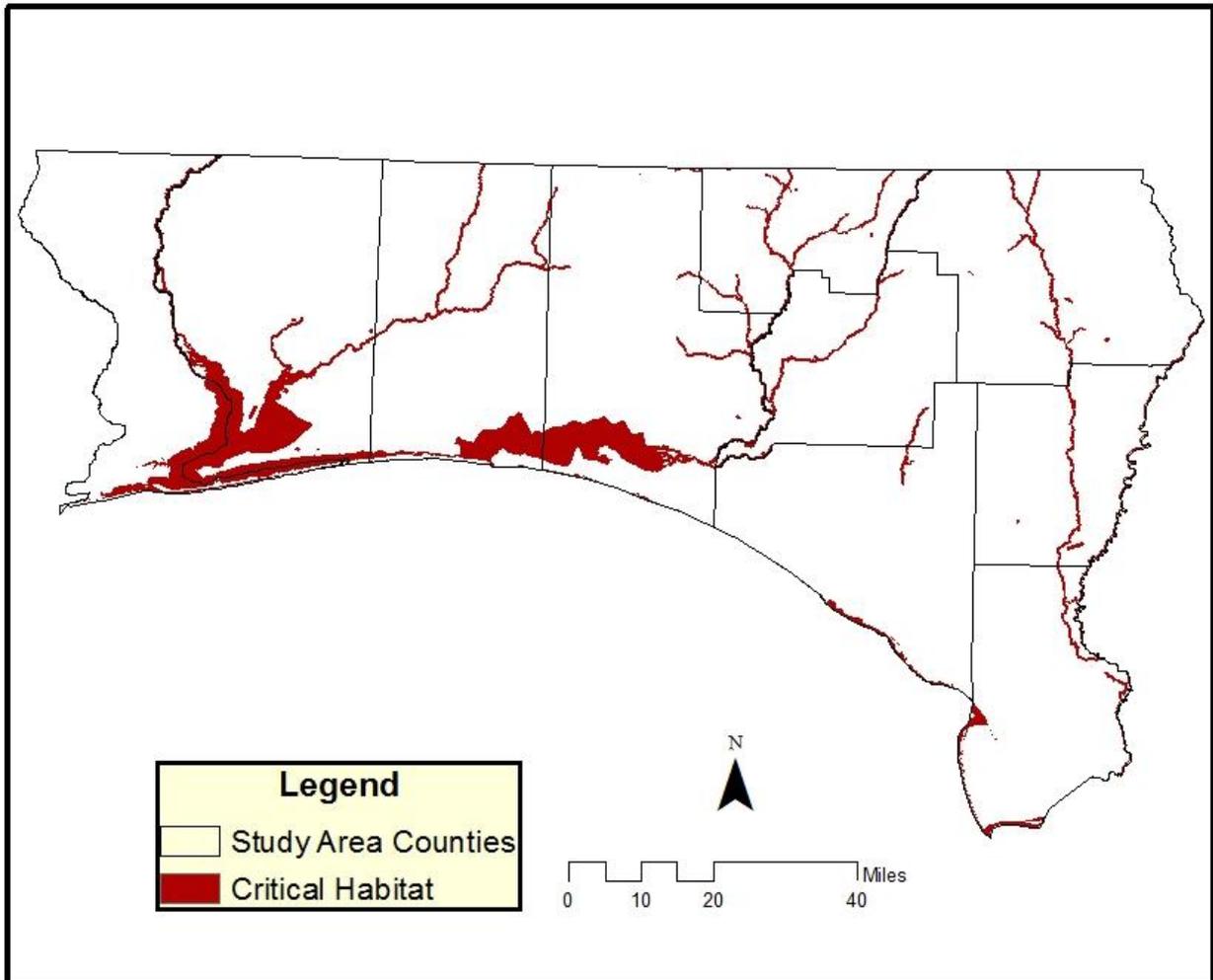




### 3) Panama City Crayfish

