Critical Lands and Waters Identification Project (CLIP): Version 4.0

Technical Report – September 2016

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ABSTRACT

This report details the ongoing maintenance and enhancement of the Critical Lands and Waters Identification Project (CLIP) database. The culmination of this effort is the release of CLIP Version 4.0, a substantial update of the database originally released as CLIP Version 1.0 in 2008, and updated as version 2.0 in 2011 and version 3.0 in 2014. CLIP version 4.0 is a hierarchical GIS database consisting of 20 core natural resource data layers grouped into five Resource Categories: Biodiversity, Landscape, Surface Water, Groundwater, and Marine. For each of the Biodiversity, Landscape, and Surface Water categories we developed Resource Priority models using simple rule-based selections. Those three models were further combined into an Aggregated CLIP Priorities model based on both rule-based selections and overlap between resource category priorities.

In addition to updating the GIS database that forms the core of CLIP 4.0, this project explored additional analyses relevant to or based on CLIP resource data. These include a sea level rise scenario for rare species habitat conservation priorities, a surface water restoration analysis, and overlays of CLIP priorities on a variety of land use and conservation issues.

Overall, the CLIP version 4.0 Aggregated Priorities model shows an increase of about 110,000 acres total (land area only), and a decrease of about 480,000 acres in Priorities 1-2 compared to CLIP version 3.0, including about 625,000 fewer acres of Priorities 1-2 on private land (acreage on conservation lands increased slightly).

We recommend that users look beyond the Aggregated CLIP Priorities model and incorporate Resource Category priorities and core data layers into analysis and decision-making, particularly given that the CLIP 4.0 aggregated model does not include all CLIP core data layers or Resource Categories. We identify needs for the CLIP database to be maintained and updated in the future, including further development of analyses related to Climate Change, Water Restoration, and Ecosystem Services. We also suggest relevant uses for CLIP including regional visioning efforts.

ACKNOWLEDGMENTS

We gratefully acknowledge the contribution of the CLIP Technical Advisory Group (TAG) members listed in this report. They reviewed data and reports, attended meetings, and offered comments and criticism that were vital to the development of CLIP version 4.0. We thank Nathan Pasco at Florida Natural Areas Inventory for valuable assistance with data development and analysis. Michael Spontak at University of Florida conducted the Surface Water Restoration analysis.

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TABLE OF CONTENTS

INTRODUCTION

This report details the ongoing maintenance and enhancement of the Critical Lands and Waters Identification Project (CLIP), a Geographic Information Systems (GIS) database and associated analyses of statewide natural resource priorities in Florida. CLIP was originally designed to support the efforts of the Century Commission for a Sustainable Florida, and the Florida Fish and Wildlife Conservation Commission's Cooperative Conservation Blueprint (CCB), a statewide collaborative effort to identify the state's most important conservation priorities. It is now providing scientific support to the U.S. Fish and Wildlife Service's Peninsular Florida Landscape Conservation Cooperative (PFLCC). The culmination of this effort is the release of CLIP Version 4.0, a substantial update of the database originally released as CLIP Version 1.0 in 2008 and updated as CLIP Version 2.0 in 2011 and CLIP Version 3.0 in 2014.

Background: Why CLIP?

Over the last twenty-five years, several agencies and groups have developed a wealth of GIS data in Florida that identify various significant natural resources. These data have become critical to a variety of conservation and sustainability efforts, through identification of important ecosystems needed to protect natural resource values. Together these efforts have begun to identify Florida's "green infrastructure," which can be described as "natural areas and other open spaces that conserve natural ecosystem values and functions, sustain clean air and water, and provide a wide array of benefits to people and wildlife" (Benedict & McMahon 2006). Green infrastructure advances the critical concept that ecosystem function, biodiversity, and the health of human communities are inextricably linked (Hoctor et al. 2008). GIS data and other information identifying opportunities to protect functioning ecosystems and biodiversity are essential for conservation design, planning, and management needed to sustain healthy ecosystems and human communities. With this in mind, the Florida Natural Areas Inventory, the University of Florida Center for Landscape Conservation Planning, and the Florida Fish and Wildlife Conservation Commission have developed the CLIP database to assess and incorporate available GIS data for identifying statewide areas of interest for protecting biodiversity, water resources, ecosystem services, and other natural resource values. The available data were collected and assessed with the help of a science team of advisors called the CLIP Technical Advisory Group (TAG).

The CLIP Database can serve as a statewide decision support information system for identifying important opportunities to protect Florida's essential ecosystems. CLIP can be used as a decision support tool for informing, for example: the work of the Century Commission, the FWC Cooperative Conservation Blueprint, the Florida Forever environmental land acquisition program, and the Landscape Conservation Cooperatives effort launched by the U.S. Fish and Wildlife Service in cooperation with various state and regional partners. It may also be suitable as a resource planning guide for various state, regional, and local entities interested in effective natural resource protection and management. Other planning efforts have focused on particular resources, whereas CLIP is intended to provide a broad synthesis of natural resource GIS data to support comprehensive identification of statewide conservation opportunities. CLIP offers a transparent incorporation and prioritization of available data, a credible process using well documented data based on expert consensus, and the flexibility to incorporate new data as it becomes available to develop enhanced identification of natural resource conservation opportunities. Ultimately, CLIP represents a set of data tools to inform decision makers, rather than a single map or conservation plan.

CLIP Timeline

CLIP began in 2006 as a request from the Century Commission for a Sustainable Florida. The Century Commission was established by the Florida Legislature in 2005 and tasked with envisioning Florida's future over the next 25-50 years, offering recommendations for the Governor and Legislature regarding impacts of population growth, and encouraging "best community-building ideas" for Florida.

In 2007, the Florida Fish and Wildlife Conservation Commission (FWC) launched the Cooperative Conservation Blueprint (CCB): a statewide initiative to develop a unified view among broad-based groups of stakeholders for Florida's conservation priorities, and a set of voluntary incentives to protect those priorities on privately-held lands, which will remain in private hands. There were obvious synergies between CLIP and the CCB, and FWC assisted the Century Commission in supporting the completion of CLIP version 1.0 in 2008 (Hoctor et al. 2009). The CLIP Version 2.0 update was supported entirely by FWC through a State Wildlife Grant, and was completed in August 2011 (Oetting, Hoctor & Stys 2012).

In 2012, the U.S. Fish and Wildlife Service (USFWS) recognized the potential value of CLIP for supporting their newly established Landscape Conservation Cooperatives (LCCs), which are envisioned as planning partnerships between federal and state agencies, tribes, non-governmental organizations, universities, and other entities to collaborate on science needs and broad-scale conservation issues, including climate change (USFWS 2014). The CLIP Version 3.0 update (Oetting, Hoctor & Volk 2014) and now the current CLIP Version 4.0 update have been funded by the Peninsular Florida LCC in support of their Science Team activities.

Disclaimers

Potential users of CLIP need to recognize that this statewide and regional scale database does not contain all data relevant to conservation in Florida. There are other data sets used by government agencies, non-government organizations, and private landowners that are useful or necessary to address specific aspects of conservation planning and management. However, CLIP can be used as a common framework or base to help inform and coordinate conservation planning at the statewide scale, and can support development of regional visions or conservation strategies. CLIP data could also be useful for some aspects of local planning. Coordination of planning efforts is essential for providing both more effective and efficient protection of Florida's green infrastructure, and CLIP provides an important opportunity to facilitate better coordination of conservation assessment, planning, and management across federal, state, regional, and local levels. Considering these points, the following "disclaimers" apply to this report, the CLIP Database Version 4.0, and any maps created using CLIP data:

> The Critical Lands and Waters Identification Project (CLIP) is a decision support database that identifies lands and waters with important natural resource attributes of state and regional significance. Private lands identified on the map may be good candidates for voluntary land acquisition programs, other public and private conservation programs, mitigation or conservation banks, or for use in innovative land planning such as conservation design, rural clustering, conservation easements, transfer of development rights, or Rural Lands Stewardship Areas, all of which seek to conserve significant natural resources. CLIP priorities represent important ecological stewardship opportunities for Florida but are not intended as an additional encumbrance on landowners other than such protections as may already be afforded by federal, state or local laws.

1. These data were created using a variety of input data ranging from 1:5,000 to 1:64,000 map scale resolution. Such data are of sufficient resolution for state and regional scale conservation planning. They are not appropriate for use in high accuracy mapping applications such as property parcel boundaries, local government comprehensive plans, zoning, DRI, site plans, environmental resource or other agency permitting, wetland delineations, or other uses requiring more specific and ground survey quality data.

2. The CLIP analysis, maps and data were developed for state and regional conservation planning purposes and are not intended, nor sufficient, to be the primary basis for local government comprehensive plans, environmental resource or agency permitting decisions.

3. These data are likely to be regularly updated and it is the responsibility of the user to obtain the most recent available version of the database.

4. Data should not be transferred to a third party, in data or map form, without noting these disclaimers. In addition, we encourage all users to direct other interested parties to access CLIP online to download data versus sharing data directly (http://www.fnai.org/clip.cfm).

Users also need to be aware that CLIP data are currently developed using multiple statewide land use / land cover data sets that were developed through the years 2003-2015. Therefore, users can expect that some new land development may not be reflected in the CLIP Database. Furthermore, because of the scale issues discussed in disclaimer #1 above, developed land uses could also occur in areas identified as CLIP priorities due to associated spatial error with 1:5,000 to 1:64,000 scale data. The user must recognize this when reviewing and using CLIP data especially for any local to regional applications.

CLIP DATABASE OVERVIEW

CLIP continues to be developed as a cooperative effort among multiple agencies, with input and review from an expert Technical Advisory Group (TAG). Lead agencies in the development of CLIP version 4.0 are the Florida Natural Areas Inventory at Florida State University, and the Center for Landscape Conservation Planning at the University of Florida. The Florida Fish and Wildlife Conservation Commission continues to be an active partner in CLIP development as well.

Development Process

This project has been conducted with the guidance, feedback, and consensus of a Technical Advisory Group (TAG). The TAG is an essential part of the CLIP process providing review and an opportunity to develop expert consensus for selecting, prioritizing, and integrating the available GIS data. TAG members have relevant scientific or technical expertise in regional conservation assessment, natural resources and ecosystems, and Geographic Information Systems (GIS). The following scientists and other technical experts participated in the TAG during the extent of the CLIP 4.0 update:

- J. B. Miller, SJRWMD
- Marianne Gengenbach, DEP-DSL
- Ellen Stere, DEP-DSL
- Dennis Hardin, FFS
- Doria Gordon, TNC
- Richard Hilsenbeck, TNC
- Amy Knight, FNAI
- Pete McGilvray, FDOT
- Katasha Cornwell, FDOT
- Dean Rogers, FDOT
- Thu-Huong Clark, FDOT
- Eric Hand, DEP-OGT
- Kathleen O'Keife, FWC
- Ed Montgomery, Rayonier Inc.
- Dan Roach, Rayonier Inc.
- Reed Noss, UCF
- Mark Barrett, FWC
- Beth Stys, FWC
- Paul Lang, USFWS
- Janis Morrow, DEP-DEAR
- Alexis Thomas, UF GeoPlan Ctr.
- Steve Traxler, USFWS

A full day TAG meeting was held on March 24, 2015 to review draft data revisions and new analyses. A half-day TAG webinar was held on February 9, 2016 to review final drafts of CLIP 4.0 data and analyses.

CLIP Database Structure

Like previous versions, CLIP version 4.0 is a hierarchical database consisting of 20 core natural resource data layers grouped into six Resource Categories: Biodiversity, Landscape, Surface Water, Groundwater, Water Restoration, and Marine (Fig. 1). For each of the Biodiversity, Landscape, and Surface Water categories we developed Resource Priority models using simple rule-based selections. Those three models were further combined into an Aggregated CLIP Priorities model based on both rule-based selections and overlap between resource category priorities. Note that the Groundwater, Water Restoration, and Marine resource categories are not included in the Aggregated CLIP Priorities model, as will be discussed further below.

Each resource category and core data layer is summarized here. Detailed descriptions and acreage breakdowns of core data layer priority classes are found in Appendix A, and maps of each CLIP data layer are provided in Appendix B.

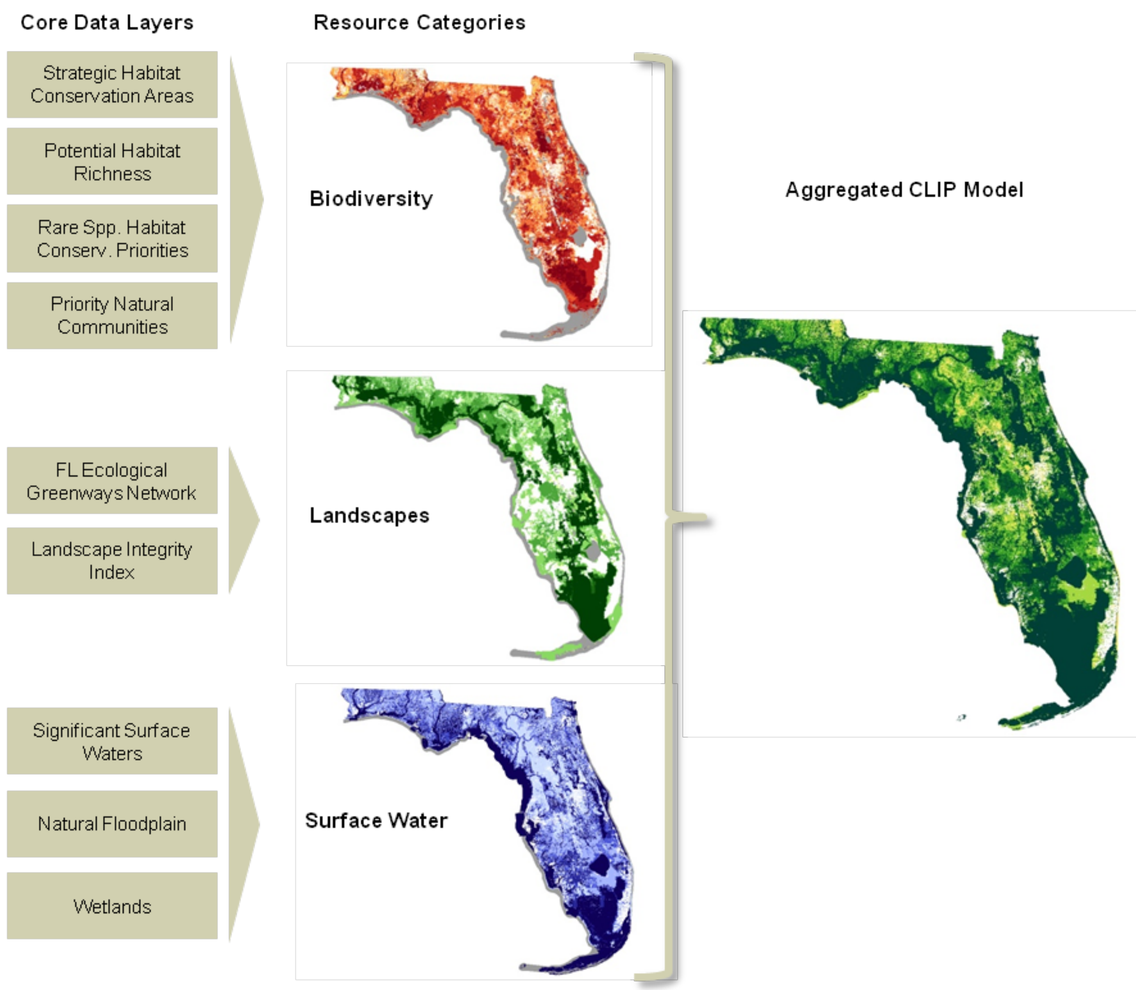

Figure 1. CLIP Version 4.0 Database Hierarchy

Biodiversity Resource Category

The Biodiversity Resource Category is comprised of Strategic Habitat Conservation Areas, Biodiversity Hotspots, Rare Species Habitat Conservation Priorities, and Priority Natural Communities. Biodiversity is the variety and variability among living organisms and the ecological complexes within which they occur including genetic diversity, species, and natural communities (Noss and Cooperrider 1994). Biodiversity is the essence of Florida's natural heritage, is essential for our growing nature-based economy, and healthy biodiversity is critical for providing ecosystem services that healthy, vibrant human communities require (Hoctor et al. 2008).

Strategic Habitat Conservation Areas. This data layer was created by FWC to identify gaps in the existing statewide system of wildlife conservation areas, and to inform ongoing land acquisition and conservation efforts. FWC modeled areas of habitat that are essential to sustain a minimum viable population for focal terrestrial vertebrate species that were not adequately protected on existing conservation lands. Potential habitat models for each species were developed from FWC 2003 Landsat satellite imagery land cover overlaid with FNAI element occurrences, FWC wildlife observations, or other data relevant for identifying potential habitat. Individual SHCAs for each species were identified as the additional areas beyond existing conservation lands that were needed to ensure a minimum viable population for species that require additional habitat protection. Of the 62 species evaluated, 33 were identified as requiring SHCAs. The final SHCA data layer is an aggregation of the individual species SHCAs. CLIP version 4.0 uses the revised SHCA update from 2009 (Endries et al. 2009), which includes four additional species – Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*), Florida black bear (*Ursus americanus floridanus*), swallow-tailed kite (*Elanoides forficatus forficatus*), and mangrove cuckoo (*Coccyzus minor*).

CLIP uses the version of SHCA that was prioritized into five classes by FWC. Priority 1 is species with Heritage ranks of S1 and G1-G3. Priority two is species with ranks of S1, G4-G5 or S2, G2-G3. Priority 3 is species with Heritage ranks of S2, G4-G5 or S3, G3. Priority 4 is species with ranks of S3, G4. Priority 5 is species with ranks of S3, G5 or S4, G4. Note: the CLIP 4.0 SHCA layer corresponds to Florida Forever Conservation Needs Assessment (FFCNA) SHCA version 4.1 (FNAI 2015).

Vertebrate Potential Habitat Richness. Because SHCAs do not address species richness, FWC also developed a richness model to identify areas of overlapping species habitat. FWC created a statewide potential habitat model for each of the 62 species included in their analysis. The Potential Habitat Richness layer includes the entire potential habitat model for each species and provides a count of the number of species with potential habitat occurring at each location. The highest number of focal species co-occurring at any location in the model is 13. Note that the version of this data layer used for CLIP version 4.0 is based on the final 2009 SHCA update (Endries et al. 2009). Also note that this layer was referred to as "Biodiversity Hotspots" in previous versions of FWC's SHCA analysis, as well as in CLIP version 1.0.

Unlike SHCAs, the Vertebrate Potential Habitat Richness layer does not address species rarity, rather it is a simple additive overlay of focal species habitat models. For CLIP, Potential Habitat Richness is prioritized by the species count, with higher species counts given higher priority over lower species counts.

Rare Species Habitat Conservation Priorities. This data layer, commonly referred to as FNAIHAB, was originally created by FNAI specifically for the Florida Forever statewide environmental land acquisition program. It is intended to show areas that have a high statewide priority for protection of habitat for Florida's rarest plant and animal species. The FNAIHAB model was designed explicitly to identify areas important for species habitat based on both species rarity and species richness.

FNAI mapped occurrence-based potential habitat for 281 species of plants, invertebrates, and vertebrates, including aquatic species. Because land acquisition was the original focus, species were included according to their need for additional habitat placed in conservation. All federally listed species were included, as well as many state listed species and several species not listed at either the federal or state levels. Suitable habitat was mapped only in the vicinity of known occurrences. Species' habitat was mapped based on remotely sensed vegetation data (Florida Cooperative Land Cover used for all modeling revisions since CLIP 2.0), as well as information from various species experts (FNAI 2015).

It is important to note that the version of FNAIHAB used for CLIP differs from the original version of FNAIHAB developed for the Florida Forever program (aka FNAIHAB-FF). For Florida Forever, species are weighted by three factors: global rarity (G-rank), total area of habitat mapped, and percent of habitat currently protected on conservation lands. That weighting system is designed to prioritize species with regard to land acquisition. Since CLIP is intended for a broader range of potential conservation planning purposes, FNAI developed a separate weighting system involving only global and state rarity ranks (G-rank and S-rank). This weighting system was developed for CLIP in consultation with FNAI scientists to reflect the relative importance for conservation of various G- and S-rank combinations. The result is a rarity-weighted richness model. Appendix C summarizes the scoring system and revisions to FNAIHAB-CLIP for version 4.0.

Priority Natural Communities. This data layer was originally created by FNAI specifically for the Florida Forever statewide environmental land acquisition program. It is intended to map high priority natural communities that are under-represented on existing conservation lands. FNAI mapped the statewide range of 14 natural community types: upland glades, pine rocklands, seepage slopes, scrub, sandhill, sandhill upland lakes, upland pine, tropical hardwood hammock, upland hardwood forest, pine flatwoods, dry prairie, coastal uplands, coastal lakes, and coastal wetlands (FNAI 2015).

CLIP Priority Natural Communities are a subset of FFCNA Natural Communities Decision Support Data version 4.1, which is primarily based on the Cooperative Land Cover (CLC) map developed by FNAI in consultation with FWC (FWC 2015). Each natural community type has been prioritized into up to three priority classes (Very High, High, and Moderate) based on landscape integrity, as described in Appendix D. The natural communities are mutually exclusive types (any given location can be classed as only one community type), so there is no overlay model of the communities. For the CLIP analysis, the natural communities are prioritized by Global rarity rank (G-rank) as well as landscape integrity class.

Landscape Resource Category

The Landscape Resource Category is comprised of the Florida Ecological Greenways Network and Landscape Integrity layers. The category is intended to identify landscape-scale areas that are important for protecting species sensitive to habitat fragmentation, functional ecosystems, and important ecosystem services.

Florida Ecological Greenways Network. The Florida Ecological Greenways Network (FEGN) model was created by the University of Florida Geoplan Center to delineate the ecological component of a Statewide Greenways System plan developed by the DEP Office of Greenways and Trails (OGT), under guidance from the Florida Greenways Coordinating Council and the Florida Greenways and Trails Council. This plan guides OGT land acquisition and conservation efforts, and promotes public awareness of the need for and benefits of a statewide ecological network. It is also used as the primary data layer to inform the Florida Forever conservation land acquisition program regarding the location of the most important conservation corridors and large, intact landscapes in the state.