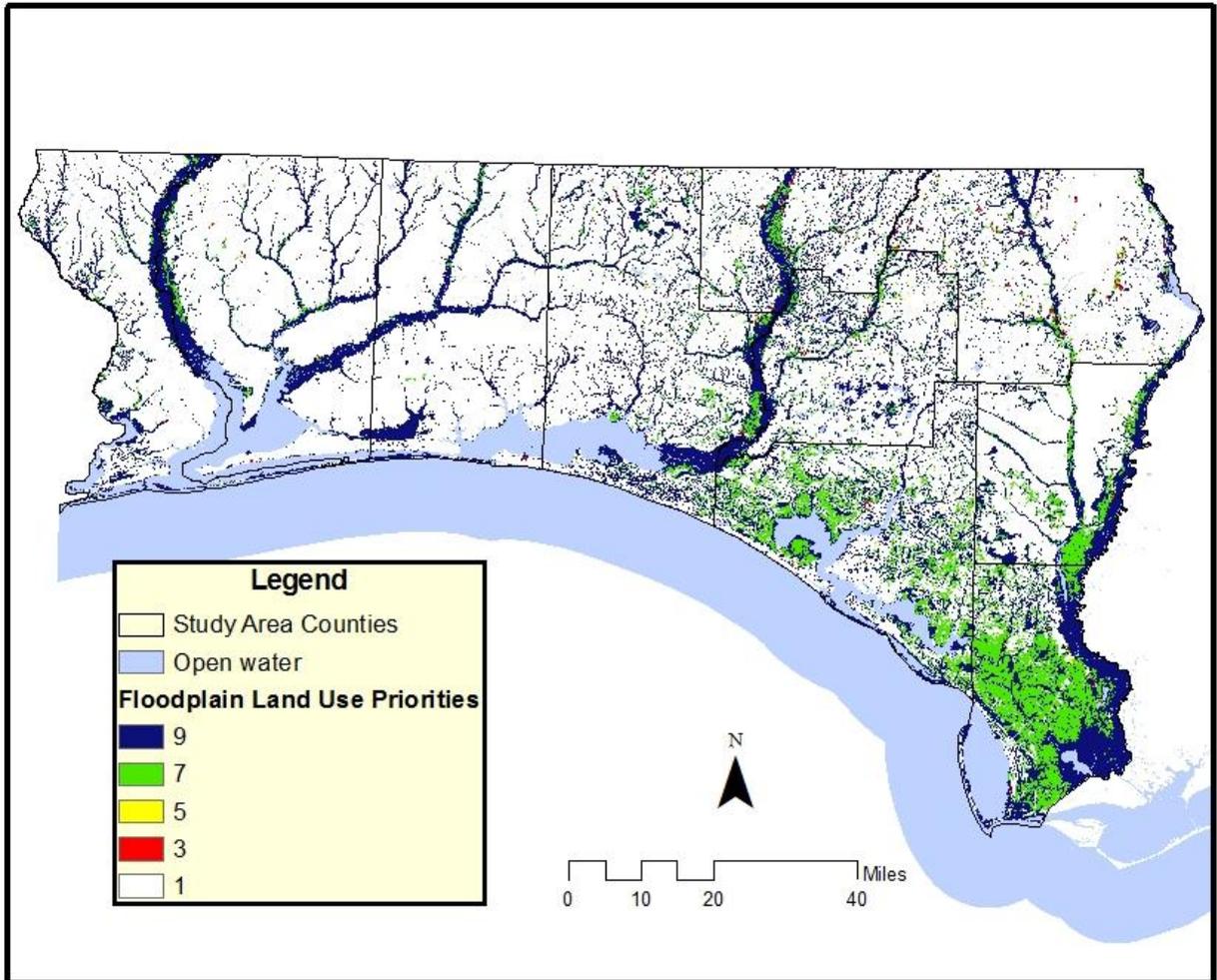


#### 4) USFWS Critical Habitat