This data layer is intended to represent a statewide network of ecological hubs and linkages designed to maintain large landscape-scale ecological functions including focal species habitat and ecosystem services throughout the state (Hoctor et al. 2000). The FEGN is prioritized by assigning individual corridors to five priority classes, based on contribution to the statewide ecological network. The highest priorities were identified as the areas that were most suitable for facilitating functional ecological connectivity in a statewide network connecting major conservation lands from the Everglades in south Florida north to the Georgia border and west to the tip of the Florida panhandle. The top priority corridors are called Critical Linkages, which are considered most important for implementing the Florida Ecological Greenways Network by providing the largest and potentially most functional connected landscapes across the state (Hoctor et al. 2005). Full details on the latest version of the FEGN are available on the University of Florida Center for Landscape Conservation Planning website (http://conservation.dcp.ufl.edu/FEGN.html).

Landscape Integrity Index. The Landscape Integrity Index (LSI) was developed by the UF Center for Landscape Conservation Planning and GeoPlan Center, specifically for CLIP. It is comprised of two related landscape indices assessing ecological integrity based on land use intensity and patch size of natural communities and semi-natural land uses. The Landscape Integrity Index was originally developed as part of the CLIP version 2.0 TAG process after discussion about the need for an additional landscape layer that identified areas of high ecological integrity based on land use intensity and patch size, where areas dominated by large patches of natural and semi-natural land use are assigned the highest significance. Note that this index is intended to primarily characterize terrestrial ecosystems and therefore values for large water bodies are not considered relevant.

The *Land Use Intensity Index* (LUI) assesses the intensity of land use within landscapes statewide based on five general categories of land cover/land use: natural, semi-natural, improved pasture, agricultural/low-intensity development, and high intensity development. The assumption is that areas dominated by high intensity land uses are more likely to have severe ecological threats and much lower ecological integrity than areas dominated by natural land cover. For CLIP 4.0, the land use data used is from the 2015 Cooperative Land Cover (CLC) data set, version 3.1, within Florida and Southeastern GAP land cover data for a buffer area in Alabama and Georgia. The land use intensity analysis was conducted by giving each land use intensity category a rank and conducting a shifting window (or neighborhood) analysis at 3 different scales: approximately 10 acres; approximately 100 acres; and approximately 1000 acres. The three different scales were used to address the fact that many species and ecological processes operate at different scales. The analysis creates an output where all of the land use intensity values within each neighborhood are summed and then reclassified to create a land use intensity index with ranks of 1-10 (where 10 equals lowest land use intensity) for each of the three scales. Each of the three scales are then combined using a weighted average where the two larger scales were given an equal weight and the smallest scale was given half the weight of the larger scales to create the final Land Use Intensity Index.

The *Patch Size Index* (PSI) combines the land use data with major roads data to identify contiguous patches of natural and semi-natural land cover and ranks them based on area. In addition all pasturelands within the south-central prairies region were also considered "intact" and potentially part of patches. This region was defined by delineating a 10km buffer around the grassland ecosystem areas in central and southwest Florida identified in the Davis Potential Natural Vegetation map for Florida, the historical extent of dry prairie from FNAI, and all known existing dry prairie occurrences from FNAI. Major roads were defined as all roads that have 4 or more through lanes or roads with average annual daily traffic of 5,000 or more vehicles per day. These roads were selected because they are considered to be the most likely to fragment habitat through a combination of road width and traffic level. Patches are identified as contiguous areas of suitable land cover not fragmented by large roads, more intensive land uses, or large or wide water bodies. Open water is not included when identifying patches or determining patch area because the Patch Size Index is intended to characterize the ecological integrity of terrestrial (including wetlands) ecosystems. The assumption is that small patches are likely to have the highest threat and lowest ecological integrity and large patches are likely to have the lowest threat and highest ecological integrity. The following scheme was used to rank patches based on area:

Patch Score	**Patch Size** (acres)
1	<10
2	10-99
3	100-999
4	1,000-4,999
5	5,000-9,999
6	10,000-49,999
7	50,000-99,999
8	100,000-499,999
9	500,000-999,999
10	1million+

The combination of the Land Use Intensity and Patch Size Indices was created by adding the two together and dividing by two to create a non-weighted average of the two indices. Values of 10 represent areas with the highest potential ecological integrity based on these landscape indices and 1 represents the lowest ecological integrity. Areas with index values of 7-10 have higher potential ecological integrity; areas with values of 5-6 have moderate ecological integrity (also includes large water bodies); areas with values of 2-4 have moderately low ecological integrity; and areas with value 1 are typically urban areas with little to no ecological integrity.

Surface Water Resource Category

The Surface Water Resource Category is comprised of the Significant Surface Waters, Natural Floodplain, and Wetlands layers. The category is intended to identify areas important for protecting surface water resources, especially the integrity of remaining high quality systems. The category is not intended to directly address priorities for restoration of degraded aquatic resources.

Significant Surface Waters. This data layer was originally created by FNAI, in consultation with state water resource experts, specifically for the Florida Forever statewide environmental land acquisition program (FNAI 2015). It is intended to show areas that have statewide significance for the purpose of land acquisition to protect significant surface waters with good water quality. This data layer is not intended to address surface waters with substantial restoration needs, only surface waters that are currently in a relatively natural condition and are a priority for protecting Florida's water resources.

The Significant Surface Waters model is a combination of seven water resource submodels: Special Outstanding Florida Water (OFW) rivers as defined by DEP, Other OFWs (on conservation lands), OFW lakes and Aquatic Preserves, coastal surface waters, the Florida Keys, springs, and rare fish basins. For each resource category, drainage basins that contributed to the resource were selected and buffers to water bodies applied. The final model was grouped into seven priority classes (see Appendix A for details). Note: the CLIP 4.0 Surface Waters layer corresponds to FFCNA Significant Surface Waters version 4.1.

Natural Floodplain. Like the Surface Waters model, the Natural Floodplain data layer was created by FNAI, in consultation with state water resource experts, specifically for the Florida Forever statewide environmental land acquisition program (FNAI 2015). It is intended to show areas that have statewide significance for land acquisition to protect natural floodplain.

This model focuses on FEMA 100-year floodplain statewide, based on the latest D-FIRM floodplain maps where available. For areas with no existing digital FEMA data (Jefferson and Okeechobee Counties; areas around Everglades in south Florida), a surrogate for 100-year floodplain was created using soils and wetlands data. The resulting data set was prioritized into six classes using the same method developed for prioritizing the Wetlands data layer (see Appendix A), based on the UF Land Use Intensity Index (LUI) and FNAI Potential Natural Areas (PNAs). The FNAI PNA data layer represents areas of intact natural vegetation as determined by interpretation of aerial photography (FNAI 2015). Note: the CLIP 4.0 Floodplain layer corresponds to FFCNA Natural Floodplain version 4.1.

Wetlands. The Wetlands data layer used for the CLIP analysis was developed by FNAI specifically for the Florida Forever statewide environmental land acquisition program (FNAI 2015). Wetlands were identified based on the Cooperative Land Cover Map version 3.1 (FWC 2015). Wetlands are prioritized based on the CLIP Land Use Intensity Index (see Landscape Integrity Index above) and FNAI Potential Natural into six priority classes. Note: the CLIP 4.0 Wetlands layer corresponds to FFCNA Functional Wetlands version 4.1.

Ground Water Resource Category

This category complements the Surface Water Resource Category by identifying conservation priorities for the protection of Florida's groundwater systems, including the Floridan, Intermediate, and Surficial Aquifer systems.

Aquifer Recharge. The Aquifer Recharge data layer was developed by Advanced Geospatial, Inc. (AGI) under subcontract to FNAI for use in the Florida Forever Conservation Needs Assessment as well as CLIP (FNAI 2015). Input data layers for the model were consistent with those used in the Florida Aquifer Vulnerability Assessment (FAVA) developed by the Florida Geological Survey and consisted of soil hydraulic conductivity, proximity to karst features, depth to water, and overburden. AGI combined the layers in a logical fashion based on observations derived from the FAVA model (AGI 2009).

The Aquifer Recharge model is prioritized into six classes based on recharge potential from the AGI model, as well as areas within Springs Protection Areas and in proximity to swallets and public water supply wells.

Marine Resource Category

The Marine Resource Category is comprised of ten core data layers involving marine habitats and focal species. These data layers were selected during consultation in 2009 with marine resource experts, primarily from the FWC Fish and Wildlife Research Institute (FWRI). The group agreed to focus on data for several priority marine habitats and species groups, including seagrass, corals/hardbottom, oyster reefs, worm reefs, manatee habitat, right whale habitat, sea turtle nesting habitat, scallop habitat, and sturgeon habitat. Unlike terrestrial data, these data layers are generally not considered comprehensive, but represent known locations only. Comprehensive survey work on marine resources lags behind that for terrestrial resources, primarily due to the large expanse of Florida's marine surroundings, and difficulties mapping these resources.

Nevertheless, marine resources are a vital component of Florida's natural heritage. Florida has the most coastal shoreline of any other state within the contiguous United States (Livingston 1990). Florida’s coastlines, including sandy beaches, help draw visitors to our state. Natural vegetated coastlines, including intertidal wetlands, also provide protection from storms, filter storm water, and provide nurseries for a multitude of economically-important recreational and commercial fishery species. These coastal resources, together with other marine habitats such as reefs and seagrasses, help support a diversity of marine life that is truly unique to Florida. A vision of Florida in 25 to 50 years would not be complete without considering the future condition of these coastal and marine ecosystems. The health of these ecosystems is closely linked with coastal land use practices (FWC 2005). Many of these coastal resources (clean sandy beaches, productive waters) provide boating, fishing, and nature viewing opportunities. At the same time, many of these coastal resources are under considerable pressure by development and are threatened by sea level rise due to climate change. Clearly, these resources need to be considered in our vision for the future to not only preserve our marine wildlife, but also to protect a large proportion of the state's tourism-based economy.

A comprehensive review of the marine resources included in the CLIP database is found in the CLIP version 2.0 Technical Report (Oetting, Hoctor & Stys 2012).

CLIP Resource Priority Models

CLIP version 4.0 is still based on an expert rules-based system developed in previous versions of CLIP, as described briefly here:

Biodiversity Resource Priorities. The following rules are used to assign core data layers from the Biodiversity Resource Category into the resource priorities model. Locations that meet multiple criteria are assigned to the highest eligible priority class.

- Priority 1: SHCA P1; Vertebrate Habitat Richness 8-13 spp.; FNAIHAB P1-2; or Nat. Com. G1-G3 Very High or High.
- Priority 2: SHCA P2; Hab. Richness 7 spp.; FNAIHAB P3; or Nat. Com. G1-G3 Medium, G4 Very High or High.
- Priority 3: SHCA P3-4; Hab. Richness 5-6 spp.; FNAIHAB P4; or Nat. Com. G4 Medium, G5 Very High or High.
- Priority 4: SHCA P5; Hab. Richness 2-4 spp.; FNAIHAB P5-6; or Nat. Com. G5 Medium.
- Priority 5: Hab. Richness 1 species.

Landscape Resource Priorities. The following rules are used to assign core data layers from the Landscape Resource Category into the resource priorities model. Locations that meet multiple criteria are assigned to the highest eligible priority class. Note that Greenways rules have changed from CLIP v3.0, since the Greenways core data layer was revised from six priority classes to five.

- Priority 1: Greenways Critical Linkages (P1).
- Priority 2: Landscape Integrity 10.
- Priority 3: Greenways P2-3; or Landscape Integrity 9.
- Priority 4: Greenways P4-5; or Landscape Integrity 7-8.
- Priority 5: Landscape Integrity 6.

Surface Water Resource Priorities. The following rules are used to assign core data layers from the Landscape Resource Category into the resource priorities model. Locations that meet multiple criteria are assigned to the highest eligible priority class.

- Priority 1: Surface Water P1; Floodplain P1; or Wetlands P1.
- Priority 2: Surface Water P2; Floodplain P2; or Wetlands P2.
- Priority 3: Surface Water P3; Floodplain P3; or Wetlands P3.
- Priority 4: Surface Water P4-5; Floodplain P4; or Wetlands P4.
- Priority 5: Surface Water P6-7; Floodplain P5-6; or Wetlands P5-6.

Aggregated CLIP Resource Priorities. The following rules are used to assign priorities from the three Resource Priority models into the Aggregated CLIP priorities model. Locations that meet multiple criteria are assigned to the highest eligible priority class.

- Priority 1: Biodiversity P1; Landscape P1; or Surface Water P1; Biodiversity, Landscape, AND Surface Water P2.
- Priority 2: Biodiversity P2; Landscape P2; or Surface Water P2; Biodiversity, Landscape, AND Surface Water P3.
- Priority 3: Biodiversity P3; Landscape P3; or Surface Water P3.
- Priority 4: Biodiversity P4; Landscape P4; or Surface Water P4.
- Priority 5: Biodiversity P5; Landscape P5; or Surface Water P5.

CLIP VERSION 4.0 UPDATES

This section highlights changes in CLIP 4.0 from the previous version 3.0 released in 2014. While CLIP version 4.0 may be thought of as an incremental update, there are still substantial changes to core data layers, resource priority models, and additional analyses that support the database. Table 1 below summarizes the changes:

CLIP Data	4.0 Update	Notes
Core Data Layers		
Strategic Habitat Conservation Areas	YES	Species priorities updates; CLC v3.1 developed lands removed
Potential Habitat Richness	no	CLC v3.1 developed lands removed
Rare Species Habitat Conservation Priorities	no	SLR alternate version completed
Priority Natural Communities	YES	Updated based on latest field mapping and CLC v3.1
Florida Ecological Greenways Network	YES	SLR Re-prioritization and combined priority classes
Landscape Integrity Index	YES	Revised with CLC v3.1 land cover
Significant Surface Waters	YES	Major revision to south FL canals etc.
Natural Floodplain	YES	Revised with CLC v3.1 land cover
Wetlands	YES	Revised with CLC v3.1 land cover
Recharge	YES	Included swallets in prioritization per FGS
Resource Priority Models		
Biodiversity Resource Priorities	YES	Revised based on core data layer updates
Landscape Resource Priorities	YES	Revised based on core data layer updates
Surface Water Resource Priorities	YES	Revised based on core data layer updates
Aggregated CLIP Priorities	YES	Revised based on Resource Priority Model updates

Table 1. Summary of changes to CLIP database from version 3.0 to version 4.0.

Developed Lands Update. For CLIP data layers that have not undergone major revisions since CLIP 3.0, we wanted to account for recent development on lands included as resource priorities. We therefore selected developed lands from the latest land cover data (CLC version 3.1) and removed it from the Strategic Habitat Conservation Areas and Vertebrate Potential Habitat Richness layers. This modification was not made to the core data layers in the official CLIP 4.0 database, but only to temporary input layers used to build the CLIP Resource Priority models. This approach maintains equivalence between those CLIP core data layers and their original source models.

Surface Water Restoration Resource Category. A major goal for the CLIP 4.0 update was to complete a new Surface Water Restoration Resource Category to complement the existing Resource Categories. Extensive analysis has been completed as summarized below and detailed in Appendix F, however the work has not yet achieved consensus approval from the CLIP Water TAG, so is not yet considered a full Resource Category as part of the CLIP 4.0 database.

Core Data Layer Updates

Strategic Habitat Conservation Areas. For CLIP purposes, SHCA's have been prioritized by species, based on heritage global and state rarity ranks (see Appendix A). Since the latest SHCA revision was completed in 2009, five species have undergone rank changes by the Florida Natural Areas Inventory, changing the groups of species included in each SHCA priority class. This has resulted in modest changes in acreages within each priority class (table 2).

Strategic Habitat Conservation Areas

CLIP 3.0		Conservation	CLIP 4.0		Conservation
Priority	Acres	Land	Priority	Acres	Land
Priority 1	1,442,630	61%	Priority 1	1,460,226	62%
Priority 2	11,525,583	68%	Priority 2	10,628,008	68%
Priority 3	4,124,072	21%	Priority 3	4,840,876	28%
Priority 4	80,752	31%	Priority 4	86,115	43%
Priority 5	1,098,867	10%	Priority 5	1,130,825	11%
	18,271,903	53%		18,146,051	53%

Table 2. Acreage comparison of Strategic Habitat Conservation Areas, CLIP 3.0 vs. CLIP 4.0.

Priority Natural Communities. The natural community core data layer was updated based on the latest land cover data (CLC version 3.1). Note that the majority of acres were classed as Very High landscape condition/priority (table 3). This is expected as modeling was generally restricted to intact natural communities with no more than moderate degradation/impact due to human land use.

Priority Natural Communities

Community	Global Rank	Priority	CLIP 3.0 Acres	CLIP 3.0 Conservation Land	CLIP 4.0 Acres	CLIP 4.0 Conservation Land
Upland Glade	G1	Very High	37	9%	37	8%
Pine Rockland	G1	Very High	14,650	98%	16,841	95%
		High	2,092	73%	10	82%
Scrub	G2	Very High	500,081	75%	461,894	76%
(includes some Scrubby Flatwoods)		High	18,612	18%	22,788	18%
		Moderate	6,726	13%	4,839	15%
Tropical (Rockland) Hammock	G2	Very High	18,233	86%	18,091	88%
		High	811	45%	757	53%
		Moderate	279	78%	258	86%
Dry Prairie	G2	Very High	150,005	63%	147,673	67%
		High	6,108	13%	7,829	18%
		Moderate	226	11%	72	38%
Seepage Slope	G2	Very High	6,382	100%	6,222	100%
		High	15	100%	0	
Imperiled Coastal Lakes	G2	Very High	1,368	38%	1,368	38%
		High	120	0%	120	0%
		Moderate	18	0%	18	0%
Coastal Uplands	G3	Very High	47,457	87%	53,888	85%
		High	2,635	46%	2,380	41%
		Moderate	189	17%	44	36%
Sandhill	G3	Very High	773,401	64%	682,905	68%
		High	43,448	26%	81,803	21%
		Moderate	8,161	20%	8,322	17%
Sandhill Upland Lakes	G3	Very High	56,364	24%	56,403	24%
		High	12,131	1%	12,131	1%
		Moderate	2,573	1%	2,573	1%
Upland Pine	G3	Very High	164,614	92%	162,066	93%
		High	3,028	36%	5,266	52%
		Moderate	544	7%	869	17%
Pine Flatwoods	G4	Very High	2,050,739	56%	1,992,295	59%
		High	213,132	12%	291,129	14%
		Moderate	67,458	7%	53,314	8%
Upland Hardwood Forest	G5	Very High	263,649	14%	127,676	30%
		High	126,947	1%	92,799	2%
		Moderate	31,697	1%	10,022	4%
Coastal Wetlands	G5	Very High	956,572	86%	963,350	86%
(Mangrove and Salt Marsh)		High	25,264	38%	30,256	41%
		Moderate	8,153	18%	6,418	22%
Total			5,583,918	59%	5,324,727	62%

Table 3. Acreage comparison of Priority Natural Communities, CLIP 3.0 vs. CLIP 4.0.

Florida Ecological Greenways Network. As part of the CLIP 4.0 updates there were major revisions to the priorities in the Florida Ecological Greenways Network (FEGN), in an effort to follow recommendations to continue work discussed in the report for the 2013 update of the FEGN (Hoctor et al. 2013).

There were three primary goals for updating the priorities in the Florida Ecological Greenways Network (FEGN):

1) Addressing potential impacts to FEGN high priorities (Priority 1 Critical Linkages and Priority 2) by up to a projected 3m sea level rise (SLR);

2) Elevating the priority of FEGN corridors that could functionally link Florida conservation lands to other states;

3) Conducting boundary edits to lower priority areas that are not essential for completing higher priority corridors (P1-P5), and consideration of additional areas either within the FEGN or not currently within the FEGN that may be relevant for ensuring the functionality of higher priority corridors within the FEGN.

Full details of the FEGN revisions are found in Appendix E. These collective priority updates resulted in significantly wider Critical Linkages in the Big Bend region, the middle St. Johns River, and in the Econfina Creek area north of Panama City. In addition, there were significant additions to Priority 2 corridors, with the elevation of most riverine corridors in north Florida that connect the FEGN to conservation lands and other ecologically significant areas in Alabama and Georgia (Figure 2). These revisions led to increases in areas included in higher FEGN priorities (table 4), but these increases are intended to provide better opportunities to avoid impacts from sea level rise, more functional corridor widths, address the need for functional connectivity to other states, and better reflect the areas that should be considered high priorities for corridor protection statewide. The new CLIP 4.0 FEGN accomplishes these goals.

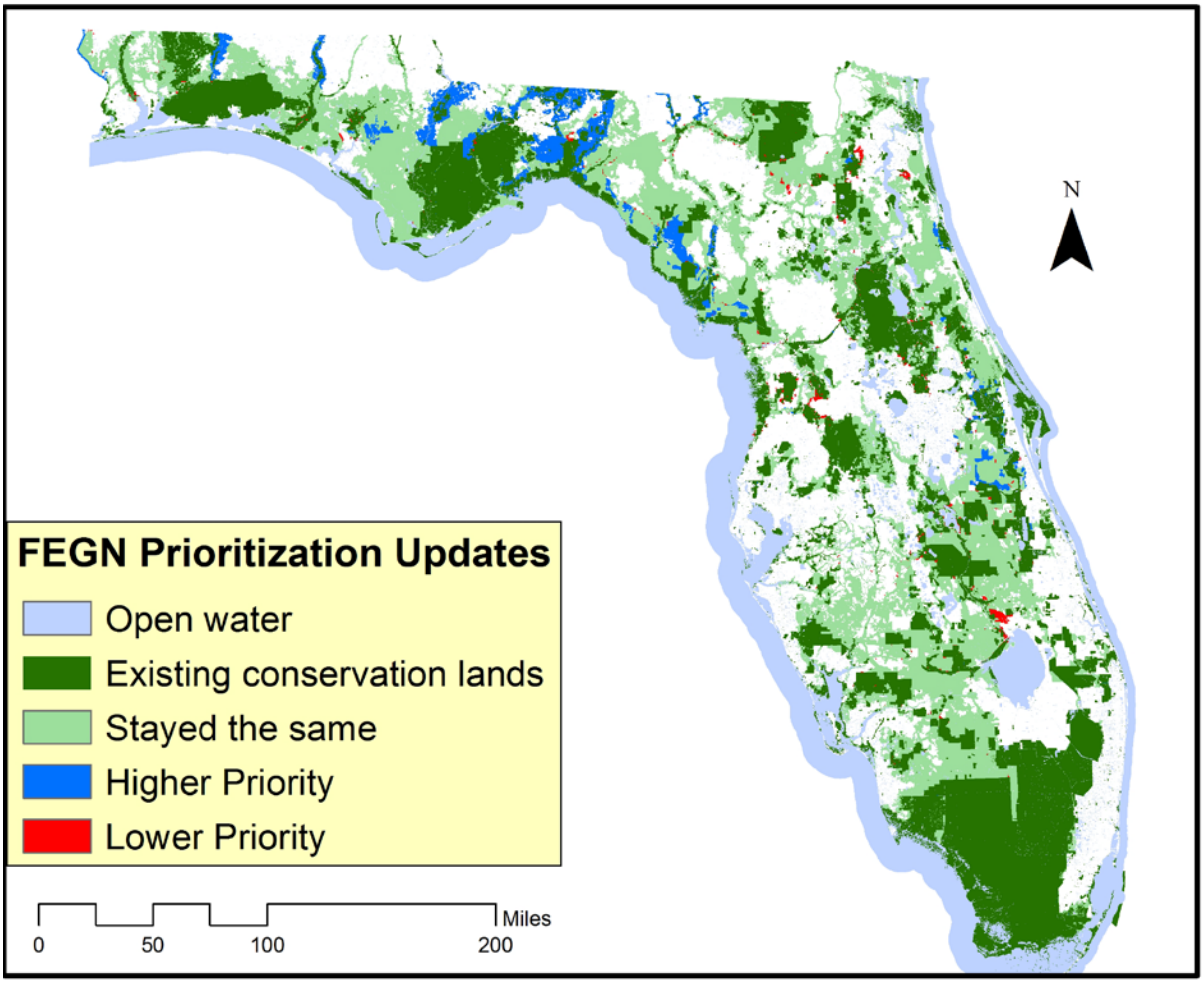

Figure 2. Comparison of the 2013 FEGN priorities (CLIP v3.0) with the new CLIP v4.0 priorities.

As a result of the shifts in corridor priorities, few acres remained in the former Priority 5 class, so this was merged into Priority 4 and the total number of classes was reduced from six to five.

Florida Ecological Greenways Network

CLIP 3.0		Conservation	**CLIP 3=4.0**		Conservation
Priority	Acres	Land	Priority	Acres	Land
Critical Linkages (P1)	10,567,176	70%	Critical Linkages (P1)	11,629,918	71%
Priority 2	4,236,146	27%	Priority 2	5,102,507	30%
Priority 3	1,199,159	25%	Priority 3	1,239,939	25%
Priority 4	981,370	24%	Priority 4	1,526,260	29%
Priority 5	1,075,838	25%			
Priority 6	3,288,063	18%	Priority 5	3,585,113	25%
	21,347,752	46%		23,083,736	49%

Table 4. Acreage comparison of Ecological Greenways Network, CLIP 3.0 vs. CLIP 4.0.

Landscape Integrity Index. There are no changes to the methodology of the LSI for CLIP 4.0, but the model has been updated using the latest land cover data (CLC version 3.1). Acreage changes are modest, with an increase of about 700,000 acres in the highest integrity value of 10 and a reduction of about 600,000 acres in value 9 (table 5).

Landscape Integrity Index (land area only)

	CLIP 3.0 Acres	Conservation Land	**CLIP 4.0** Acres	Conservation Land
LSI 10 (highest)	3,247,529	92%	3,959,128	90%
LSI 9	8,332,665	47%	7,718,473	42%
LSI 8	7,361,250	24%	7,404,425	26%
LSI 7	3,697,190	20%	3,757,512	22%
LSI 6	1,384,925	17%	1,331,175	18%
LSI 5	874,654	18%	967,045	19%
LSI 4	1,905,380	8%	1,564,179	8%
LSI 3	3,114,455	4%	3,888,221	4%
LSI 2	3,257,558	4%	3,316,696	3%
LSI 1 (lowest)	1,750,859	1%	1,169,199	3%
Total	34,926,465	29%	35,076,053	30%

Table 5. Acreage comparison of Landscape Integrity Index, CLIP 3.0 vs. CLIP 4.0.

Significant Surface Waters. The primary purpose of this update was to remove the influence of artificial canals from certain areas of the state, primarily South Florida WMD and the St. Johns River headwaters region, areas with very flat topography and extensive canal networks. In the past these canals were buffered like natural water bodies, implying that water flowed into them from surrounding areas and contributed to significant surface waters downstream. We know that's typically not true for canals in the south Florida / upper St. Johns regions. These canals are designed to drain off or transfer water between certain areas not necessarily adjacent to the entire length of the canal (many canals are lined with dikes that would prevent such runoff). In addition, many of these areas experience sheet-flow during rainfall events that is not reflected in the canal buffering. These issues were raised by public commenters during the review/outreach phase of early CLIP and Cooperative Conservation Blueprint efforts.

There are a total of eight sub-models included in the Surface Waters model. Only three of those sub-models – "Coastal", "Other OFWs", and "Water Supply" – include the canals in question, so only those three sub-models were completely rebuilt. The other five sub-models – "special OFW Rivers", "Keys", "Springs", "Rare Fish Basins", and "OFW Lakes & Inland Aquatic Preserves", remain unchanged, although their basin proximity scores were revised as noted below.

The new method eliminated canals and other artificial waterways from consideration in the Update Zone. Only natural stream systems were buffered by 1,000 feet and 1 mile. Natural waterbody polygons intersecting these stream systems were buffered as well. In addition, natural wetland polygons intersecting the stream systems were also selected. During review, experts also recommended revising the scoring of basin proximity, effectively "flattening" the influence of proximity on the overall score. More details on these revisions are found in FNAI (2015). These revisions resulted in a significant increase in Priority 1 (land only) of about 1.7 million acres, with a corresponding reduction in Priority 2 of about 1.7 million acres (Figure 3, Table 6).

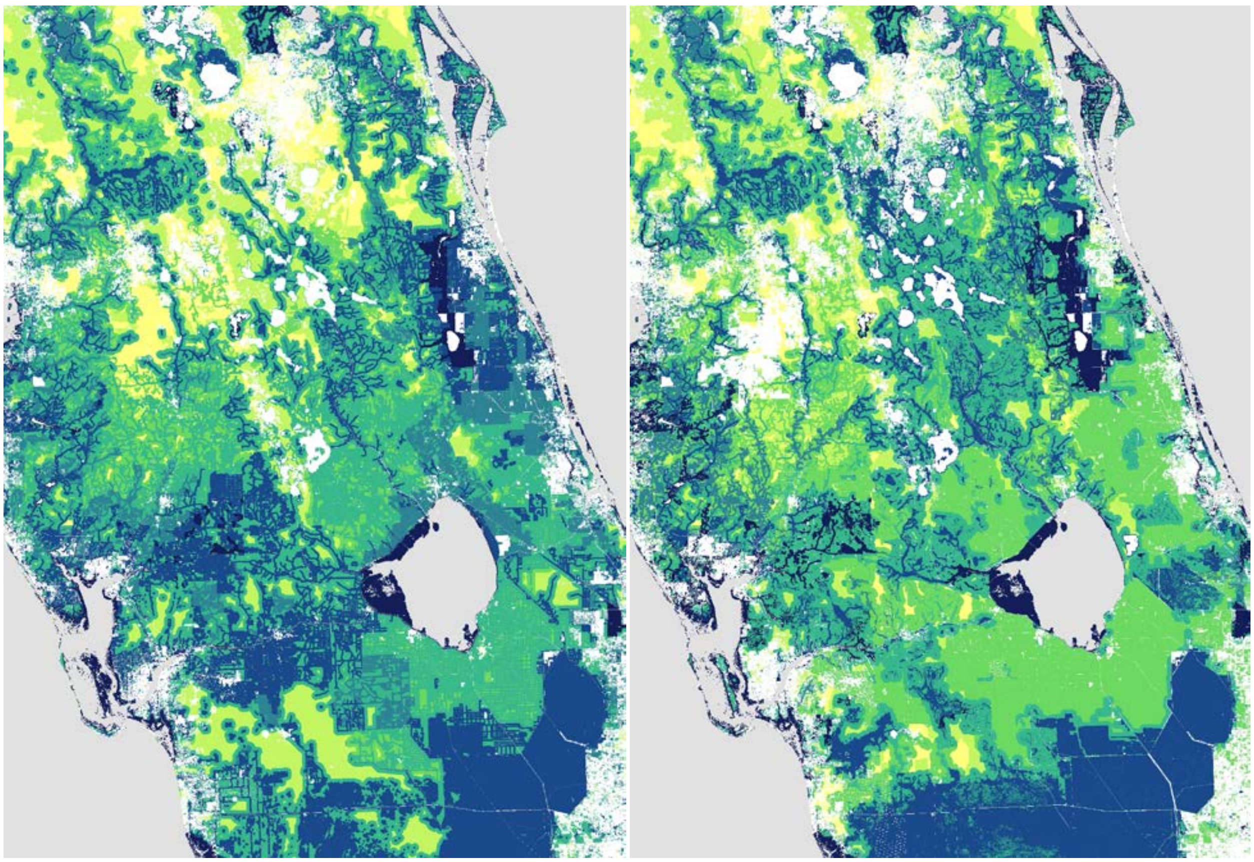

Figure 3. Region of primary revisions to Surface Waters, CLIP 3.0 (left) vs. CLIP 4.0 (right).

Surface Waters

	CLIP 3.0			CLIP 4.0		
	Total Acres	Land Area Acres	Conservation Land	Total Acres	Land Area Acres	Conservation Land
Priority 1	6,075,392	1,202,552	63%	7,825,215	2,933,650	55%
Priority 2	7,823,233	7,214,134	60%	5,904,418	5,476,515	71%
Priority 3	2,355,516	2,276,963	20%	1,907,445	1,879,510	26%
Priority 4	11,477,563	11,195,175	30%	8,603,427	8,559,872	34%
Priority 5	2,064,749	2,038,001	11%	5,522,092	5,494,991	9%
Priority 6	4,898,922	4,623,393	19%	4,414,824	4,398,220	16%
Priority 7	2,459,536	2,418,841	5%	1,934,492	1,918,534	5%
Total	37,154,912	30,969,059	33%	36,111,913	30,661,292	33%

Table 6. Acreage comparison of Significant Surface Waters, CLIP 3.0 vs. CLIP 4.0.

Natural Floodplain. The CLIP 4.0 Natural Floodplain model is a moderate revision from the previous version, based on the latest Cooperative Land Cover version 3.1 and the updated Landscape Integrity Index, used in scoring floodplain and wetlands. Acreage changes are modest, with a reduction of about 550,000 acres in Priority 1 and an increase of about 200,000 acres in Priority 2 (table 7).

Natural Floodplain

	CLIP 3.0 Acres	Conservation Land	**CLIP 4.0** Acres	Conservation Land
Priority 1	5,284,762	89%	4,733,894	90%
Priority 2	2,198,740	51%	2,400,303	60%
Priority 3	2,771,075	25%	2,734,910	30%
Priority 4	2,376,188	11%	2,779,588	11%
Priority 5	683,489	8%	877,139	11%
Priority 6	1,803,275	8%	1,457,442	7%
Total	15,117,529	46%	14,983,278	47%

Table 7. Acreage comparison of Natural Floodplain, CLIP 3.0 vs. CLIP 4.0.

Wetlands. Like Floodplain, the wetlands data layer has seen no changes in methodology, merely an update based on current land cover (CLC version 3.1) and the Landscape Integrity layer update. Acreage changes from CLIP 3.0 version are fairly modest, with a reduction of about 470,000 acres in Priority 1, and an increase of about 200,000 acres in Priority 2 (table 8).

Wetlands

	CLIP 3.0 Acres	Conservation Land	**CLIP 4.0** Acres	Conservation Land
Priority 1	5,051,382	89%	4,578,837	90%
Priority 2	1,954,968	48%	2,148,569	57%
Priority 3	2,310,350	23%	2,309,538	29%
Priority 4	1,425,481	10%	1,755,080	11%
Priority 5	298,042	6%	368,856	9%
Priority 6	286,426	4%	249,303	5%
Total	11,326,648	54%	11,410,182	55%

Table 8. Acreage comparison of Wetlands, CLIP 3.0 vs. CLIP 4.0.

Resource Category Priority Model Updates

Based on recommendations of CLIP analysts and consensus of the TAG, there are no major methodological changes to the CLIP Priorities models in version 4.0. However, some priority class rules have changed as required by changes in core data layer priority classes, as described below.

Biodiversity Resource Priorities Model. There are no changes to the priority class rules for this model in CLIP version 4.0. Due to only minor changes in the Biodiversity core data layers, acreage in Biodiversity Resource Priorities has changed modestly, with a decrease of about 70,000 acres in Priority 1 and 475,000 acres in Priority 2 (table 9).

Biodiversity Resource Priorities Model

	CLIP 3.0 Acres	Conservation Land	CLIP 4.0 Acres	Conservation Land
Priority 1	5,557,321	67%	5,485,918	68%
Priority 2	9,864,718	55%	9,389,110	56%
Priority 3	5,103,767	11%	5,389,000	17%
Priority 4	5,931,511	4%	5,983,991	4.3%
Priority 5	1,210,967	1%	1,178,565	1.7%
Total	27,668,284	36%	27,426,584	37%

Table 9. Acreage comparison of Biodiversity Resource Priorities, CLIP 3.0 vs. CLIP 4.0.

Landscape Resource Priorities Model. As noted above the latest revision of the Ecological Greenways Network resulted in a reduction of priority classes from six to five. The priority class rules for the CLIP 4.0 Landscape Resource Priorities Model were shifted accordingly, with the result that acreage shifts from CLIP 3.0 are moderate. There is an increase of about 270,000 acres acres in Priority 1, and an increase of about 195,000 acres in Priority 2 (table 10).

Landscape Resource Priorities Model

	CLIP 3.0 Acres	Conservation Land	CLIP 4.0 Acres	Conservation Land
Priority 1	10,497,474	70%	10,768,131	69%
Priority 2	292,605	39%	487,589	44%
Priority 3	8,288,933	22%	7,901,953	23%
Priority 4	5,757,939	12%	6,012,914	14%
Priority 5	704,659	10%	756,355	8%
Total	25,541,610	39%	25,926,942	40%

Table 10. Acreage comparison of Landscape Resource Priorities, CLIP 3.0 vs. CLIP 4.0.

Surface Water Resource Priorities Model. The significant revisions to the Surface Water core data layer have resulted in substantial changes to the overall Surface Waters Resource Priorities model, with about 585,000 acres more in Priority 1 and 1.5 million less in Priority 2 (land acreage only - table 11).

Surface Water Resource Priorities Model

	CLIP 3.0 Land Acres	Conservation Land	CLIP 4.0 Land Acres	Conservation Land
Priority 1	6,075,339	85%	6,661,334	76%
Priority 2	5,737,077	37%	4,187,284	49%
Priority 3	3,991,973	16%	3,470,770	21%
Priority 4	10,355,909	16%	11,855,298	16%
Priority 5	4,952,828	10%	4,528,252	10%
Total	31,113,127	32%	30,702,938	33%

Table 11. Acreage comparison of Surface Water Resource Priorities, CLIP 3.0 vs. CLIP 4.0.

Aggregated CLIP Priorities Model Update

Aggregated CLIP prioritization rules are unchanged from version 3.0. Overall, CLIP version 4.0 identifies about 110,000 more acres (land only) total and about 820,000 more in the top priority class. When viewing Priorities 1 and 2 together, there are about 480,000 fewer acres in version 4.0, with about 625,000 fewer acres on private lands (table 12).

Version 4.0

	Total Acres	Land	Conservation Lands	Private Lands
Priority 1	19,571,080	14,511,076	8,824,698	5,686,377
Priority 2	5,461,015	5,047,332	1,242,761	3,804,572
Priority 3	5,258,741	5,172,639	226,806	4,945,833
Priority 4	6,106,599	5,971,597	128,149	5,843,448
Priority 5	1,051,981	987,991	1,513	986,478
Total	37,449,416	31,690,635	10,423,927	21,266,708
Priority 1-2	25,032,096	19,558,408	10,067,459	9,490,949

Version 3.0

	Total Acres	Land	Conservation Lands	Private Lands
Priority 1	17,940,948	13,693,818	8,624,316	5,069,502
Priority 2	6,802,953	6,348,770	1,302,373	5,046,398
Priority 3	5,345,379	5,246,655	143,406	5,103,249
Priority 4	5,439,711	5,174,897	68,609	5,106,289
Priority 5	1,365,779	1,115,461	4,809	1,110,652
Total	36,894,769	31,579,602	10,143,512	21,436,089
Priority 1-2	24,743,901	20,042,588	9,926,689	10,115,899

Table 12. Acreage comparison of CLIP Aggregated Priorities, CLIP 3.0 vs. CLIP 4.0.

Contribution of individual Resource Category Priority models to the overall CLIP priorities shows little change from CLIP version 4.0 (table 13). Considering Priority 1 only, about half the area meets P1 criteria from more than one Resource Category. The Landscapes Category accounts for the most area of any single category at 31 percent. Overlay promotion rules add very little to the result. Considering Priorities 1 and 2 together shows a more balanced contribution, with 62 percent contributed by multiple criteria, and individual category contributions ranging from 8 to 19 percent. Note that the Landscapes Category contains a large amount of acreage in Priority 1 (much of which does not overlap with Biodiversity or Surface Water priorities) and relatively little in Priority 2 (table 10), accounting for the difference in contribution of Landscapes between P1 only and P1-2 combined.

Contribution of Resource Category Priorities to Aggregated CLIP Priorities
(land area only, water excluded)

CLIP Priority 1 Only:

CLIP Criteria Met By:	CLIP 1.0 % of P1	CLIP 2.0 % of P1	CLIP 3.0 % of P1	CLIP 4.0 % of P1
Multiple resource categories	56%	45%	48%	45%
Biodiversity Resource Category only	24%	11%	11%	10%
Landscapes Resource Category only	11%	32%	31%	31%
Surface Water Resource Category only	8%	12%	10%	13%
Overlay promotion rules	1.4%	0.8%	0.2%	0.5%

CLIP Priorities 1-2:

CLIP Criteria Met By:	CLIP 1.0 % of P1-2	CLIP 2.0 % of P1-2	CLIP 3.0 % of P1-2	CLIP 4.0 % of P1-2
Multiple resource categories	58%	60%	61%	62%
Biodiversity Resource Category only	20%	20%	19%	19%
Landscapes Resource Category only	6%	6%	6%	8%
Surface Water Resource Category only	15%	13%	12%	10%
Overlay promotion rules	1.3%	1.7%	2%	1.9%

Table 13. Contribution of Resource Priorities models to CLIP Aggregated Priorities.

We can drill down further and examine how individual core data layers are contributing to overall CLIP priorities. Here we will look only at CLIP Priority 1 for simplicity (table 14). CLIP version 4.0 shows a slight decrease in the area contributed by multiple core data layers (from 55% to 52%, about 64,000 acres). Surface Waters has increased considerably from 2.7% to 7% (about 670,000 acres). Of all core data layers, Greenways continues to contribute the most area to overall CLIP priorities.

How Are Core Data Layers Contributing to CLIP P1?
(land area only, water excluded)

CLIP version 4.0

CLIP P1 Criteria Met by:	Acres	% of P1
Multiple core layers	7,480,726	52%
Greenways P1 only	4,560,203	31%
Surface Water P1 only	1,034,777	7%
Natural Communities P1 only	478,328	3.3%
FNAIHAB P1-2 only	387,723	2.7%
SHCA Priority 1 only	250,389	1.7%
Biodiversity Hotspots 8-13 spp. only	116,346	0.8%
Overlay promotion (P2 for all 3 resource cats)	71,673	0.5%
Floodplain P1 only	69,834	0.5%
Wetlands P1 only	61,075	0.4%
total	14,511,076	

CLIP version 3.0

CLIP P1 Criteria Met by:	Acres	% of P1
Multiple core layers	7,544,559	55%
Greenways P1 only	4,296,016	31%
Natural Communities P1 only	510,323	3.7%
FNAIHAB P1-2 only	398,745	2.9%
Surface Water P1 only	365,296	2.7%
SHCA Priority 1 only	253,218	1.8%
Biodiversity Hotspots 8-13 spp. only	119,485	0.9%
Floodplain P1 only	95,920	0.7%
Wetlands P1 only	77,917	0.6%
Overlay promotion (P2 for all 3 resource cats)	32,339	0.2%
total	13,693,818	

Table 14. Contribution of core data layers to CLIP Priority 1.

ADDITIONAL CLIP ANALYSES

In addition to the CLIP version 4.0 database outlined above, we continue to pursue additional analyses based on CLIP data. These analyses aim to enhance the applicability of CLIP to a broader range of conservation planning issues. Ultimately some may be incorporated back into the CLIP database, while others will remain adjunct analyses.

Rare Species Habitat Conservation Priorities – Sea Level Rise

As part of the CLIP team's efforts to assess potential impacts from climate change and sea level rise on statewide conservation priorities (also discussed in the context of the greenways network update above), we developed an alternative weighting scenario for the FNAI Rare Species Habitat Conservation Priorities ("FNAIHAB") Core Data Layer.

In this alternative scenario, species were weighted in part based on a sea level rise vulnerability assessment known as "SIVVA", developed by a team assessing statewide species vulnerability to climate change and sea level rise (Reece et al. 2013). As part of the SIVVA assessment, 300 species were scored for vulnerability to sea level rise. Of those, 97 are also among the 281 species included in the FNAIHAB conservation priorities model. For those 97 species, weighting scores were based on a weighted average of the Vulnerability (2/3) and Adaptive Capacity (1/3) SIVVA modules. The remaining FNAIHAB species were assumed to have neutral vulnerability to sea level rise (Table 15).

GRANK	Points
G1	1200
G2T1	1080
G3T1	936
G4T1	720
G5T1	372
G2	400
G3T2	360
G4T2	312
G5T2	240
G3	120
G4T3	108
G5T3	94
G4	38
G5T4	34
G5	12

SRANK	Points
S1	36
S2	12
S3	4
S4	1
S5	0

SIVVA	Points
1.000	1250
0.900	1000
0.800	750
0.700	500
0.600	250
0.500	0

Table 15. Species Scoring for FNAIHAB-SLR model. Grank and Srank scoring are identical to standard FNAIHAB-CLIP model. Additional points based on SIVVA Vulnerability and Adaptive Capacity modules, averaged across four SLR scenarios (0.5 meter, 1m, 2m, 3m).