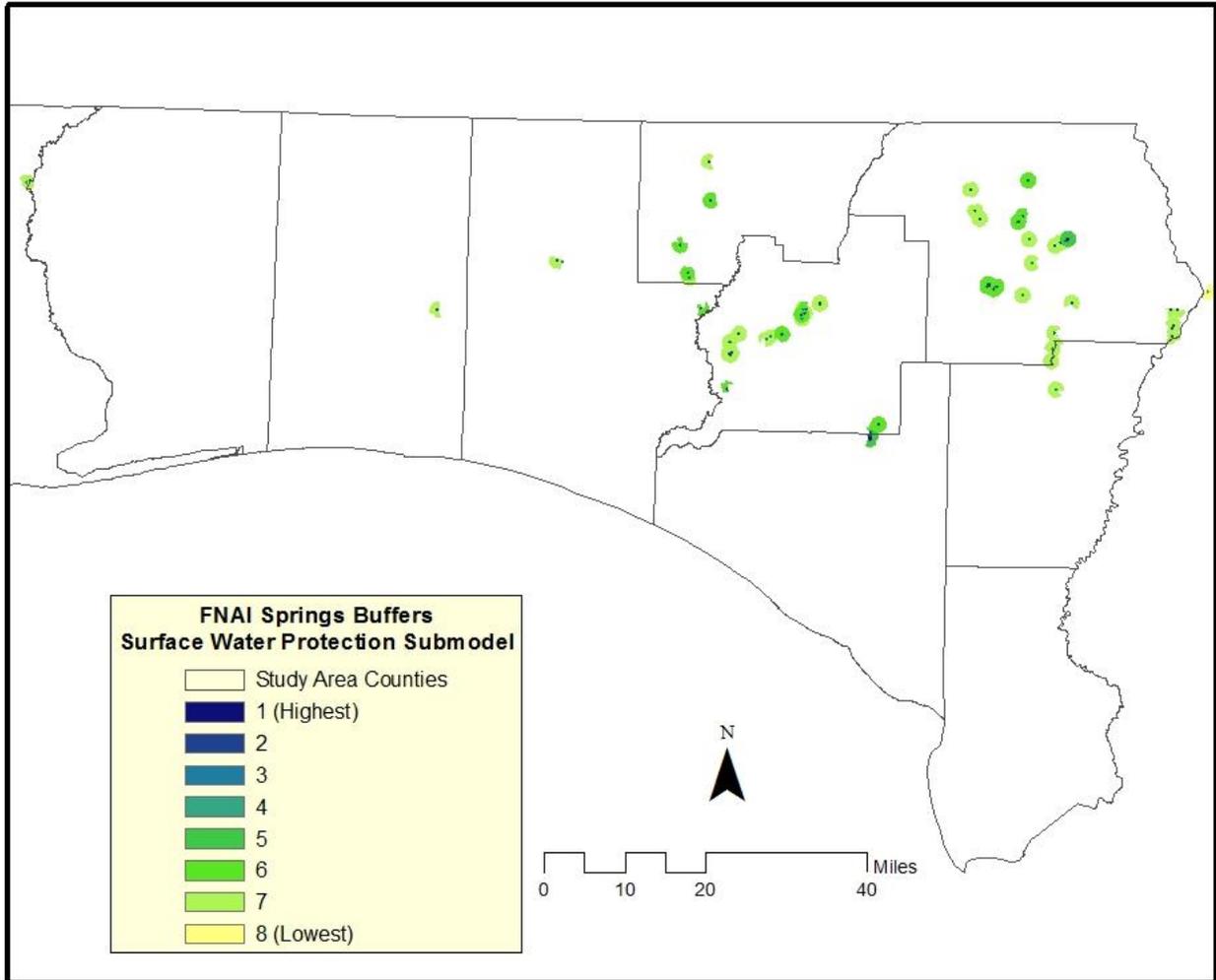


### E. Surface Water