This model was designed to be comparable to the original FNAIHAB model in terms of priority classes, with priorities shifting among individual species (Fig. 4). Nevertheless, the overall model did shift acreage as shown in Table 16. Fig. 5 shows that priorities shifted geographically as well, with an increase in Priorities 1-2 in south Florida and a decrease in north Florida and the panhandle.

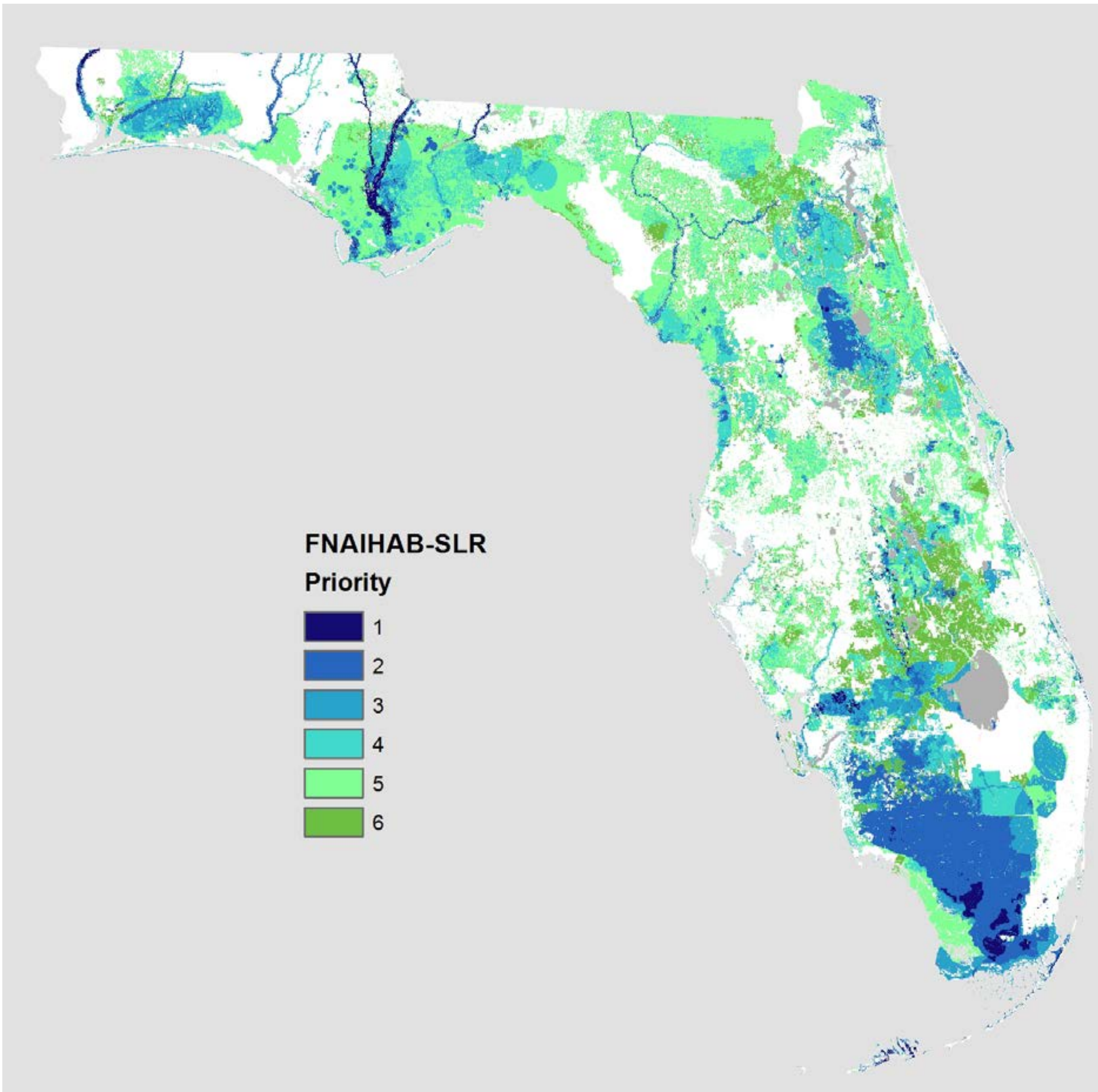

Fig. 4. FNAIHAB – Sea Level Rise alternative scenario model.

FNAIHAB Acreage Comparison

Priority	Standard	SLR
1	816,301	406,252
2	2,640,068	2,901,209
3	2,743,537	2,315,711
4	4,984,666	3,927,997
5	5,339,863	8,011,713
6	3,676,878	2,638,431
total	20,201,313	20,201,313

Table 16. FNAIHAB model acreage comparison.

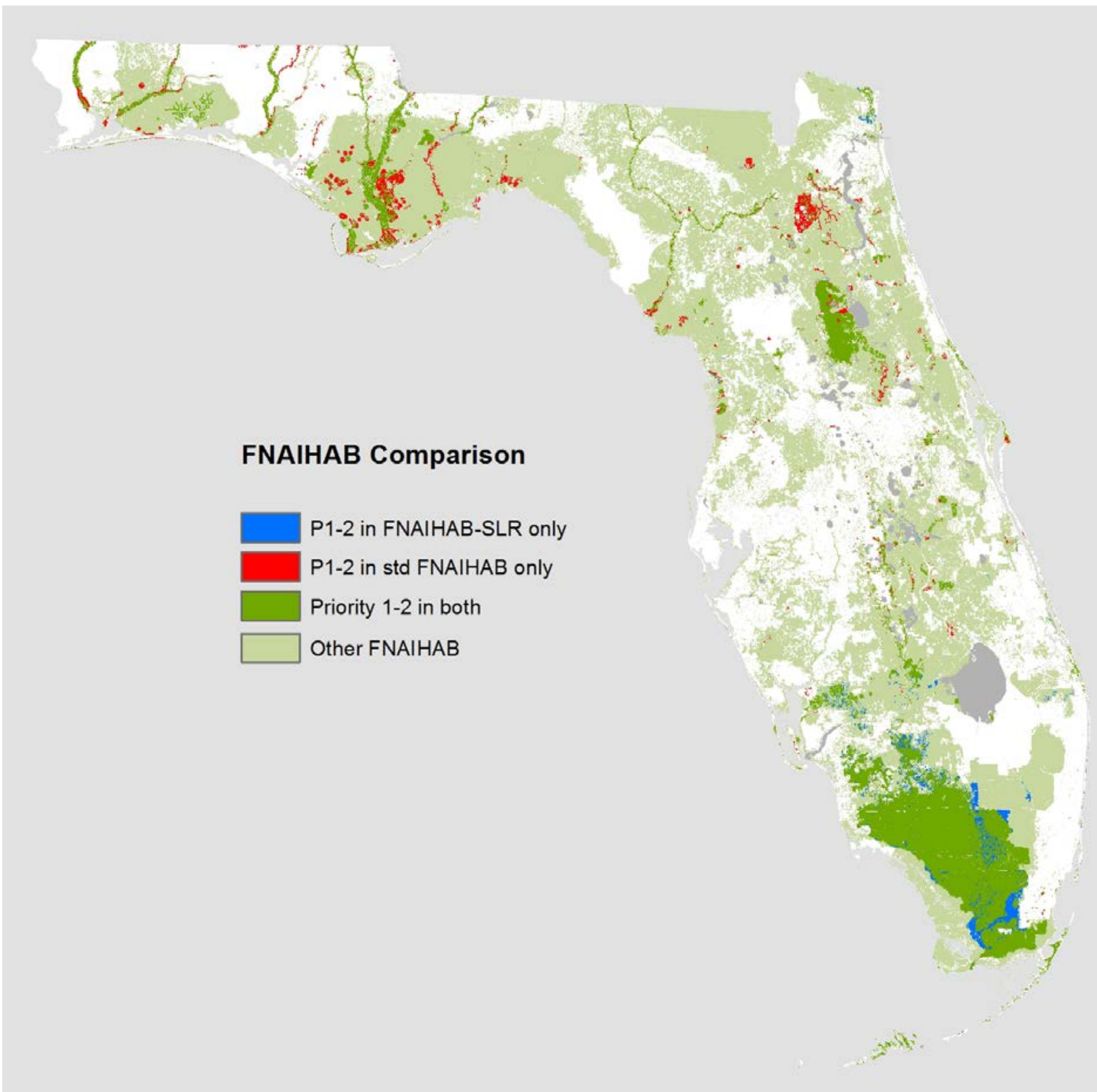

Figure 5. Comparison of Priorities 1-2 in FNAIHAB standard and sea level rise (SLR) models.

Surface Water Restoration Priorities

A major undertaking over the past two years had been an effort to model statewide priorities for surface water restoration needs. Existing CLIP surface water priorities focus on water systems that are relatively intact with relatively natural flows and water quality. Since the earliest versions of CLIP we have recognized a need to identify additional surface water priorities with respect to altered/degraded water systems that are current or potential targets for restoration efforts. Our goal has been to develop a new CLIP Resource Category devoted to surface water restoration priorities. Significant modeling was completed as part of the latest CLIP v4.0 updates and reviewed by a water technical advisory group, but the group has yet to reach consensus on final model versions that would be suitable for the CLIP database. Appendix F summarizes work to date on this effort.

CLIP Overlays

One valuable use of the CLIP database is to overlay CLIP priorities onto other data that represent potential threats to natural resources, or opportunities for conservation. These overlays highlight specific areas of potential conflict or potential synergy between natural resource conservation priorities and other unrelated priorities or values. They also serve to highlight areas where different conservation strategies might be employed. For example, some resource issues might best be addressed through land acquisition and active resource management, while others might be dealt with via landowner incentives or strategies to address cumulative impacts. Highlighting the relationship between CLIP priorities and features such as agricultural lands, sea level rise projections, or impaired water bodies help to indicate areas where different conservation strategies might best be employed. Appendix G includes several overlays of CLIP v4.0 priorities 1-2 with other such data.

CONCLUSION/RECOMMENDATIONS

- The CLIP database should continue to be maintained to incorporate new or revised core data layers as they become available. The Florida Natural Areas Inventory, University of Florida, and Florida Fish and Wildlife Conservation Commission have a Memorandum of Understanding (MOU) to work together to continue to maintain and develop the CLIP database. However, this MOU does not guarantee continued funding for CLIP.

- Users should look beyond the Aggregated CLIP Priorities model to incorporate Resource Category Priorities and core data layers into analyses and decision-making. For example, some users may find that core data layers provide more detailed information for addressing specific conservation resource planning decisions, whereas the Aggregated CLIP Priorities are primarily intended to serve as a broader brush depiction of areas of higher conservation priorities for general state and regional applications.

- Data and policies available to inform water restoration, ecosystem services, and climate change issues continue to evolve – those analyses need further development, with the goal to add at least some of these new Resource Categories or analysis results to the next update of the CLIP database.

- This version of CLIP includes a simple user tutorial to facilitate appropriate uses of CLIP at state, regional, and local scales. However, in future versions, with appropriate funding, other tools such as offline data viewers, ArcGIS analysis tools, and other decision support tools and information should be considered to further increase the utility of the CLIP database. The goal for future tool development is to enable state, regional, and local planning and analysis staff to use the best available data on statewide and regional conservation priorities as a foundation to facilitate sound conservation and land use planning, design, and policy.

- CLIP data are relevant to regional natural resource assessments, including "visioning" efforts that project trends and develop strategies to encourage development patterns that avoid impacts to important natural resources. CLIP has been used in at least two such efforts – in south-central/southwest Florida and the panhandle – so far, showing that CLIP has value as a starting point for identifying state and regionally significant natural resource areas. At the same time, use of CLIP data, and comparison to any available regional data, may serve as a useful means to determine other potential gaps in CLIP data and to enhance future iterations of the CLIP database. Regional visioning has included statewide CLIP priorities and various overlays, incorporation of additional natural resource and other data for identifying regional and local conservation priorities. One goal is to continue development of regional applications of CLIP to enhance statewide CLIP data with regionally specific conservation priorities data in all regions of the state.

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Strategic Habitat Conservation Areas - 2009 Revision

This data layer was created by FWC to identify gaps in the existing statewide system of wildlife conservation areas, and to inform ongoing land acquisition and conservation efforts. FWC modeled areas of habitat that are essential to sustain a minimum viable population for focal species of terrestrial vertebrates that were not adequately protected on existing conservation lands. For CLIP v4 this layer has been re-prioritized to reflect five species rank changes as noted below.

	Acres	Conservation Land
Priority 1	1,460,226	62%
Priority 2	10,628,008	68%
Priority 3	4,840,876	28%
Priority 4	86,115	43%
Priority 5	1,130,825	11%
Total	18,146,051	53%

Note: SHCA priorities are not based on species richness. If two or more species overlap, the area will be classed according to the species with the highest priority.

Note: This version of SHCA includes habitat on conservation lands. In the 2009 study, several species were deemed not to require SHCAs due to habitat already on conservation lands. Those species are listed as having "SHCAs" on conservation lands only, below.

Priority 1 SHCAs for species with ranks of **S1 and G1-G3**.

Species		State Rank	Global Rank	
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	S1	G5T1	
Charadrius nivosus	Cuban Snowy Plover	S1	G3	Formerly P2
Microtus pennsylvanicus dukecampbelli	Florida Salt Marsh Vole	S1	G5T1	
Myotis grisescens	Gray Bat	S1	G3	
Nerodia clarkii taeniata	Atlantic Salt Marsh Snake	S1	G4T1	
Odocoileus virginianus clavium	Florida Key Deer	S1	G5T1	
Oryzomys palustris pop. 2	Sanibel Island Rice Rat	S1	G5T1	
Peromyscus polionotus allophrys	Choctawhatchee Beach Mouse	S1	G5T1	
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	S1	G5T1	
Peromyscus polionotus peninsularis	St. Andrews Beach Mouse	S1	G5T1	
Peromyscus polionotus phasma	Anastasia Island Beach Mouse	S1	G5T1	
Puma concolor coryi	Florida Panther	S1	G5T1	
Sylvilagus palustris hefneri	Lower Keys Marsh Rabbit	S1	G5T1	

Species with "SHCA" on Conservation Lands only:

Kinosternon baurii pop. 1	Lower Keys Mud Turtle	S1	G5T1	Formerly P2
Plestiodon egregius egregius	Florida Keys Mole Skink	S1	G5T1	Formerly P2
Plestiodon egregius insularis	Cedar Key Mole Skink	S1	G5T1	
Tantilla oolitica	Rim Rock Crowned Snake	S1	G1	

Priority 2 SHCAs for species with ranks of **S1, G4-G5 or S2, G2-G3**.

Ammodramus maritimus fisheri	Louisiana Seaside Sparrow	S1	G4T4	
Ammodramus maritimus macgillivraii	Mac Gillivray's (Smyrna) Seaside Sparrow	S2	G4T3	
Aphelocoma coerulescens	Florida Scrub Jay	S2	G2	
Buteo brachyurus	Short-tailed Hawk	S1	G4	
Crocodylus acutus	American Crocodile	S2	G2	
Desmognathus monticola	Seal Salamander	S1	G5	
Nerodia clarkii clarkii	Gulf Salt Marsh Snake	S2	G4T3	Formerly P4
Notophthalmus perstriatus	Striped Newt	S2	G2	
Oryzomys palustris pop. 3	Silver Rice Rat	S2	G5T2	
Plestiodon reynoldsi	Sand Skink	S2	G2	
Sciurus niger avicennia	Big Cypress Fox Squirrel	S2	G5T2	
Ursus americanus floridanus	Florida Black Bear	S2	G5T2	

Species with "SHCA" on Conservation Lands only:

Ambystoma cingulatum	Frosted Flatwoods Salamander	S2	G2
Grus canadensis pratensis	Florida Sandhill Crane	S2	G5T2
Lithobates okaloosae	Florida Bog Frog	S2	G2
Picoides borealis	Red-Cockaded Woodpecker	S2	G3

Priorities 3-5 continued on next page.

Strategic Habitat Conservation Areas - cont.

Priority 3 SHCAs for species with ranks of **S2, G4-G5 or S3, G3**.

Ammodramus maritimus peninsulae	Scott's Seaside Sparrow	S3	G4T3	
Athene cunicularia floridana	Burrowing Owl	S3	G4T3	
Elanoides forficatus forficatus	Swallow-tailed Kite	S2	G5	
Patagioenas leucocephala	White-crowned Pigeon	S3	G3	
Podomys floridanus	Florida Mouse	S3	G3	
Rostrhamus sociabilis	Snail Kite	S2	G4	Formerly P2
Species with "SHCA" on Conservation Lands only:				
Caracara cheriway	Crested Caracara	S2	G5	
Gopherus polyphemus	Gopher Tortoise	S3	G3	
Myotis austroriparius	Southeastern Bat	S3	G3	
Parkesia motacilla	Louisiana Waterthrush	S2	G5	
Sciurus niger shermani	Sherman's Fox Squirrel	S3	G5T3	
--	Wading Birds	S2	G4	

Priority 4 SHCAs for species with ranks of **S3 and G4**.

Hyla andersonii	Pine Barrens Tree Frog	S3	G4
Species with "SHCA" on Conservation Lands only:			
Anas fulvigula fulvigula	Mottled Duck	S3	G4
Falco sparverius paulus	Southeastern American Kestrel	S3	G5T4

Priority 5 SHCAs for species with ranks of **S3, G5 or S4,G4.**

Accipiter cooperii	Cooper's Hawk	S3	G5
Coccyzus minor	Mangrove Cuckoo	S3	G5
Species with "SHCA" on Conservation Lands only:			
Aramus guarauna	Limpkin	S3	G5
Haliaeetus leucocephalus	Bald Eagle	S3	G5
Passerina ciris	Painted Bunting	S3	G5
Rynchops niger	Black Skimmer	S3	G5
Vireo altiloquus	Black Whiskered Vireo	S3	G5

Priority 6 SHCAs for species with ranks of **S4-S5 and G5**.

None of the species included in the SHCA analysis fit these criteria.

FWC Biodiversity Hotspots
(Vertebrate Potential Habitat Richness)

Because SHCAs do not address species richness, FWC also developed Biodiversity Hotspots to identify areas of overlapping vertebrate species habitat. FWC created a statewide potential habitat model for each species included in their analysis. In some cases only a portion of the potential habitat was ultimately designated as SHCA for each species. The Biodiversity Hotspots layer includes the entire potential habitat model for each species and provides a count of the number of species habitat models occurring at each location. The highest number of focal species co-occurring at any location in the model is 13.

	Acres	Conservation Land
13 Species	2	100%
12 Species	1,804	82%
11 Species	17,677	69%
10 Species	61,874	59%
9 Species	166,956	59%
8 Species	583,035	70%
7 Species	1,048,017	60%
6 Species	2,195,841	55%
5 Species	4,065,118	52%
4 Species	5,646,513	47%
3 Species	4,879,292	26%
2 Species	4,029,196	20%
1 Species	2,995,819	17%
Total	25,691,145	38%

FNAI Rare Species Habitat Conservation Priorities

The FNAIHAB model was designed to identify areas important for species habitat based on both species rarity and species richness. FNAI mapped occurrence-based potential habitat for 281 species of plants, invertebrates, and vertebrates, including aquatic species. Mapped habitat was classified as High, Medium, or Low Suitability for each species. For most species, suitable habitat was mapped only in the vicinity of known occurrences, so that if the state acquires lands based on these priorities they will be assured of protecting a known population of the species. Species were weighted by Global and State rarity rank. **This version of FNAIHAB uses a different species weighting system from the version used in the Florida Forever Conservation Needs Assessment.** The Florida Forever version considers percent of each species' habitat protected on conservation lands in weighting species (higher weight given to species with more habitat on private lands, than for species with more habitat on conservation lands, all else being equal).

	Acres	Conservation Land
Priority 1	814,114	64%
Priority 2	2,637,456	80%
Priority 3	2,738,154	68%
Priority 4	4,970,178	47%
Priority 5	5,327,775	25%
Priority 6	3,663,218	28%
Total	20,150,897	45%

Priority 1
The following example combinations of species habitat meet Priority 1 criteria:
High Suitability habitat for: 1 G1S1 species; 3 G2S2 spp.; 10 G3S3 spp.; 31 G4S4 spp.; 100 G5S5 spp.

Priority 2
The following example combinations of species habitat meet Priority 2 criteria:
High Suitability habitat for: 2 G2S2 species; 5 G3S3 spp.; 15 G4S4 spp.; 49 G5S5 spp.
Medium Suitability habitat for one G1S1 species.

Priority 3
The following example combinations of species habitat meet Priority 3 criteria:
High Suitability habitat for: 1 G3T1 or G3T2 subspecies; 1 G2S2 sp.; 3 G3S3 spp.; 10 G4S4 spp.; 30 G5S5 spp.
Medium Suitability habitat for two G2S2 species.
Low Suitability habitat for one G1S1 species.

Priority 4
The following example combinations of species habitat meet Priority 4 criteria:
High Suitability habitat for: 1 G4T2 or G5T2 subspecies; 2 G3S3 spp.; 5 G4S4 spp.; 15 G5S5 spp.
Medium Suitability habitat for one G2S2 species.
Low Suitability habitat for two G2S2 species.

Priority 5
The following example combinations of species habitat meet Priority 5 criteria:
High Suitability habitat for 1 G3S3 species; 2 G4S4 spp.; 9 G5S5 spp.
Medium Suitability habitat for two G3S3 species.
Low Suitability habitat for one G2S2 species.

Priority 6
All remaining habitat for any combination of species not meeting criteria for higher priorities.

FNAI Priority Natural Communities

This data layer was created by FNAI specifically for the Florida Forever statewide environmental land acquisition program. It is intended to map natural communities that are under-represented on existing conservation lands. FNAI mapped the statewide range of 14 natural community types: 14 natural community types: upland glades, pine rocklands, seepage slopes, scrub, sandhill, sandhill upland lakes, upland pine, tropical hardwood hammock, upland hardwood forest, pine flatwoods, dry prairie, coastal uplands, coastal lakes, and coastal wetlands. Natural communities are prioritized by Global rarity rank (G-rank) as well as landscape integrity priority class (Very High, High, Moderate).

Community	Global Rank	Priority	Acres	Conservation Land
Upland Glade	G1	Very High	37	8%
Pine Rockland	G1	Very High	16,841	95%
		High	10	82%
Scrub	G2	Very High	461,894	76%
(includes some Scrubby Flatwoods)		High	22,788	18%
		Moderate	4,839	15%
Tropical (Rockland) Hammock	G2	Very High	18,091	88%
		High	757	53%
		Moderate	258	86%
Dry Prairie	G2	Very High	147,673	67%
		High	7,829	18%
		Moderate	72	38%
Seepage Slope	G2	Very High	6,222	100%
		High	0	
Imperiled Coastal Lakes	G2	Very High	1,368	38%
		High	120	0%
		Moderate	18	0%
Coastal Uplands	G3	Very High	53,888	85%
		High	2,380	41%
		Moderate	44	36%
Sandhill	G3	Very High	682,905	68%
		High	81,803	21%
		Moderate	8,322	17%
Sandhill Upland Lakes	G3	Very High	56,403	24%
		High	12,131	1%
		Moderate	2,573	1%
Upland Pine	G3	Very High	162,066	93%
		High	5,266	52%
		Moderate	869	17%
Pine Flatwoods	G4	Very High	1,992,295	59%
		High	291,129	14%
		Moderate	53,314	8%
Upland Hardwood Forest	G5	Very High	127,676	30%
		High	92,799	2%
		Moderate	10,022	4%
Coastal Wetlands	G5	Very High	963,350	86%
(Mangrove and Salt Marsh)		High	30,256	41%
		Moderate	6,418	22%
Total			5,324,727	62%

UF/OGT Ecological Greenways Network

The Florida Ecological Greenways Network model was created to delineate the ecological component of a Statewide Greenways System plan developed by the DEP Office of Greenways and Trails, under guidance from the Florida Greenways Coordinating Council and the Florida Greenways and Trails Council. This plan guides OGT land acquisition and conservation efforts, and promotes public awareness of the need for and benefits of a statewide greenways network. It is also used as the primary data layer to inform the Florida Forever conservation land acquisition program regarding the location of the most important conservation corridors and large, intact landscapes in the state. A major revision to the Ecological Greenways Network was completed in 2013, with additional revisions in 2015 leading to a change in priority classes from six to five.

Priority	Acres	Conservation Land
Priority 1	11,629,918	71%
Priority 2	5,102,507	30%
Priority 3	1,239,939	25%
Priority 4	1,526,260	29%
Priority 5	3,585,113	25%
Total	23,083,736	49%

Priority 1
Critical Linkages, defined as areas with very high ecological significance while also having areas most threatened by development.

For Priorities 2-5, the ecological greenways corridors are priotized based on:
1) potential importance for maintaining or restoring populations of wide-ranging species (e.g. Florida black bear and Florida panther);
2) importance for maintaining statewide, connected reserve network from south Florida through the panhandle.
3) other important landscape linkages that provide additional opportunities to maintain statewide connectivity especially in support of higher priority linkages.
4) provide important riparian corridors within Florida and to other states.
5) Other regionally significant opportunities to protect large intact landscapes.

Priority 2
High priority greenways not meeting Critical Linkages threshold.

Priority 3
Priority 3 ecological greenway corridors - provide significant alternative linkages to Priority 1 and Priority 2 corridors.

Priority 4
Priority 4 ecological greenway corridors - provide important riparian corridors within Florida and to other states.
One Priority 4 corridor is needed to protect the northern half of the St. Johns black bear populations.
Priority 4 corridors also represent other regionally significant opportunities to protect large intact landscapes.

Priority 5
Remaining ecological greenway corridors of moderate statewide significance.

UF Landscape Integrity Index

The landscape integrity layer is comprised of two related landscape indices assessing ecological integrity based on land use intensity and patch size of natural communities and semi-natural land uses. The land use intensity index characterizes the intensity of land use across the state based on five general categories of natural, semi-natural (such as rangelands and plantation silviculture), improved pasture, agricultural/low-intensity development, and high intensity development. The patch size index combines the land use data with major roads data (such as 4 lane or wider roads and high traffic roads) to identify contiguous patches of natural and semi-natural land cover and ranks them based on area. The combination of the land use intensity and patch size indices was created by adding the two together and dividing by two to create a non-weighted average of the two indices. Values of 10 represent areas with the highest potential ecological integrity based on these landscape indices and 1 represents the lowest ecological integrity. Please note that this index is intended to primarily characterize terrestrial ecosystems and therefore values for large water bodies are not considered significant.

	Land Acres	Conservation Land
Index Level 10	3,959,128	90%
Index Level 9	7,718,473	42%
Index Level 8	7,404,425	26%
Index Level 7	3,757,512	22%
Index Level 6	1,331,175	18%
Index Level 5	967,045	19%
Index Level 4	1,564,179	8%
Index Level 3	3,888,221	4%
Index Level 2	3,316,696	3%
Index Level 1	1,169,199	3%
Total	35,076,053	30%

Index Level 10
Areas with the highest ecological integrity where natural lands predominate in very large patches.
Index Level 9
Additional areas with the highest ecological integrity
Index Level 8
Areas with high ecological integrity
Index Level 7
Areas with moderately high ecological integrity
Index Level 6
Areas with moderate ecological integrity
Index Level 5
Areas with moderate ecological integrity--also includes most large areas of coastal water and large lakes, which are not intended to be a primary target of this index.
Index Level 4
Areas with moderately low ecological integrity
Index Level 3
Areas with low ecological integrity
Index Level 2
Areas with very low ecological integrity
Index Level 1
Areas with little or no ecological integirty due to predominance of intensive land uses.

FNAI Surface Waters

This data layer was created by FNAI, in consultation with state water resource experts, specifically for the Florida Forever statewide environmental land acquisition program. It is intended to show areas that have statewide significance for land acquisition to protect significant surface waters with good water quality. This data layer is not intended to address surface waters with substantial restoration needs, only surface waters that are currently in a relatively natural condition and are a priority for protecting Florida's water resources.

	Total Acres*	Land Area Acres	Conservation Land
Priority 1	7,825,215	2,933,650	55%
Priority 2	5,904,418	5,476,515	71%
Priority 3	1,907,445	1,879,510	26%
Priority 4	8,603,427	8,559,872	34%
Priority 5	5,522,092	5,494,991	9%
Priority 6	4,414,824	4,398,220	16%
Priority 7	1,934,492	1,918,534	5%
Total	36,111,913	30,661,292	33%

**NOTE: Total Acres includes water within target resources (e.g. OFWs, seagrass beds, aquatic preserves, etc.)*

SubModel	Description
Priority 1	
Special OFW Rivers	1,000ft buffer of waterbodies within OFW model priority 1 basins.
Coastal	1,000ft buffer of shellfish harvest areas, seagrass beds, aquatic preserves, and natl estuarine preserves.
Keys	1,000ft buffer of keys shoreline.
Springs	1,000ft buffer of 1st Magnitude springs.
Rare Fish Basins	1,000ft buffer of waterbodies within FWC model priority 1 basins.
OFW Lakes	1,000ft buffer of OFW lakes and inland aquatic preserves.
Water Supply	1,000ft buffer of DEP Class 1 (potable water) water bodies.
Priority 2	
Special OFW Rivers	1,000ft buffer of waterbodies within OFW model priority 2 basins.
MA OFWs	1,000ft buffer of waterbodies within proximity 1 basins.
Springs	1,000ft buffer of magnitude 2-4 springs.
Rare Fish Basins	1,000ft buffer of waterbodies within FWC model priority 2 basins.
Priority 3	
Special OFW Rivers	1,000ft buffer of waterbodies within OFW model priority 3 basins.
Coastal	1,000ft buffer of waterbodies within proximity 2-3 basins.
Keys	1mile buffer of keys shoreline.
Springs	1mile buffer of 1st Magnitude springs.
Rare Fish Basins	1,000ft buffer within priority 3 basins.
Water Supply	1,000ft buffer of waterbodies within proximity 2-3 basins.
Priority 4	
Special OFW Rivers	1mile buffer within priority 1-2 basins; 1,000ft buffer within priority 4-5 basins.
Coastal	1mile buffer within proximity 1 basins
MA OFWs	1mile buffer within proximity 1 basins; 1,000ft buffer within proximity 2-3 basins.
Springs	1mile buffer of magnitude 2-4 springs.
Rare Fish Basins	1mile buffer within priority 1-2 basins; 1,000ft buffer within priority 4-5 basins.
Water Supply	1mile buffer within proximity 1 basins
Priority 5	
Special OFW Rivers	1mile buffer within priority 3-4 basins; 1,000ft buffer within priority 6 basins.
Coastal	1mile buffer within proximity 2-3 basins; 1,000ft buffer within proximity 4+ basins.
MA OFWs	1mile buffer within proximity 2-3 basins; 1,000ft buffer within proximity 4+ basins.
Rare Fish Basins	1mile buffer within priority 3-4 basins
Water Supply	1mile buffer within proximity 2-3 basins; 1,000ft buffer within proximity 4+ basins.
Priority 6	
Special OFW Rivers	1mile buffer within priority 5 basins; remainder of priority 1 basins.
Coastal	1mile buffer within proximity 4+ basins; remainder of proximity 1 basins.
MA OFWs	1mile buffer within proximity 4+ basins; remainder of proximity 1 basins.
Rare Fish Basins	1mile buffer within priority 5 basins; remainder of priority 1 basins.
Water Supply	1mile buffer within proximity 4+ basins; remainder of proximity 1 basins.
Priority 7	
Special OFW Rivers	1mile buffer within priority 6 basins; remainder of priority 2-6 basins.
Coastal	Remainder of proximity 2+ basins.
MA OFWs	Remainder of proximity 2+ basins.
Rare Fish Basins	Remainder of priority 2-5 basins.
Water Supply	Remainder of proximity 2+ basins.

FNAI Natural Floodplain

Like the Surface Waters model, the Natural Floodplain data layer was created by FNAI, in consultation with state water resource experts, specifically for the Florida Forever statewide environmental land acquisition program. It is intended to show areas that have statewide significance for land acquisition to protect natural floodplain. This model focuses on FEMA 100-year floodplain statewide, and is prioritized by the Land Use Intensity Index developed by UF as a component of the CLIP Landscape Integrity Layer, and by FNAI Potential Natural Areas.

	Acres	Conservation Land
Priority 1	4,733,894	90%
Priority 2	2,400,303	60%
Priority 3	2,734,910	30%
Priority 4	2,779,588	11%
Priority 5	877,139	11%
Priority 6	1,457,442	7%
Total	14,983,278	47%

Land Use Intensity Index	PNA 1-4	PNA 5	Non-PNA
10 (low intensity)	Floodplain P1	P2	P2
9	P2	P3	P3
8	P3	P3	P4
7	P3	P4	P4
6	P4	P4	P5
5	P4	P5	P6
4	P5	P6	P6
3	P6	P6	P6
2	P6	P6	P6
1	P6	P6	P6

Wetlands

The Wetlands data layer used for the CLIP analysis was developed by FNAI specifically for the Florida Forever statewide environmental land acquisition program. The source layer for wetlands is the Water Management District FLUCCS land cover. FLUCCS wetlands are prioritized by the Land Use Intensity Index developed by UF as a component of the CLIP Landscape Integrity Layer, and by FNAI Potential Natural Areas.

	Acres	Conservation Land
Priority 1	4,578,837	90%
Priority 2	2,148,569	57%
Priority 3	2,309,538	29%
Priority 4	1,755,080	11%
Priority 5	368,856	9%
Priority 6	249,303	5%
Total	11,410,182	55%

Land Use Intensity Index	PNA 1-4	PNA 5	Non-PNA
10 (low intensity)	Wetlands P1	P2	P2
9	P2	P3	P3
8	P3	P3	P4
7	P3	P4	P4
6	P4	P4	P5
5	P4	P5	P6
4	P5	P6	P6
3	P6	P6	P6
2	P6	P6	P6
1	P6	P6	P6

Aquifer Recharge

The Aquifer Recharge data layer identifies areas of potential recharge important for natural systems and human use. The data are prioritized based on features that contribute to aquifer vulnerability such as thickness of the intermediate aquifer confining unit and closed topographical depressions, as well as areas within springshed protection zones and in proximity to public water supply wells.

	Acres	Conservation Land
Priority 1	1,108,062	21%
Priority 2	3,265,920	16%
Priority 3	6,075,478	18%
Priority 4	7,508,557	22%
Priority 5	6,632,648	26%
Priority 6	8,535,559	49%
Total	33,126,226	29%

Priority 1
Highest recharge areas that overlap with Springs Protection Areas, public water supply buffers, and/or swallets.

Priority 2
Highest recharge areas that DO NOT overlap with Springs Protection Areas, public water supply buffers, and/or swallets, OR high recharge areas that overlap with Springs Protection Areas, public water supply buffers, and/or swallets.

Priority 3
High recharge areas that DO NOT overlap with Springs Protection Areas, public water supply buffers, and/or swallets, OR moderate recharge areas that overlap with Springs Protection Areas, public water supply buffers, and/or swallets.

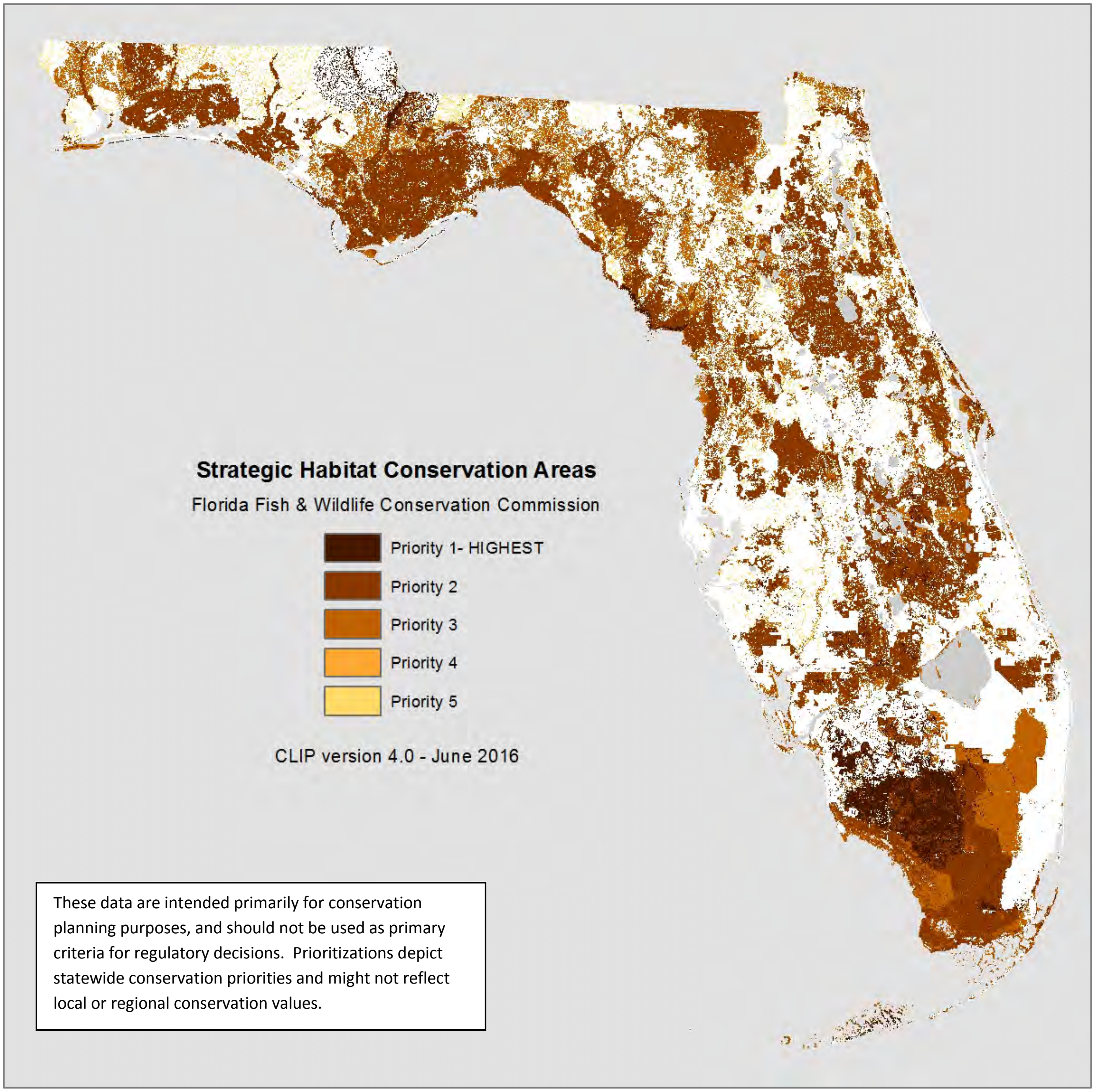
Priority 4
Moderate recharge areas that DO NOT overlap with Springs Protection Areas, public water supply buffers, and/or swallets, OR moderately low recharge areas that overlap with Springs Protection Areas, public water supply buffers, and/or swallets.

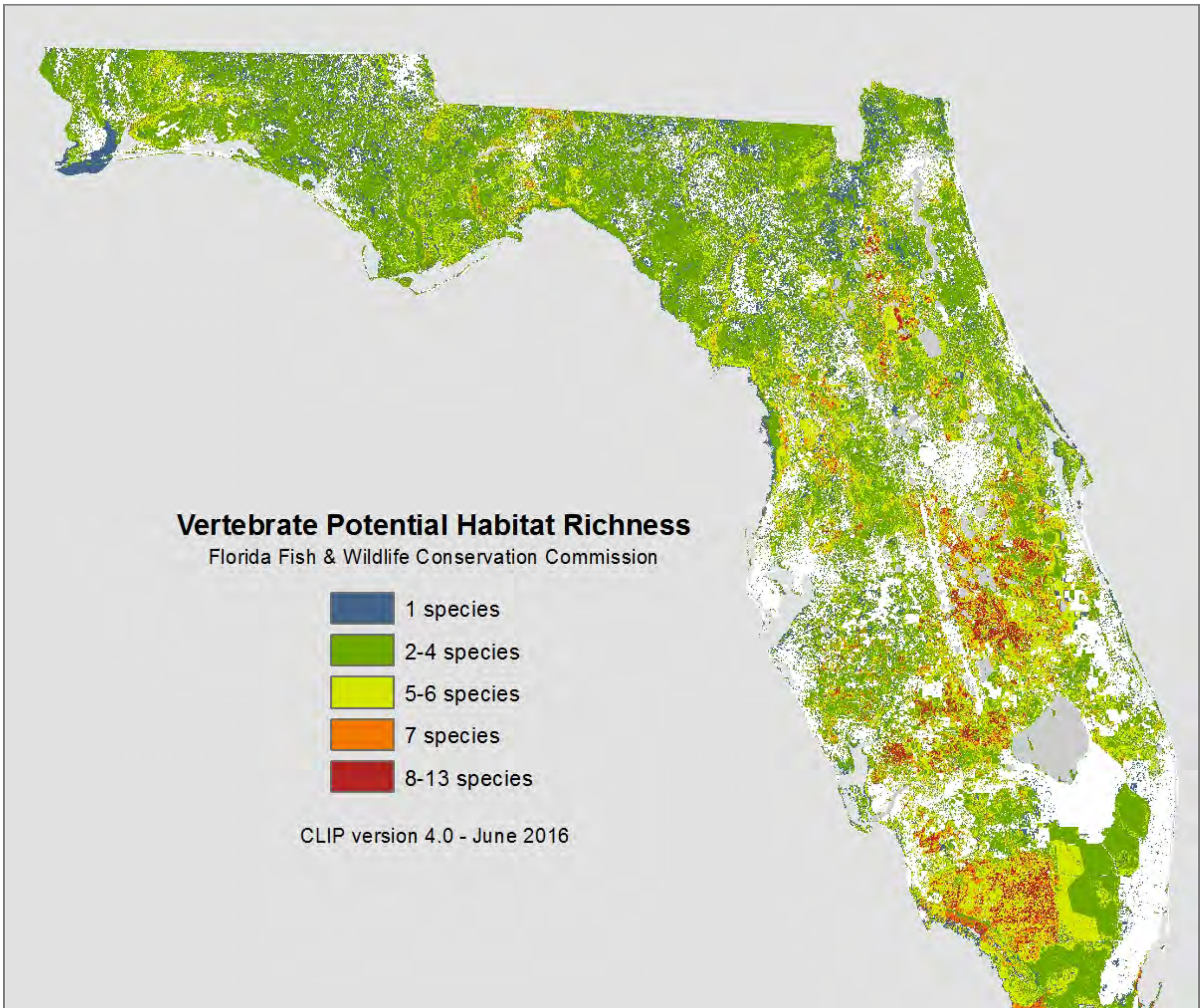
Priority 5
Moderately low recharge areas that DO NOT overlap with Springs Protection Areas, public water supply buffers, and/or swallets, OR low recharge areas that overlap with Springs Protection Areas, public water supply buffers, and/or swallets.

Priority 6
Low recharge areas that do not overlap with Springs Protection Areas, public water supply buffers, and/or swallets.

APPENDIX B.

Maps of CLIP version 4.0 Core Data Layers and Priority Models


Strategic Habitat Conservation Areas
Florida Fish & Wildlife Conservation Commission
Priority 1- HIGHEST
Priority 2
Priority 3
Priority 4
Priority 5
CLIP version 4.0 - June 2016
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.