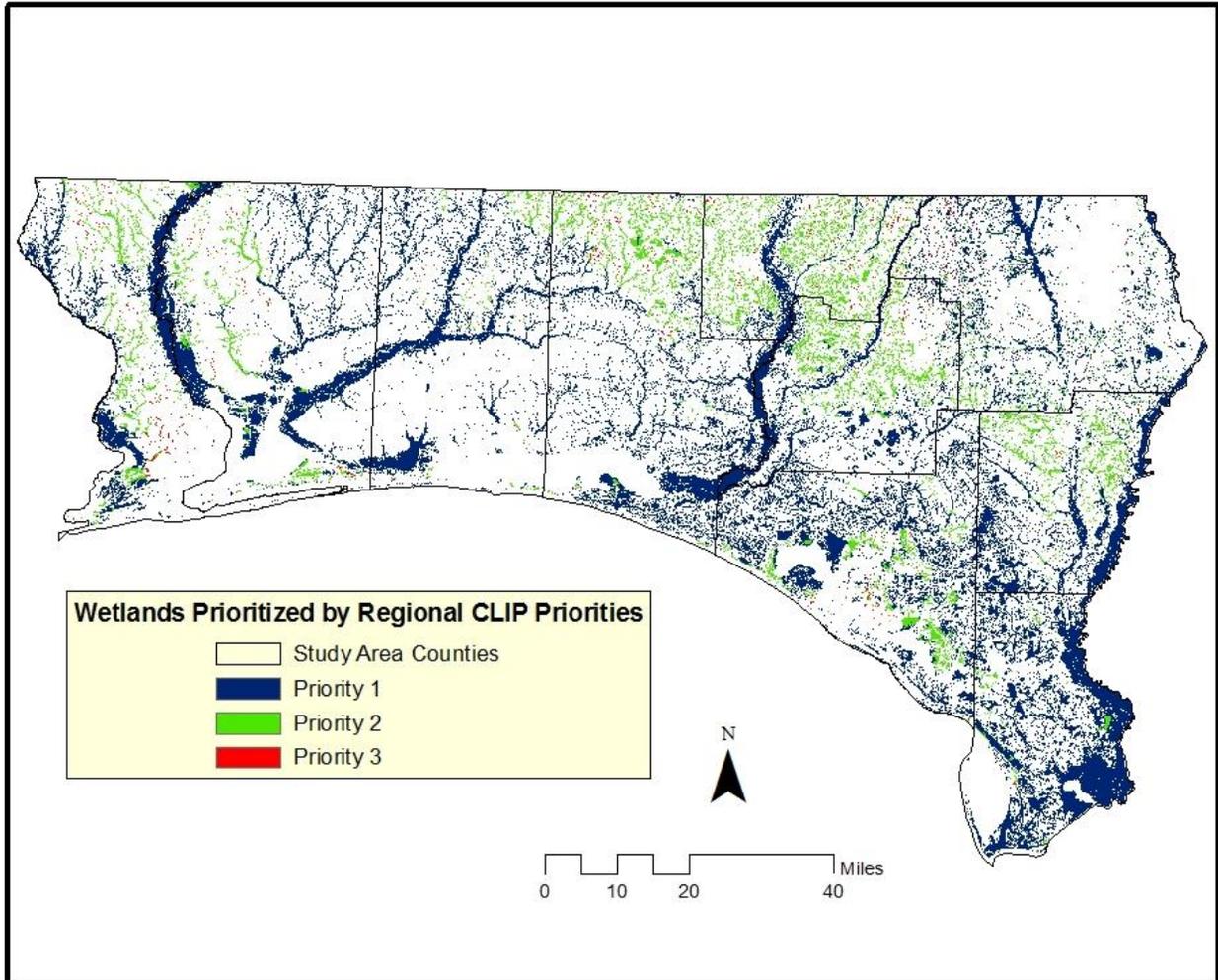
#### 1) Green Links 100 Year Floodplain Land Use