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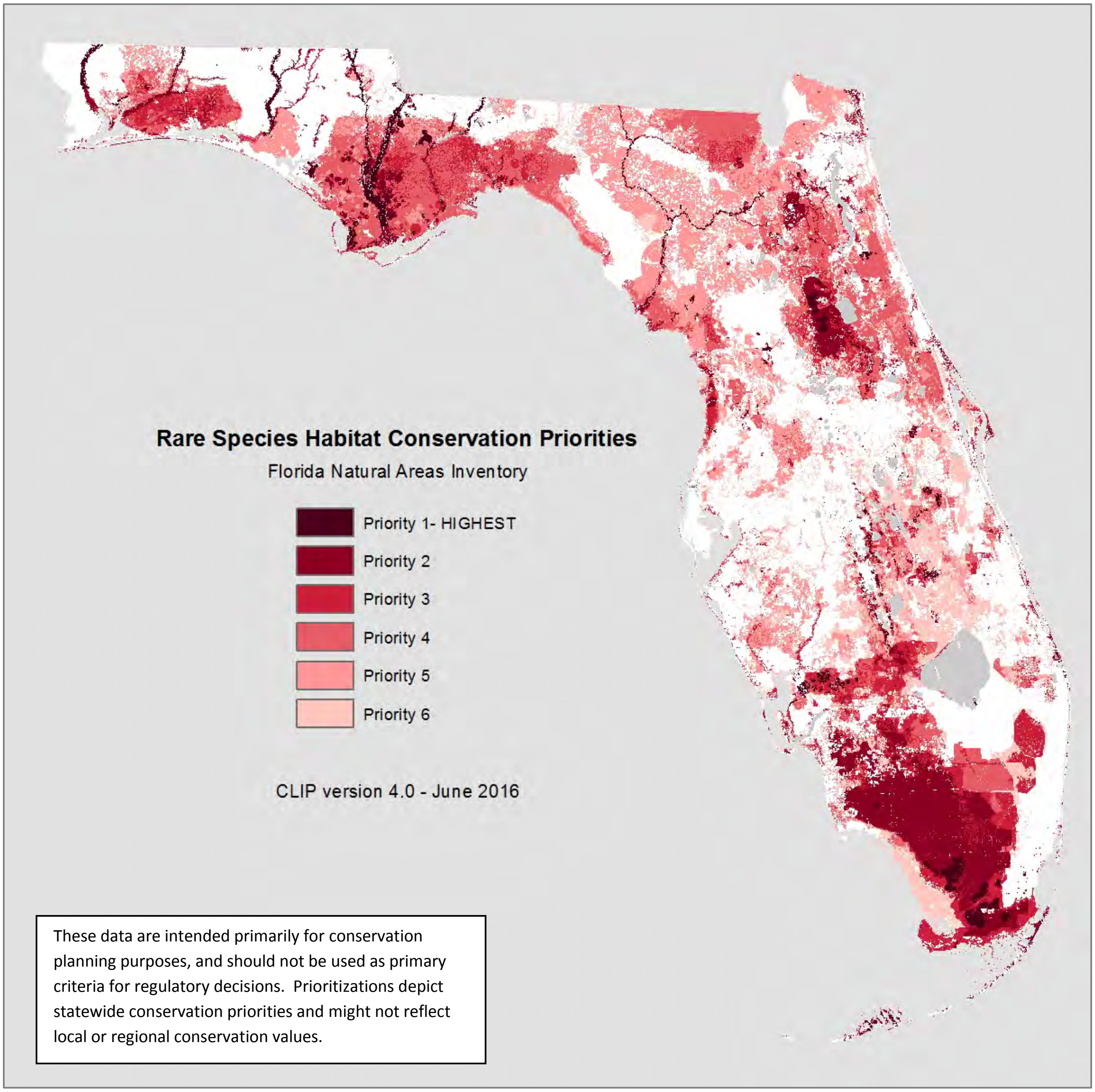

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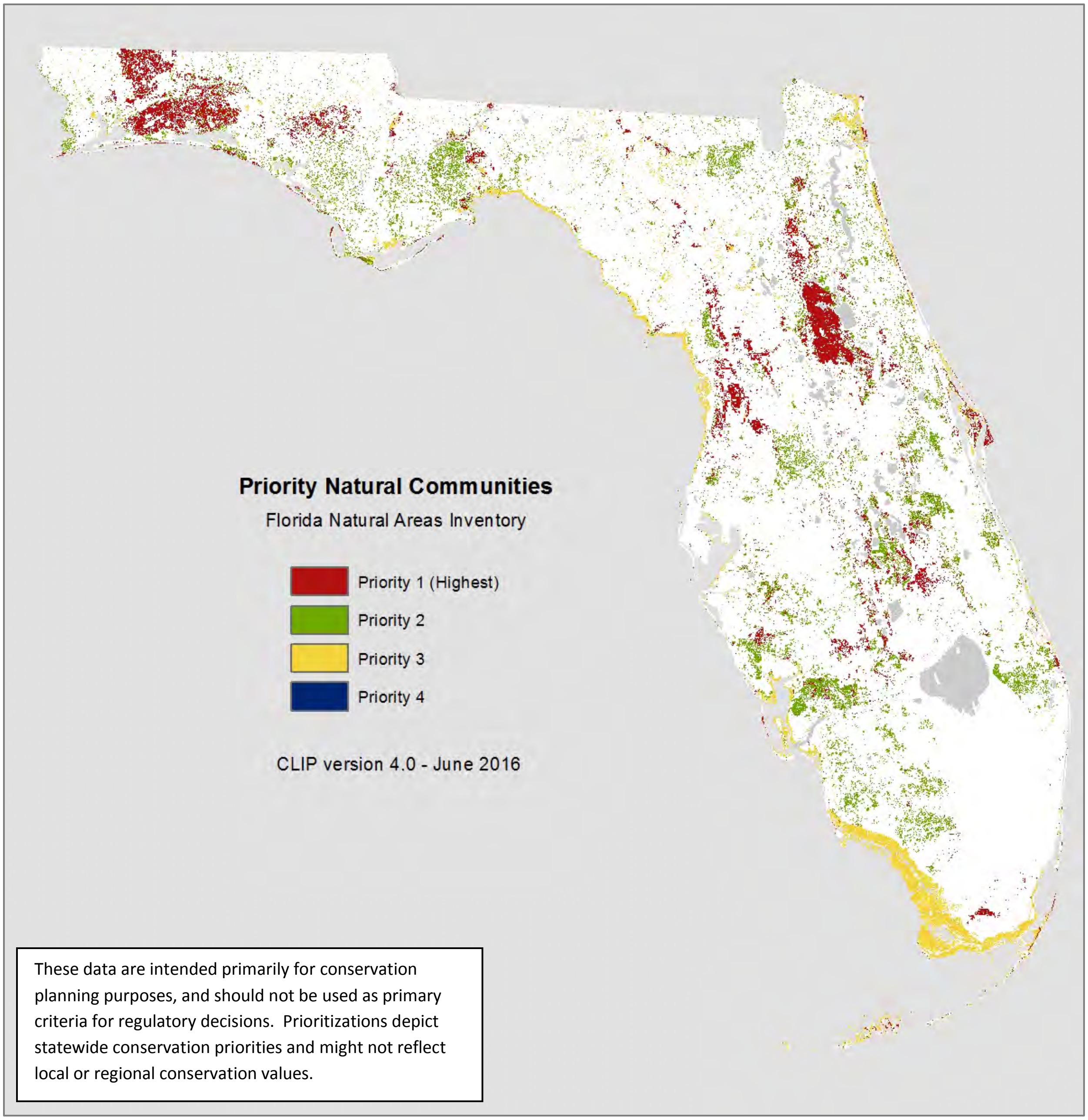
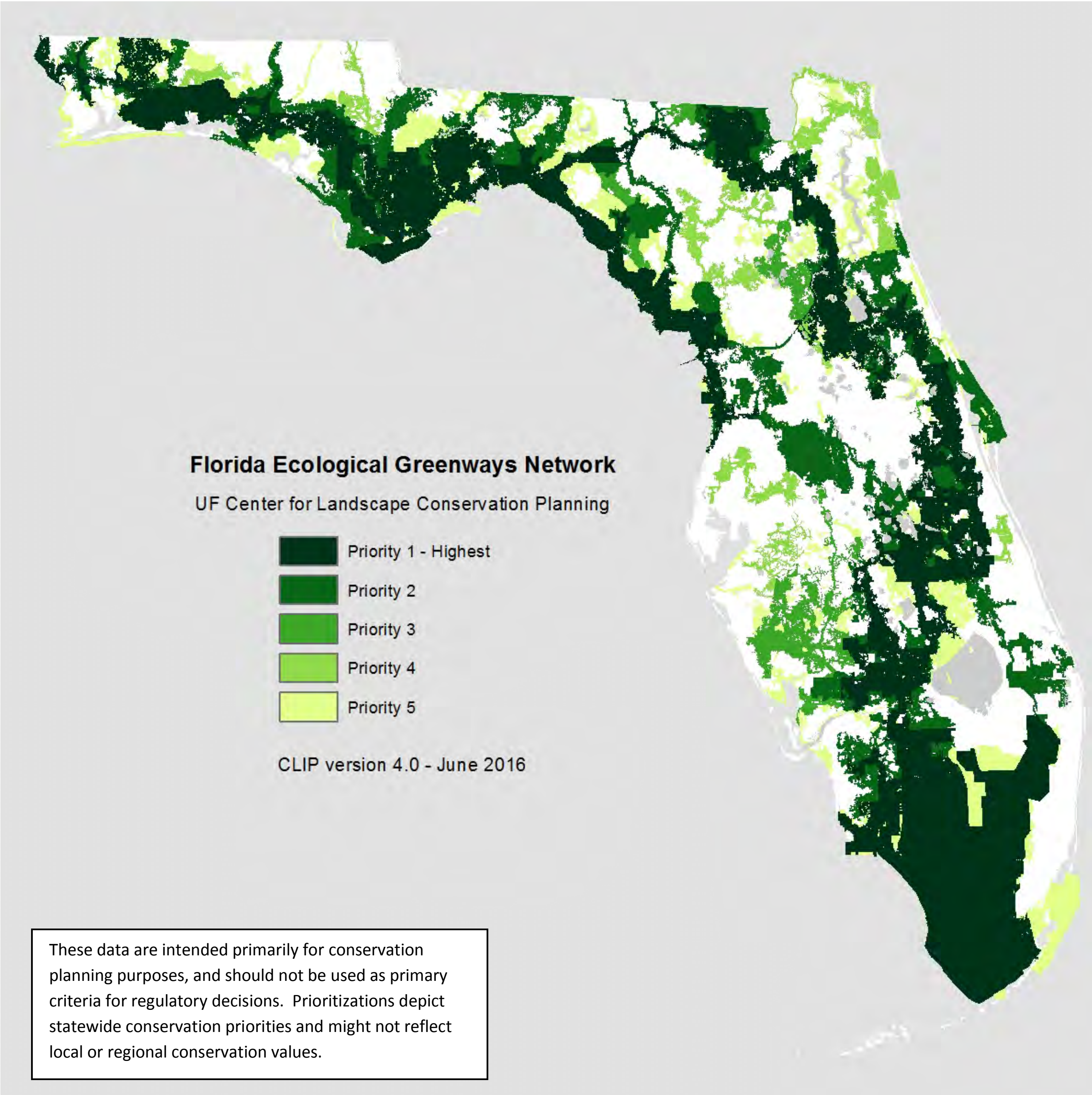
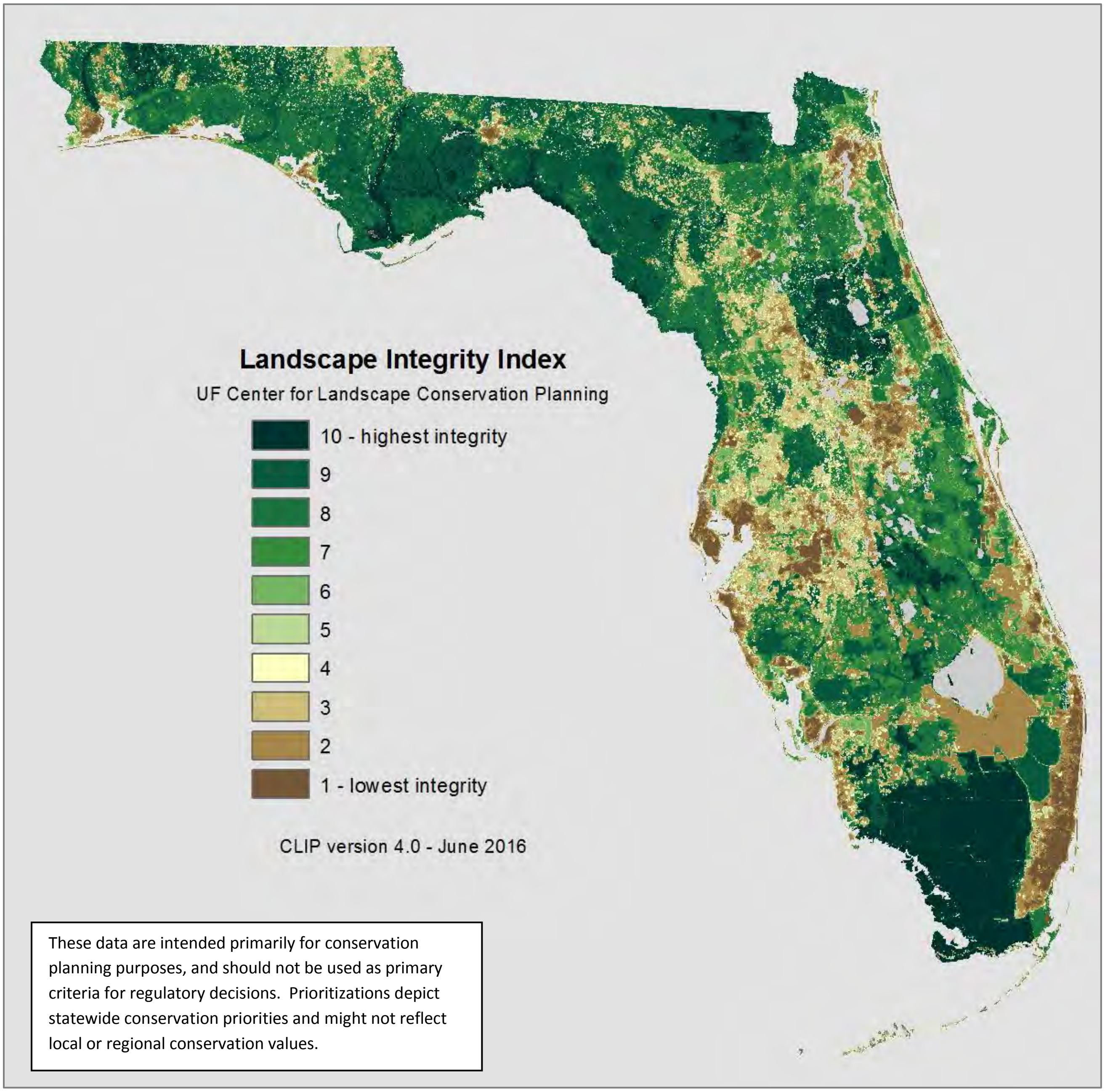
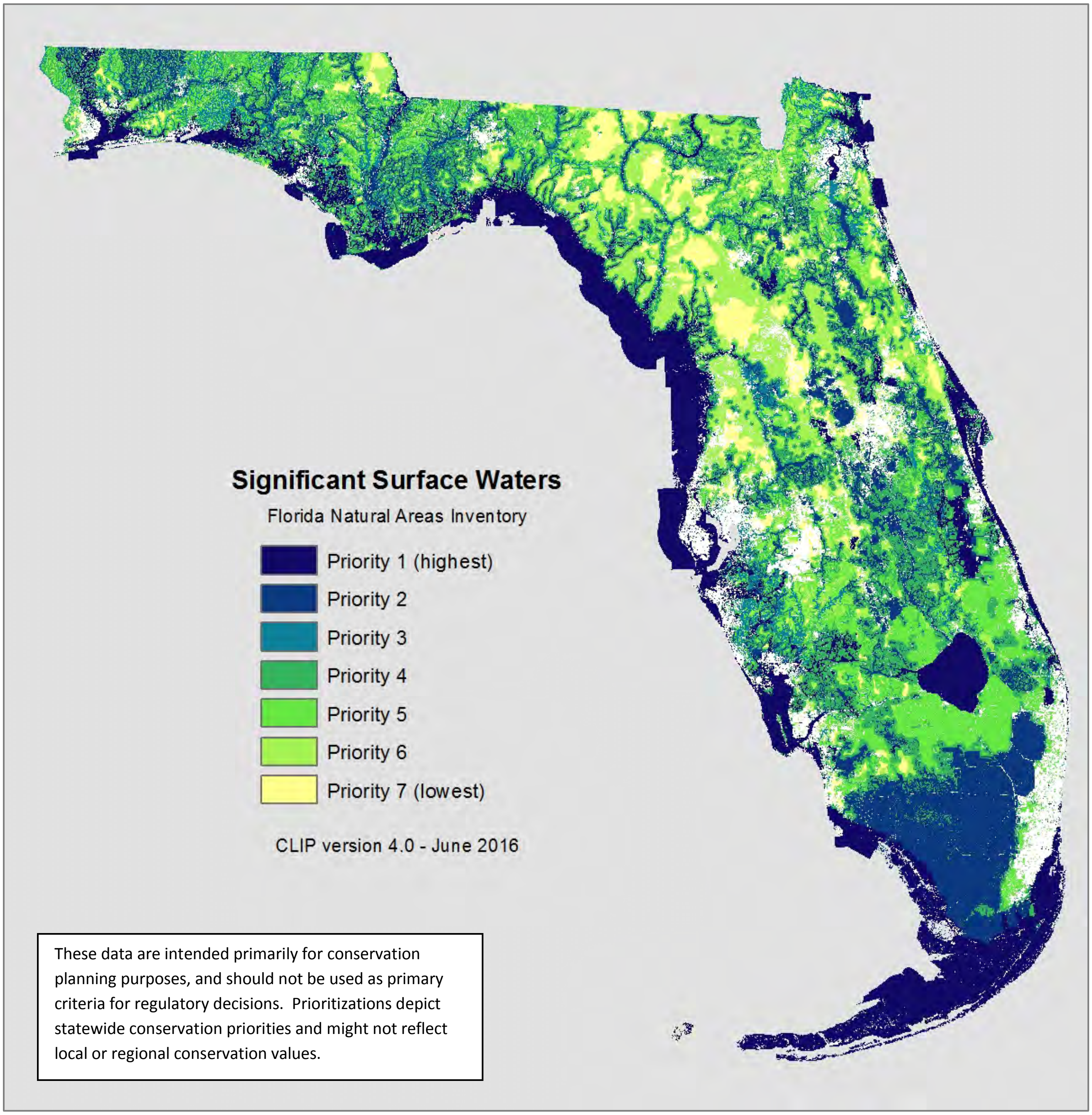
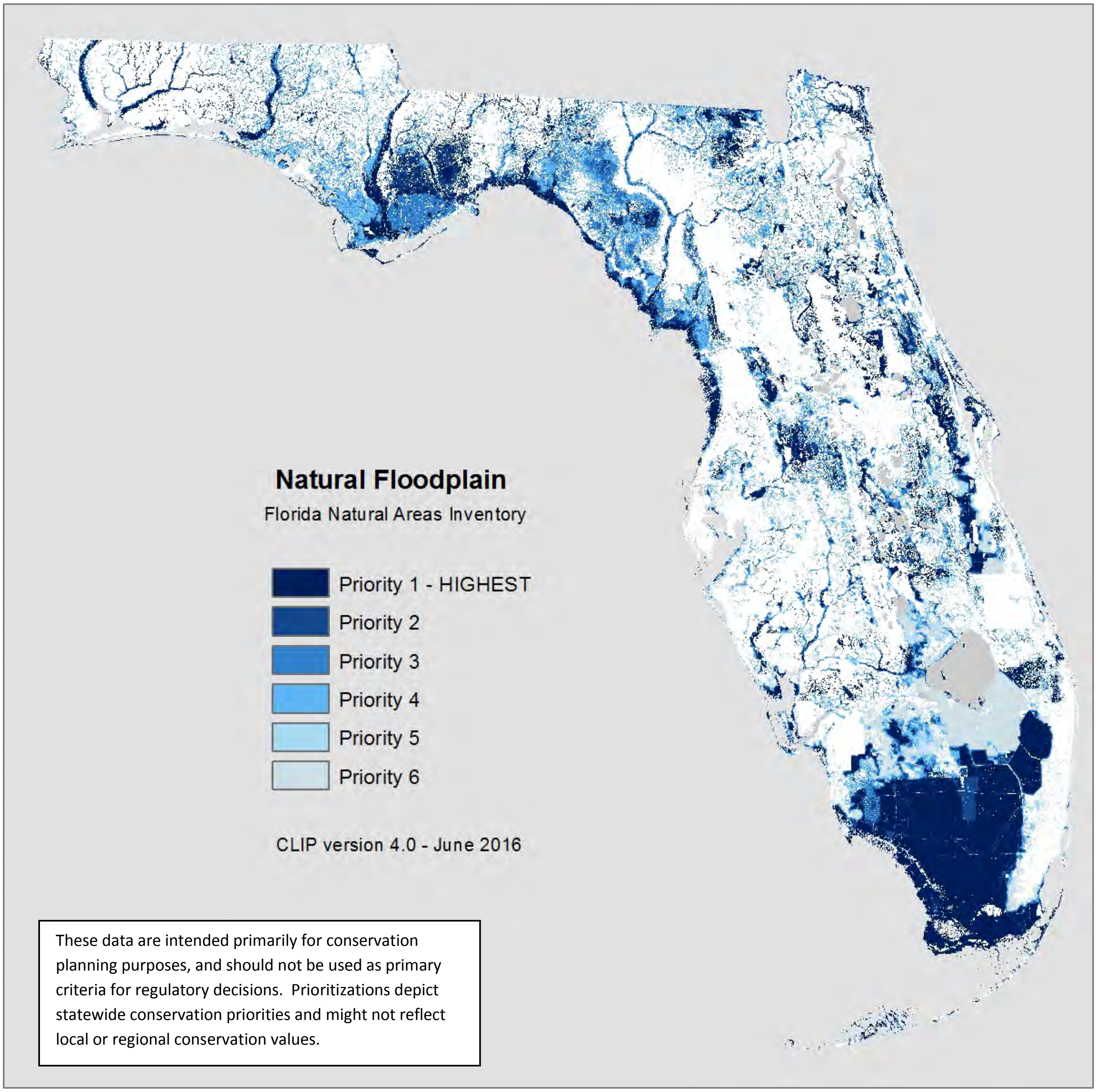

Priority Natural Communities
Florida Natural Areas Inventory
Priority 1 (Highest)
Priority 2
Priority 3
Priority 4
CLIP version 4.0 - June 2016
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.

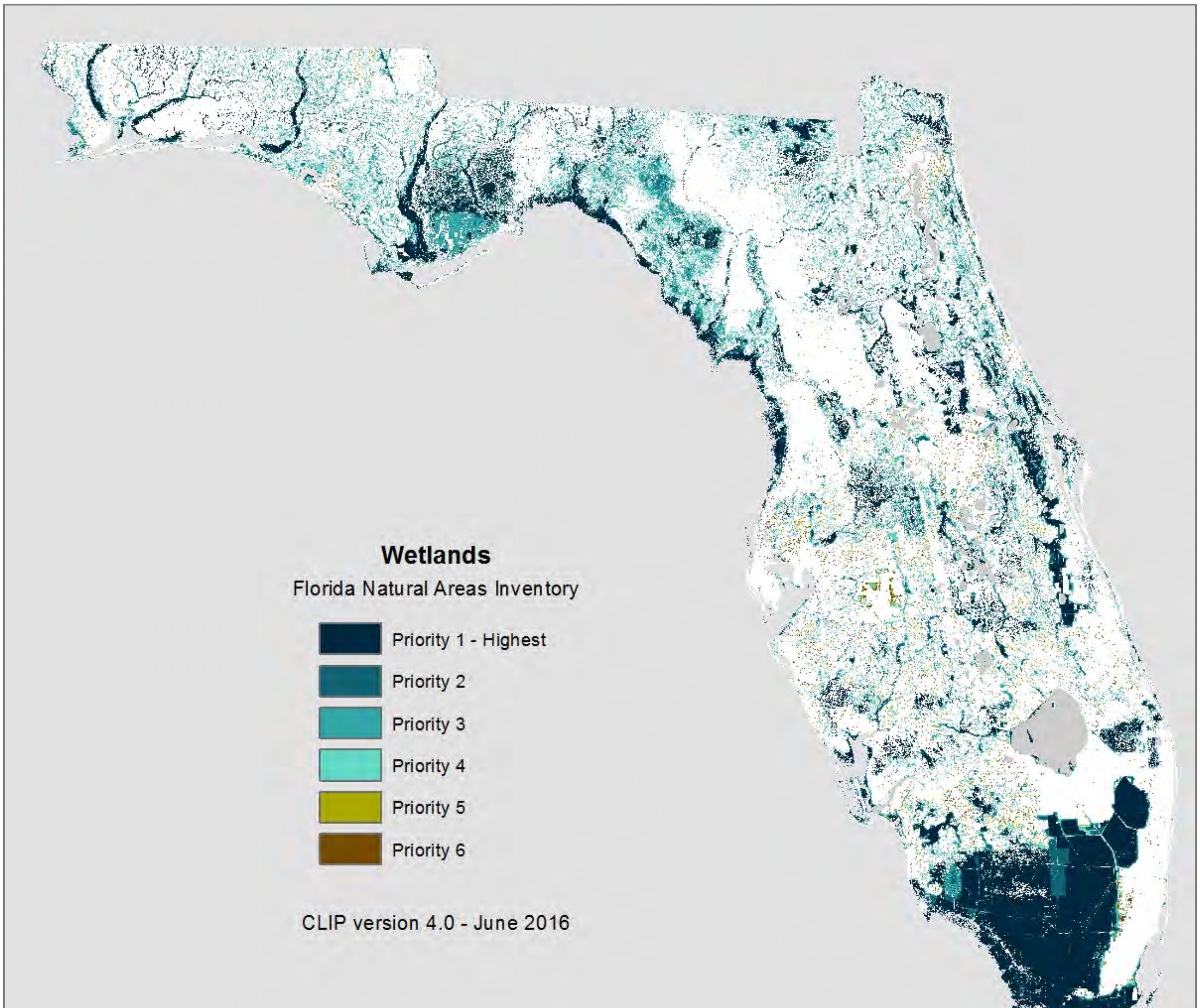


These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.

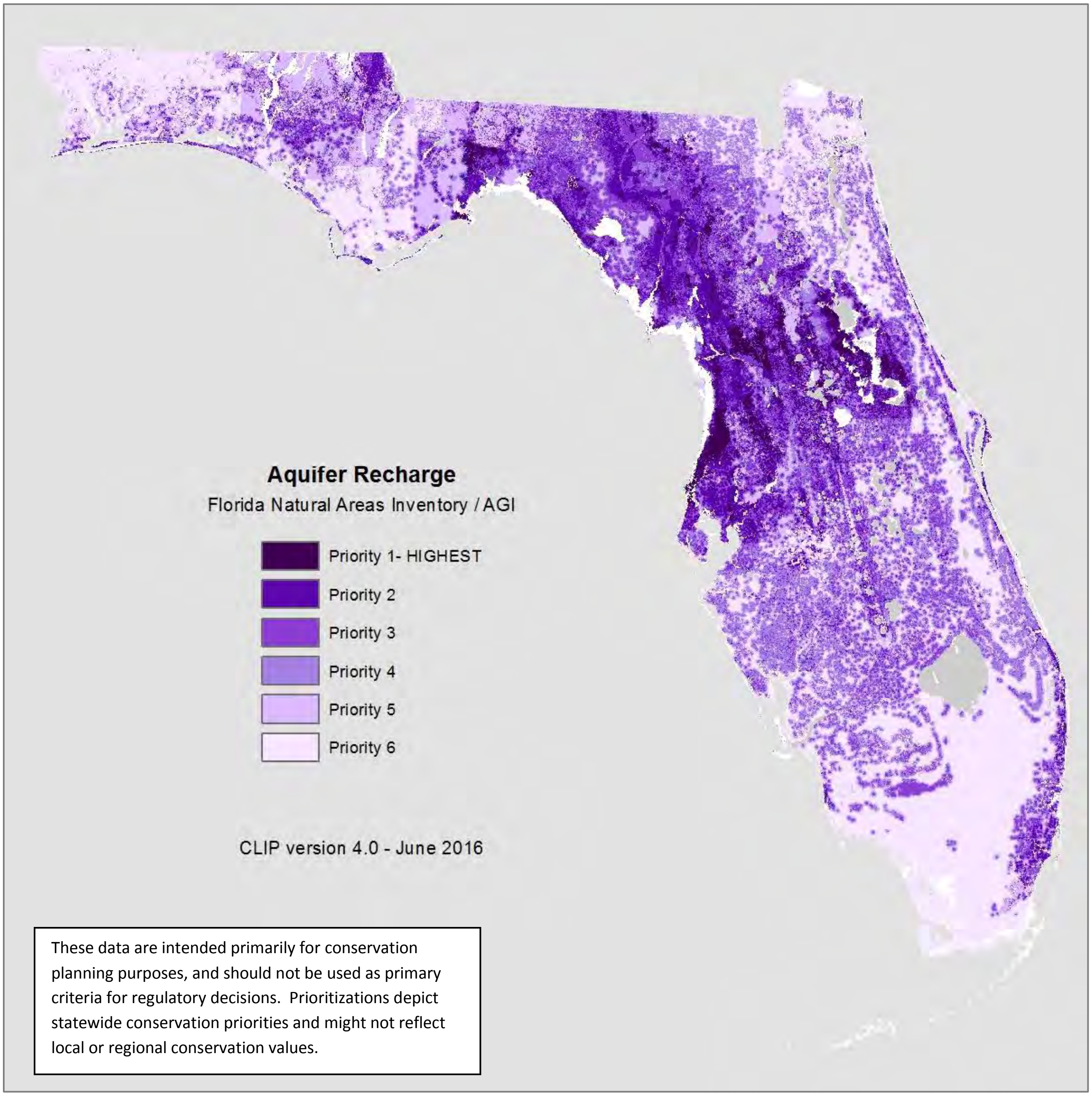

Landscape Integrity Index
UF Center for Landscape Conservation Planning
10 - highest integrity
9
8
7
6
5
4
3
2
1 - lowest integrity
CLIP version 4.0 - June 2016
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.


Significant Surface Waters
Florida Natural Areas Inventory
Priority 1 (highest)
Priority 2
Priority 3
Priority 4
Priority 5
Priority 6
Priority 7 (lowest)
CLIP version 4.0 - June 2016
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.

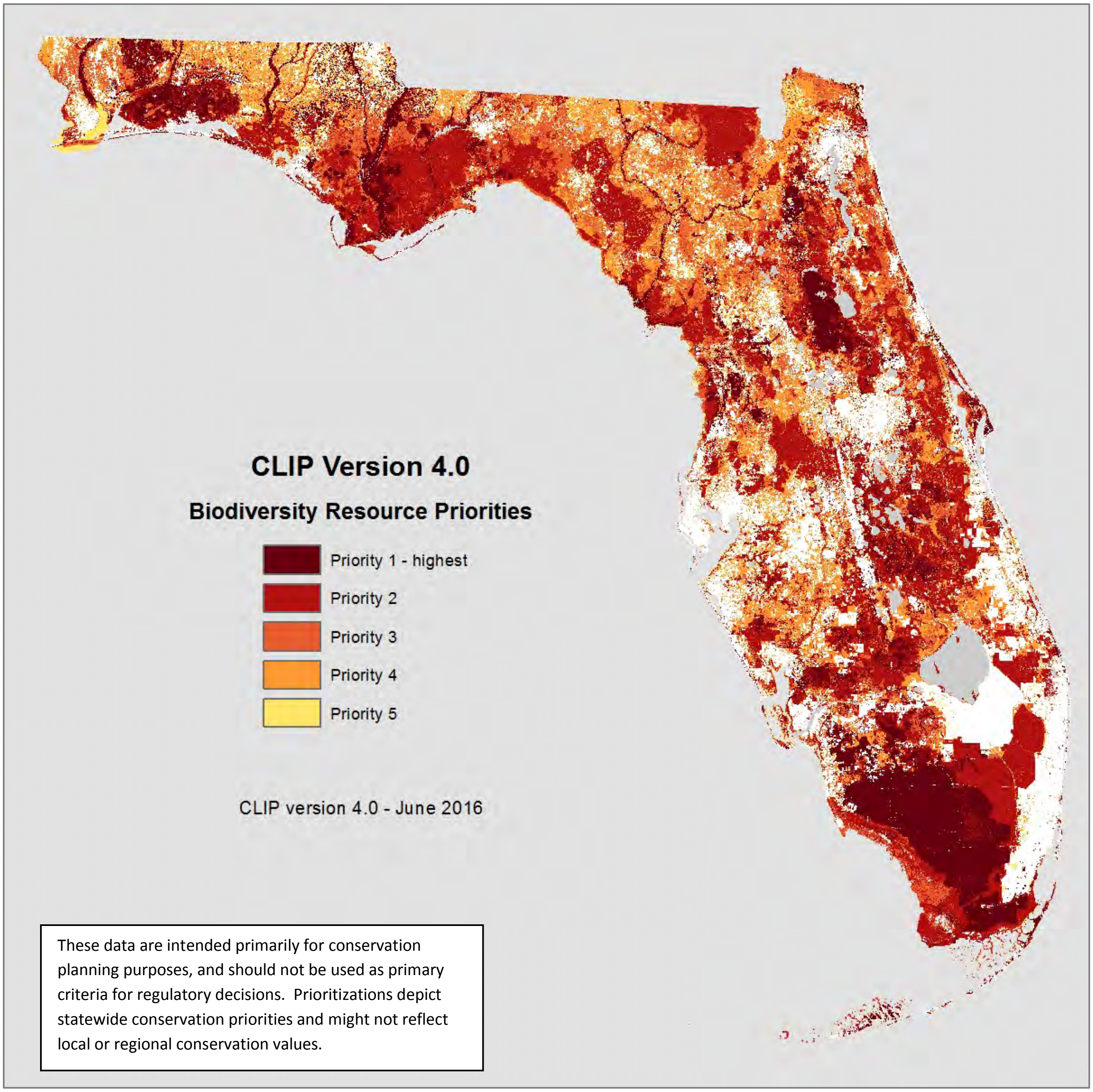

Natural Floodplain
Florida Natural Areas Inventory
Priority 1 - HIGHEST
Priority 2
Priority 3
Priority 4
Priority 5
Priority 6
CLIP version 4.0 - June 2016
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.



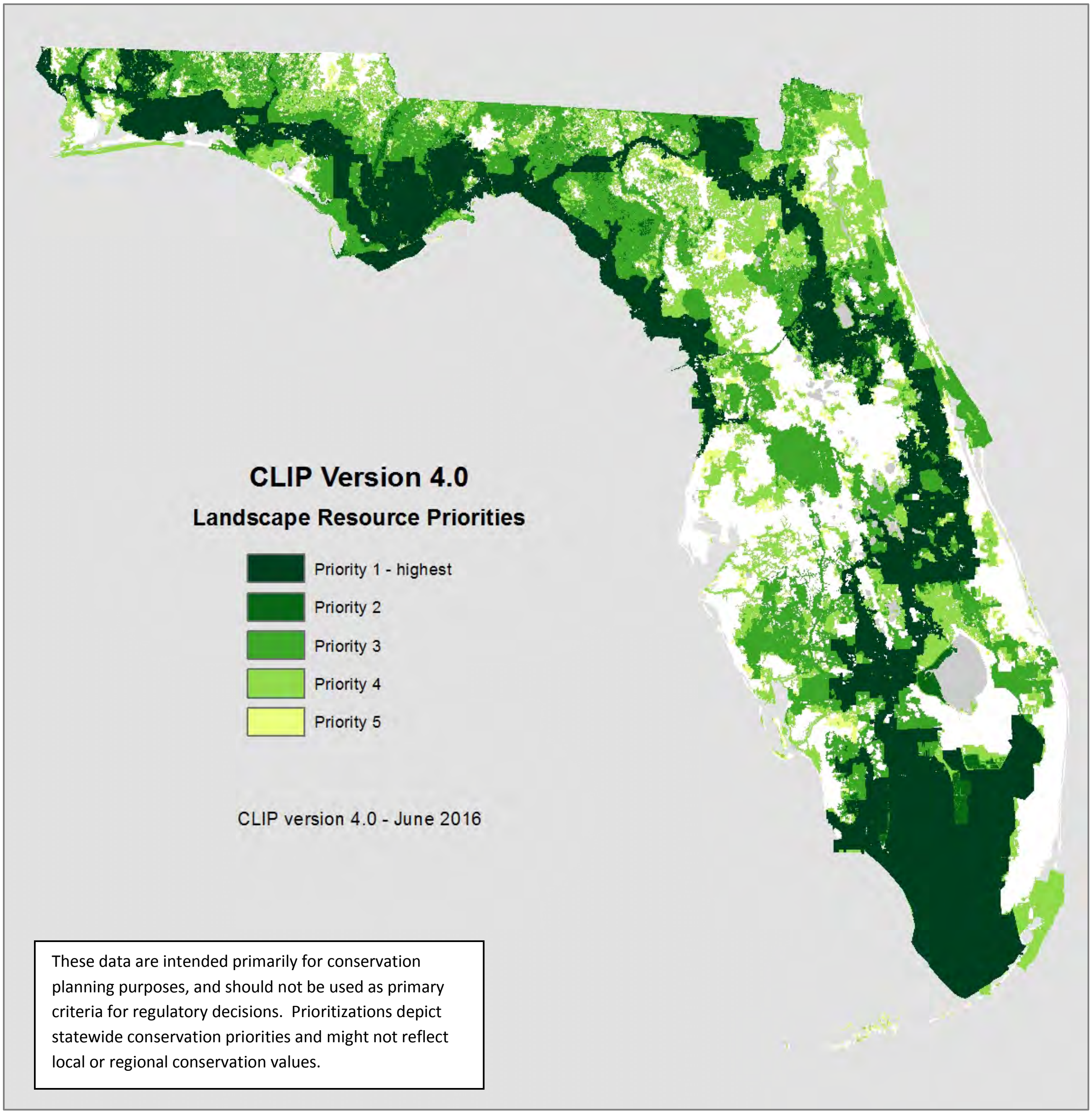
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.

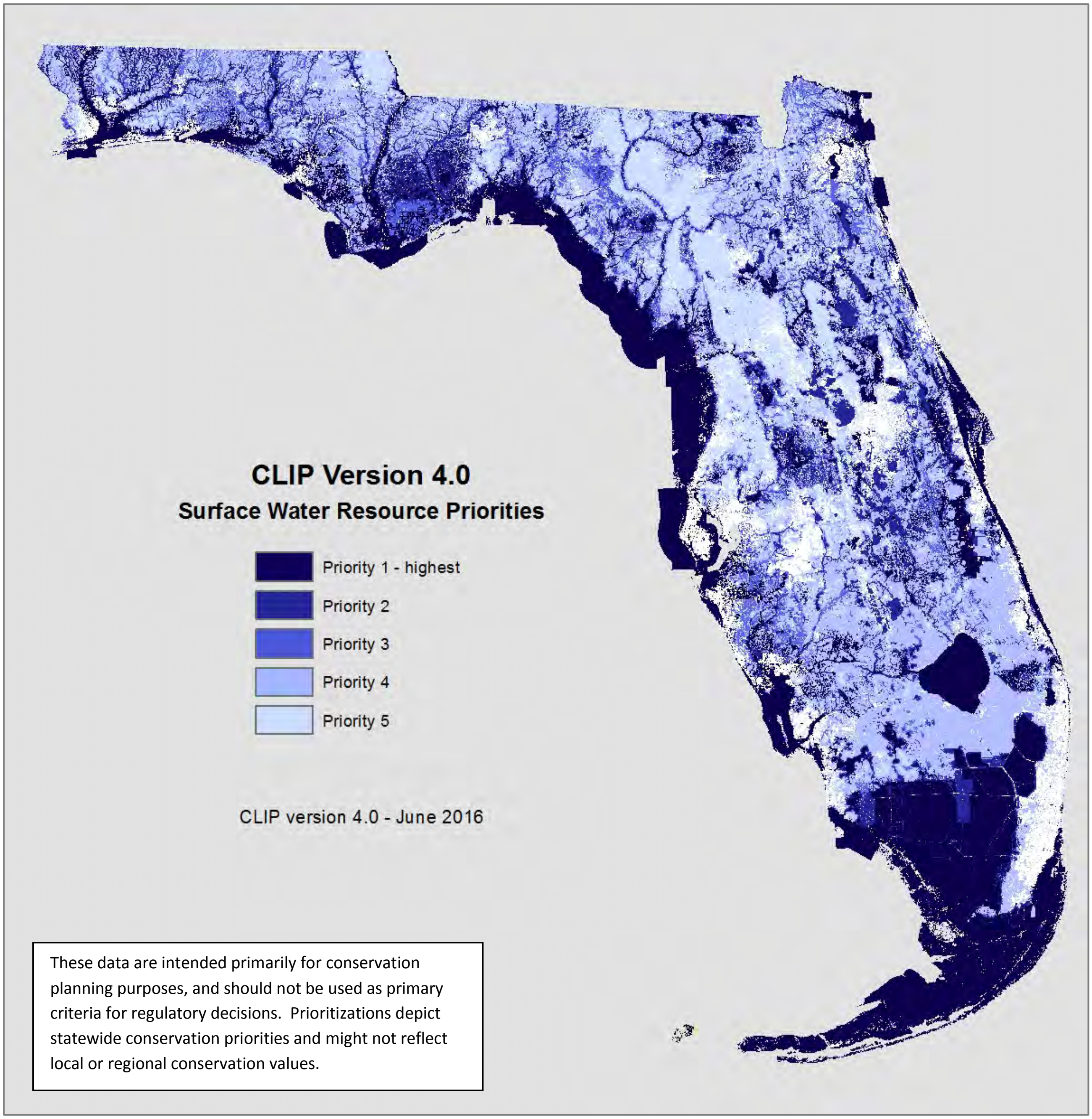


These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.

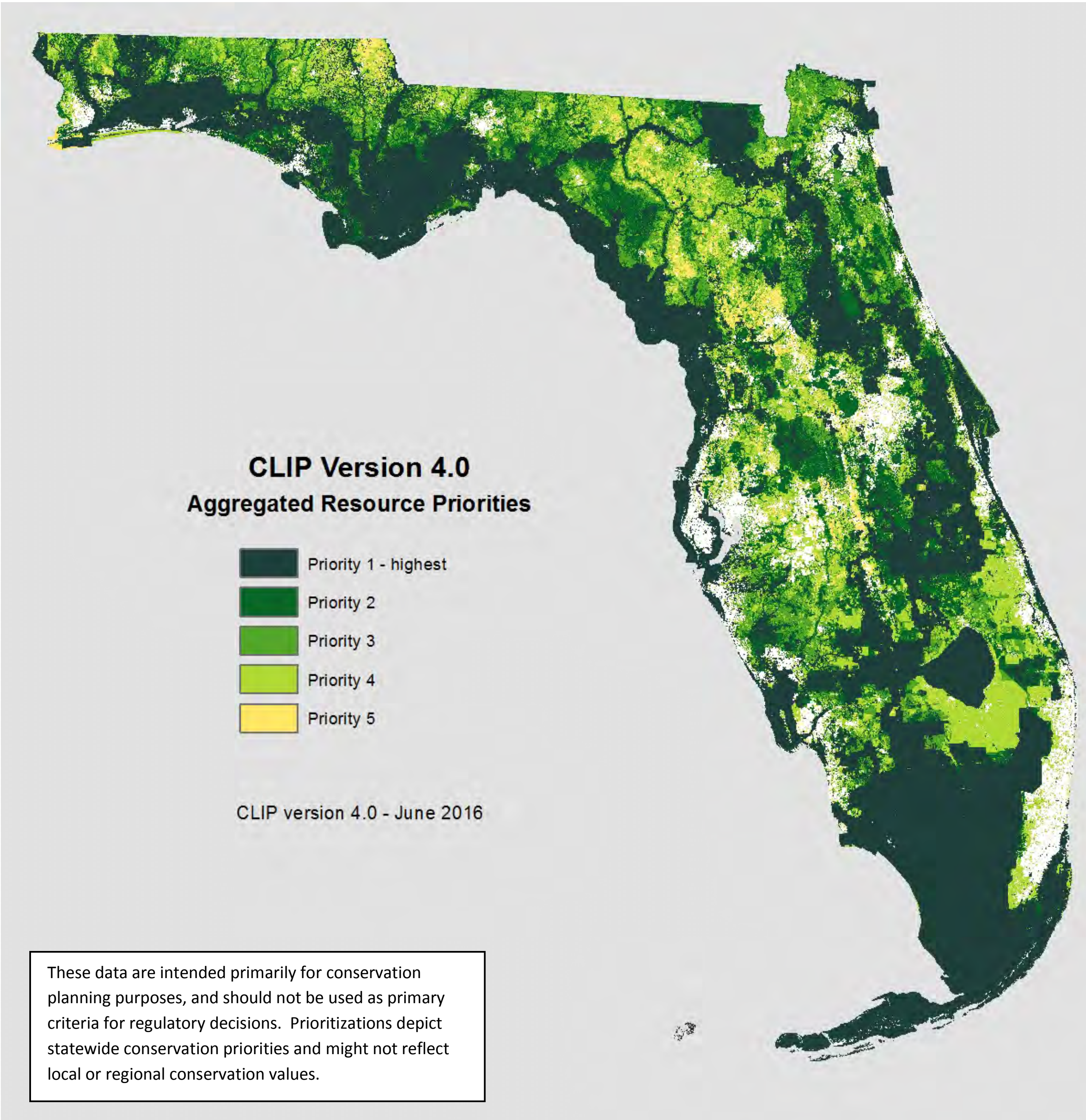


These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.