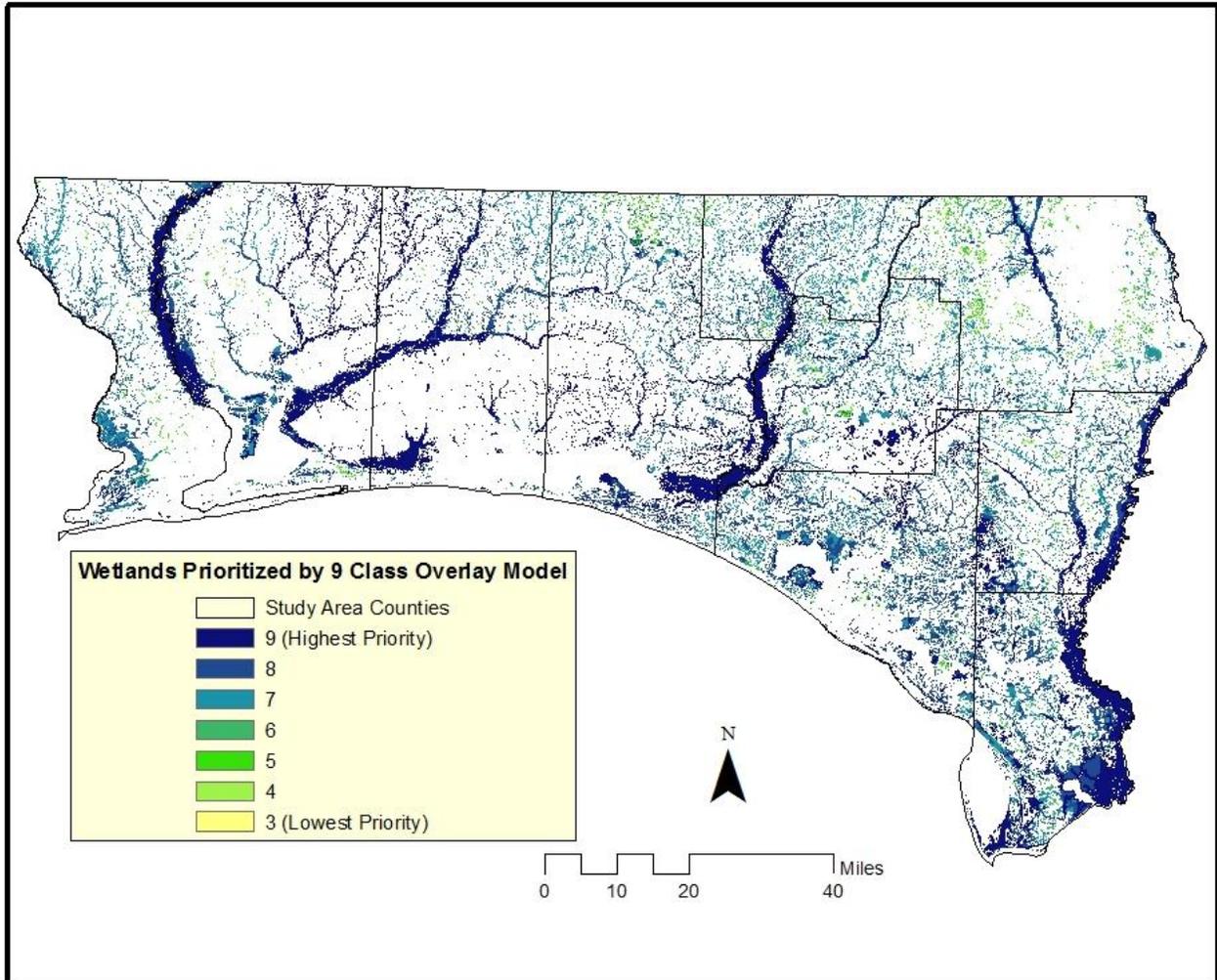
## 2) FNAI Springs Buffer Submodel



### 3) Green Links Wetlands Regional CLIP Priorities

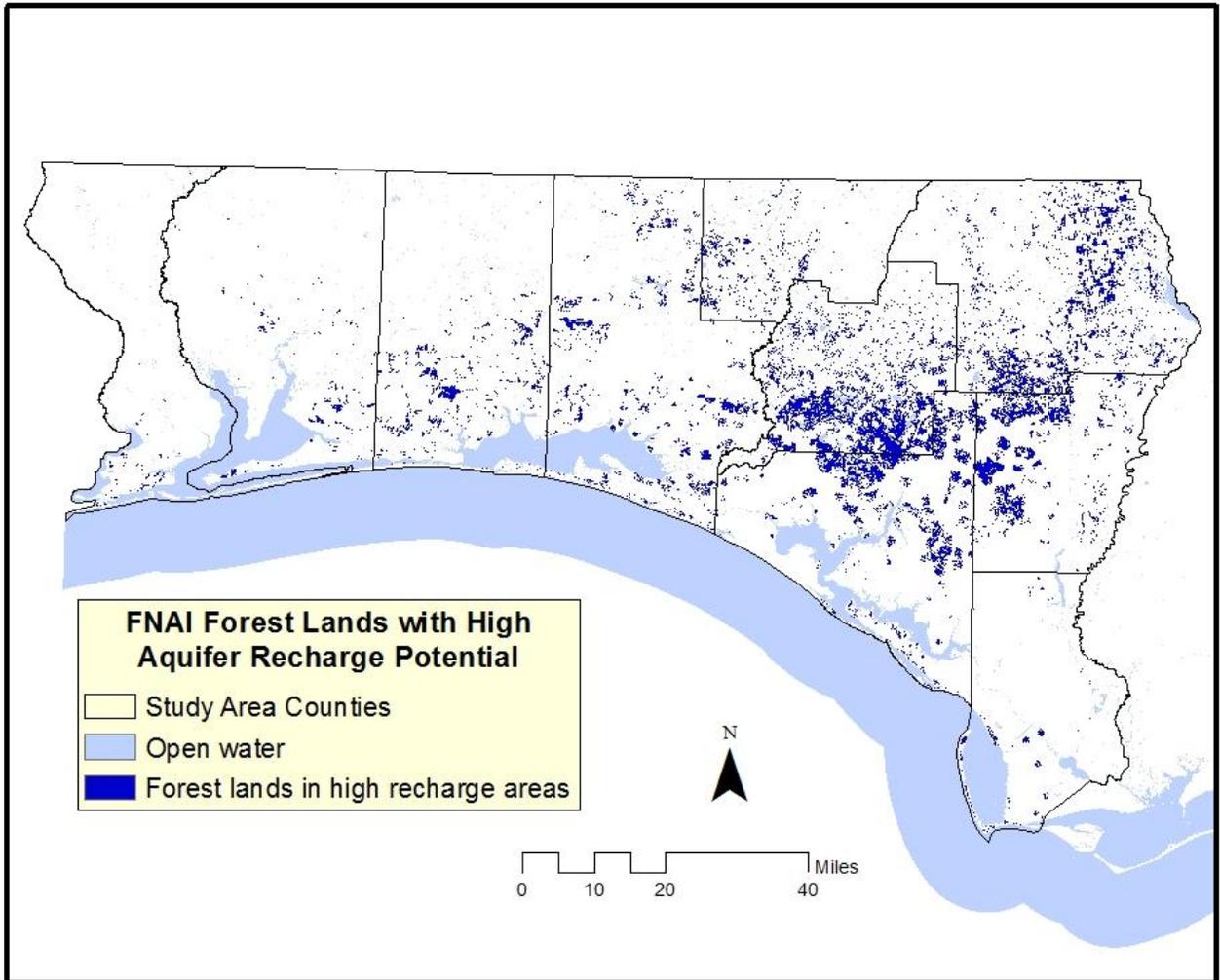


#### 4) GL Wetlands Overlay Model Priorities



F. Sustainable Forestry

1) FNAI Forest Aquifer Recharge Areas



## 2) FNAI Sustainable Forestry Priorities