CLIP Version 4.0
Landscape Resource Priorities
Priority 1 - highest
Priority 2
Priority 3
Priority 4
Priority 5
CLIP version 4.0 - June 2016
These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.



These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.



These data are intended primarily for conservation planning purposes, and should not be used as primary criteria for regulatory decisions. Prioritizations depict statewide conservation priorities and might not reflect local or regional conservation values.

FNAI Rare Species Habitat Conservation Priorities
Species Habitat Overlay Weighting Summary

The scoring systems used to weight habitat models for the 281 species included in the FNAIHAB-CLIP model differs from the method used for the original Florida Forever version of FNAIHAB (currently FNAIHAB-FF version 4.0). The Florida Forever version weights each species habitat model by three factors: Global rarity rank (G-rank), total habitat acres mapped, and percent of habitat protected on existing conservation lands. The CLIP system was designed to prioritize the model toward species most in need of protection through land acquisition. For CLIP we wanted a more general prioritization of species, so the system below uses only G-rank and S-rank (State-level rarity).

The weighting system outlined below was based on a survey and extensive discussions with FNAI scientists with expertise in zoology, botany, and ecology, and first-hand knowledge of many if not all of these species.

Complete documentation of species modeling methods, habitat suitability scoring, and overlay technique are provided in the Florida Forever Conservation Needs Assessment Technical Report (FNAI 2013).

Step 1. Each species was assigned points based on G-rank and S-rank (T-rank indicates subspecies):

GRANK	Points
G1	1200
G2T1	1080
G3T1	936
G4T1	720
G5T1	372
G2	400
G3T2	360
G4T2	312
G5T2	240
G3	120
G4T3	108
G5T3	94
G4	38
G5T4	34
G5	12

SRANK	Points
S1	36
S2	12
S3	4
S4	1
S5	0

continued on page C-2…

Step 2. Grank and Srank points were added to obtain a score, or weight, for each species:

Grank	Points	# Species*	Example Species
G1 S1	1236	112	scrub lupine, torreya, Godfrey's spiderlily, Kemp's ridley, Panama City crayfish
G2T1 S1	1116	9	deltoid spurge, FL lantana
G3T1 S1	972	2	Crystal Lake nailwort
G4T1 S1	756	8	Atlantic saltmarsh snake, Apalachicola River aster
G2 S1	436	22	rockland orchid, blackmouth shiner, fringed campion, shiny-rayed pocketbook
G2 S2	412	49	FL scrub-jay, frosted flatwoods salamander, celestial lily, manatee
G5T1 S1	408	26	FL panther, FL grasshopper sparrow, southeastern beachmouse
G3T2 S1	396	0	
G3T2 S2	372	1	gulf sturgeon
G4T2 S1	348	0	
G4T2 S2	324	4	snail kite, clamshell orchid
G5T2 S1	276	0	
G5T2 S2	252	13	FL black bear, FL sandhill crane, hairy beach sunflower, mangrove fox squirrel
G3 S1	156	17	shoal bass, gray bat, snowy plover
G4T3 S1	144	0	
G3 S2	132	4	red-cockaded woodpecker, piping plover, green turtle, rayed creekshell
G5T3 S1	130	0	
G3 S3	124	13	loggerhead, FL bonamia, eastern indigo snake, scrub plum
G4T3 S2	120	0	
G4T3 S3	112	1	scrub buckwheat
G5T3 S2	106	0	
GNA S1	99	1	eaton's spleenwort
G5T3 S3	98	0	
G4 S1	74	3	meadow jointvetch, triangle floater
G5T4 S1	70	0	
G4 S2	50	1	wood stork
G5 S1	48	0	
G5T4 S2	46	0	
G4 S3	42	0	
G4 S4	39	0	
G5T4 S3	38	0	
G5T4 S4	35	0	
G5 S2	24	1	crested caracara
G5 S3	16	0	
G5 S4	13	0	
G5 S5	12	0	

*species included in FNAIHAB model, not all species.

Step 3. Species models were scored by weight multiplied by suitability score (10-point scale) and overlaid. Class breaks were assigned to divide the continuous value range into 6 priority classes:

Class	Values	Examples (assuming High suitability)
Priority 1	12,000+	1 G1S1, 3 G2S2, 10 G3S3, 31 G4S4, 100 G5S5
Priority 2	5850-11,999	2 G2S2, 5 G3S3, 15 G4S4, 49 G5S5
Priority 3	3520-5849	1 G2S2, 1 G3T2S2, 3 G3S3, 10 G4S4, 30 G5S5
Priority 4	1700-3519	1 G5T2S2, 2 G3S3, 5 G4S4, 15 G5S5
Priority 5	780-1699	1 G3S3, 2 G4S4, 9 G5S5
Priority 6	1-779	1 G4S4, 1 G5S5

APPENDIX D. CLIP 4.0 Priority Natural Communities:

Criteria for Prioritization

FNAI developed the following prioritization system for natural communities in consultation with staff ecologists.

- Natural Communities were categorized as "small patch" or "large extent" for prioritization purposes:

  Small Patch:

  - Upland Glade*
  - Pine Rockland**
  - Coastal Uplands
  - Scrub
  - Seepage Slope
  - Tropical Hammock
  - Sandhill Upland Lake
  - Imperiled Coastal Lakes

  Large Extent:

  - Dry Prairie
  - Sandhill
  - Pine Flatwoods
  - Upland Pine
  - Upland Hardwood Forest
  - Coastal Wetlands

- Natural Communities were prioritized into 3 classes – Very High, High, and Medium (areas of less than “Medium” quality would not have been mapped).

- *All areas of **Upland Glade** are classed **Very High**.

- ****Pine Rockland** was classed based on patch size only. Patches less than 0.25 acres were classed High, all larger patches were classed Very High (based on consultation with scientists).

- Remaining communities were prioritized using the **Land Use Intensity Index** (LUI) with a bonus for **Potential Natural Areas** (PNA) Priorities 1-4 as shown in the following prioritization matrices:

Small Patch:

LUI	Priority	PNA 1-4 Bonus
10	V HIGH	V HIGH
9	V HIGH	V HIGH
8	V HIGH	V HIGH
7	V HIGH	V HIGH
6	HIGH	V HIGH
5	HIGH	V HIGH
4	MED	HIGH
3	MED	MED
2	MED	MED
1	MED	MED

Large Extent:

LUI	Priority	PNA 1-4 Bonus
10	V HIGH	V HIGH
9	V HIGH	V HIGH
8	V HIGH	V HIGH
7	HIGH	V HIGH
6	HIGH	V HIGH
5	MED	HIGH
4	MED	HIGH
3	MED	MED
2	MED	MED
1	MED	MED

- **Note that PNA values 5 and 100 are not included.** For this analysis those areas were treated as Non-PNA to allow the LUI to dictate the result.
- In general this system was determined to be compatible with reference natural community points and natural community EOs.

Florida Ecological Greenways Network CLIP 4 Priorities Update

Introduction

As part of the CLIP 4.0 updates we included revisions to the priorities in the Florida Ecological Greenways Network (FEGN), in an effort to follow recommendations to continue work discussed in the report for the 2013 update of the FEGN (Hoctor et al. 2013).
There are three primary goals for updating the priorities in the Florida Ecological Greenways Network (FEGN):

1) Addressing potential impacts to FEGN high priorities (Priority 1 Critical Linkages and Priority 2) by up to a projected 3m sea level rise (SLR);

2) Elevating the priority of FEGN corridors that could functionally link Florida conservation lands to other states;

3) Conducting boundary edits to lower priority areas that are not essential for completing higher priority corridors (P1-P5), and consideration of additional areas either within the FEGN or not currently within the FEGN that may be relevant for ensuring the functionality of higher priority corridors within the FEGN.

The first step of this process was the development of a comparison of the FEGN high priorities with projected SLR of 1m, 2m, and 3m (**Figure 1**). This comparison indicated that there are two high priority areas potentially most affected by SLR that may be addressed by adding additional areas beyond projected SLR: the Big Bend coast from the Crystal River area north and west to Apalachicola National Forest (**Figure 2**); and the middle St. Johns River area east of Sanford (**Figure 3**).

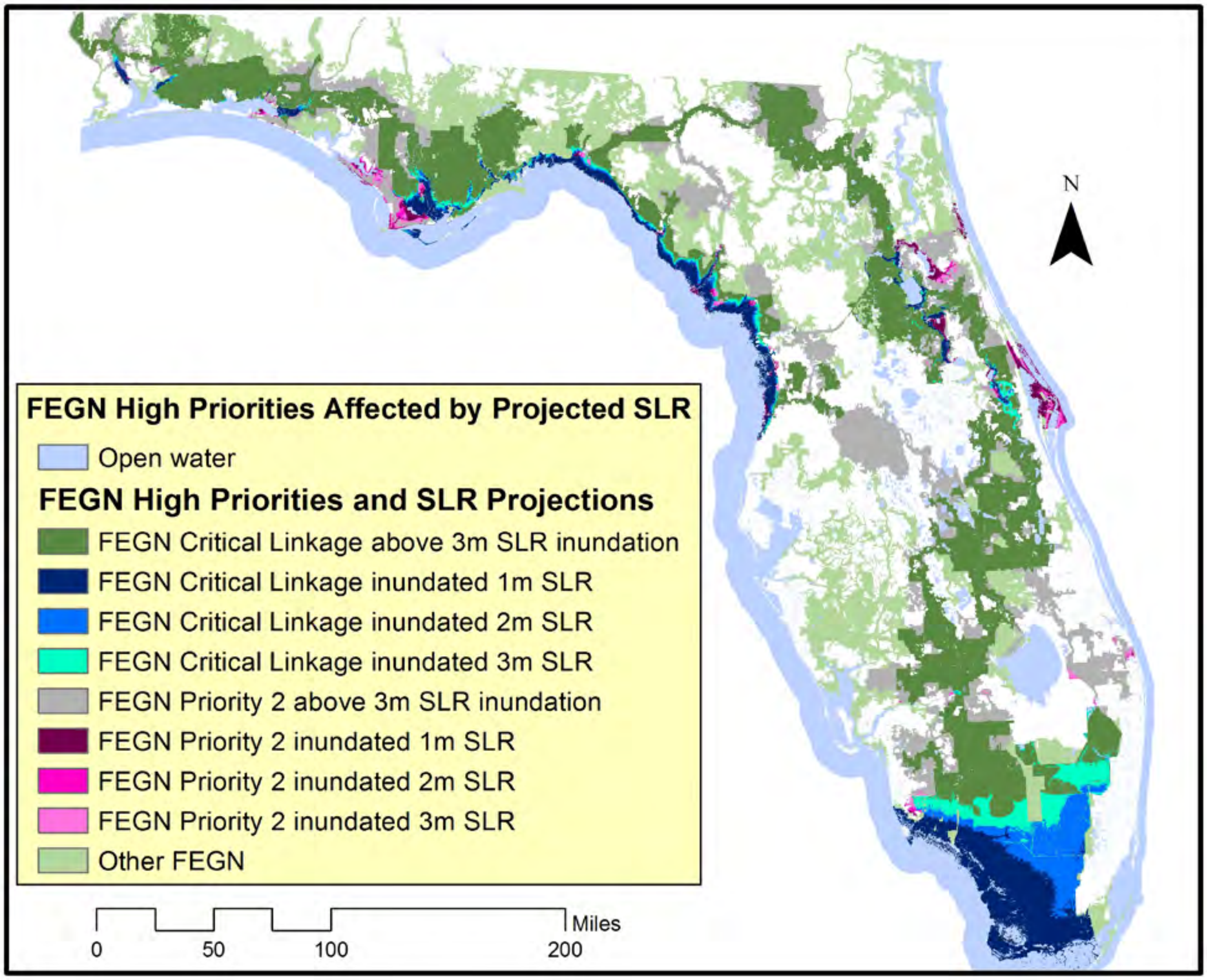


Figure 1. Potential impacts of SLR up to 3 meters on FEGN Critical Linkages and Priority 2 corridors.

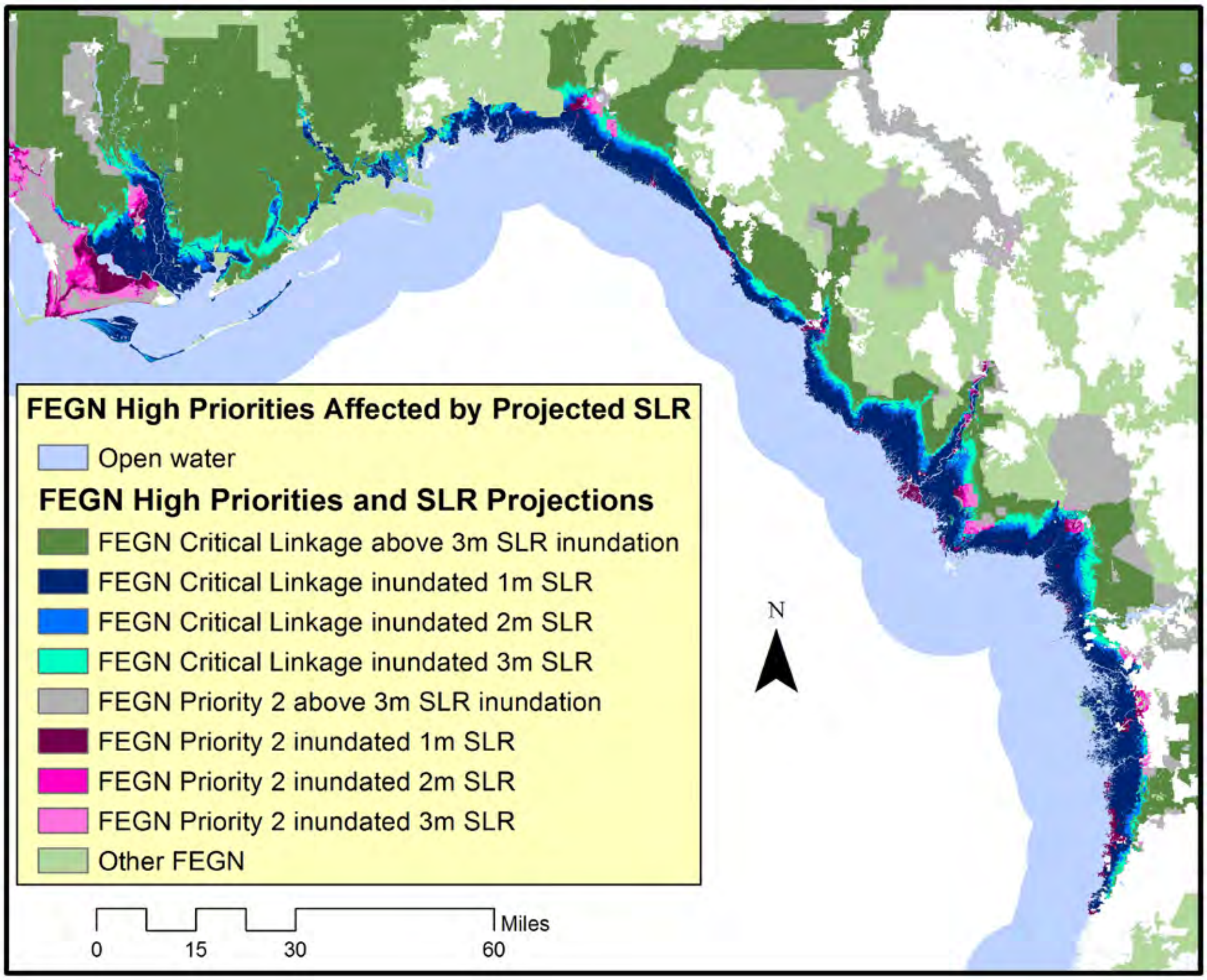


Figure 2. Potential impacts of SLR up to 3 meters on FEGN Critical Linkages and Priority 2 corridors in the Florida Big Bend region.

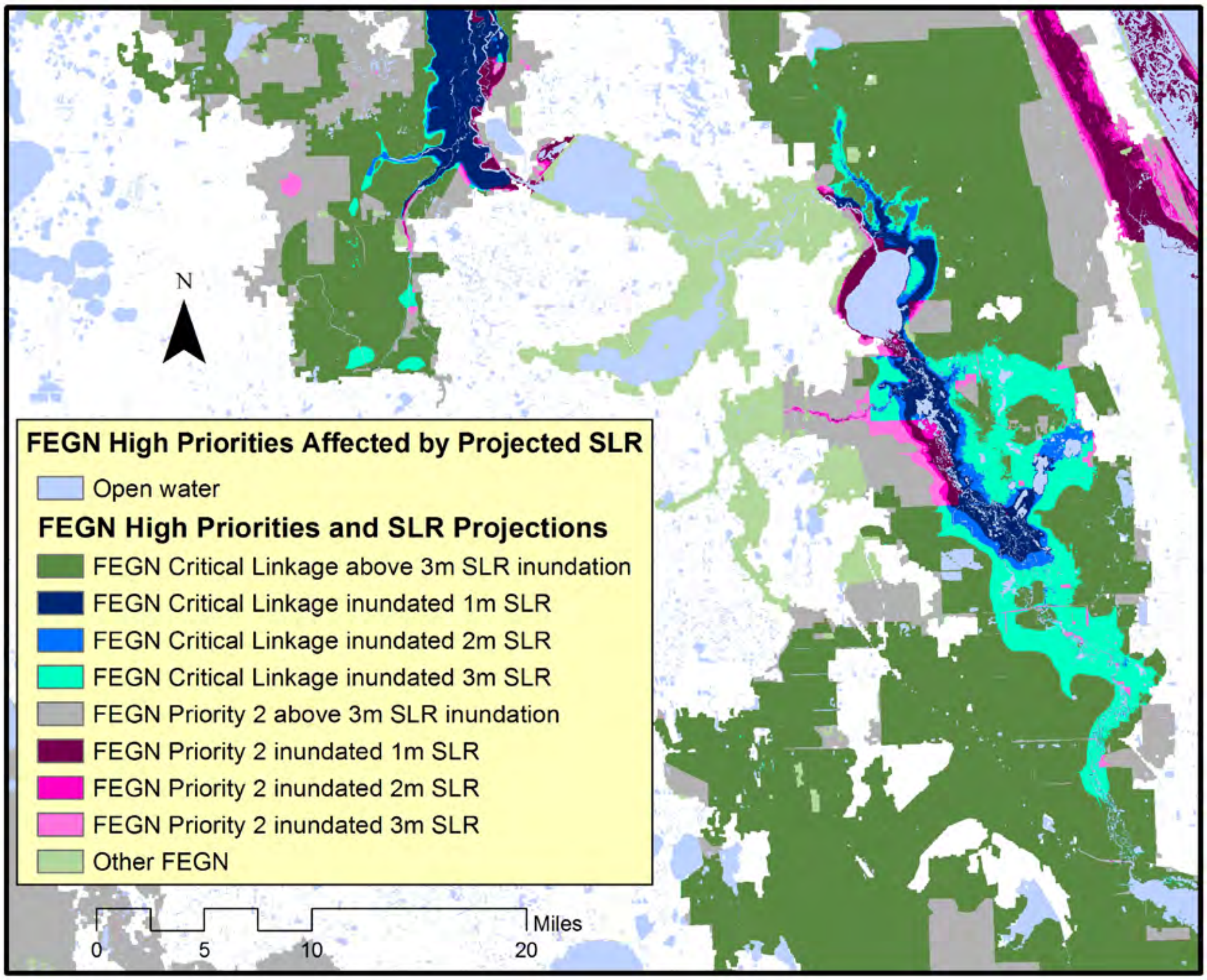


Figure 3. Potential impacts of SLR up to 3 meters on FEGN Critical Linkages and Priority 2 corridors in middle St. Johns area east of Sanford and Orlando.

We developed options to present to the CLIP TAG for addressing SLR impacts in these areas. There are many potential options for addressing the potential impacts to the Big Bend FEGN high priorities including:

1) Expanding the high priorities and potentially adding additional lands into the FEGN along the Big Bend coast to provide a wide corridor (up to 2 miles or more) beyond a 3m SLR (**Figure 4**).
2) Elevating the priority of a more inland wetland corridor traversing Mallory Swamp and San Pedro Bay (**Figure 4**).
3) Elevating the priority of the Suwannee River corridor from its mouth up river to east of San Pedro Bay (**Figure 4**).
4) Addition of high priority inland corridors from the Aucilla River and/or St. Marks River conservation lands southeast of Tallahassee north to the Red Hills, west to the Ochlockonee River, and then south to Apalachicola National Forest (Red Hills corridor) to address potentially extreme SLR impacts in the St. Marks National Wildlife Refuge area (**Figure 5**).

The middle St. Johns River option was to consider expanding the Critical Linkage around strategic areas of the St. Johns River, which is currently the only Critical Linkage connecting conservation lands in south Florida to those in the rest of the state. The options for expansion are limited by development to the west and east of the river corridor, though there are some opportunities to widen the Critical Linkage (**Figure 6**). This could include elevating the lower Econlockhatchee River to Critical Linkage status. Other options we considered included adding a second Critical Linkage between south and north Florida along the I-4 corridor. The two options for accomplishing this objective are a potential corridor between Reedy Creek and the Green Swamp primarily in western Orange County (**Figure 7**) and a Peace River to Green Swamp connection east of Lakeland (**Figure 8**).

We also considered assigning higher priority to south to north corridors within north Florida that connect to areas of conservation significance in Georgia and Alabama. FEGN Critical Linkages have up to this point emphasized protecting functional ecological connectivity across Florida. However, adaptation to climate change should include protection or restoration of options to facilitate northward migration. Though this is addressed by Critical Linkages in the Florida peninsula, it is not addressed directly by Critical Linkages in the Panhandle, which are primarily oriented east-west versus south-north. One option for addressing this issue was to consider elevating various river corridors or other strategic areas in north Florida from current moderate priority status (Priority 3 or Priority 4) to at least Priority 2 or Priority 3 (if not Critical Linkage) status when they provide significant opportunities to connect to conservation lands or other landscape-scale ecological priorities in southern Georgia or Alabama (**Figure 9**).

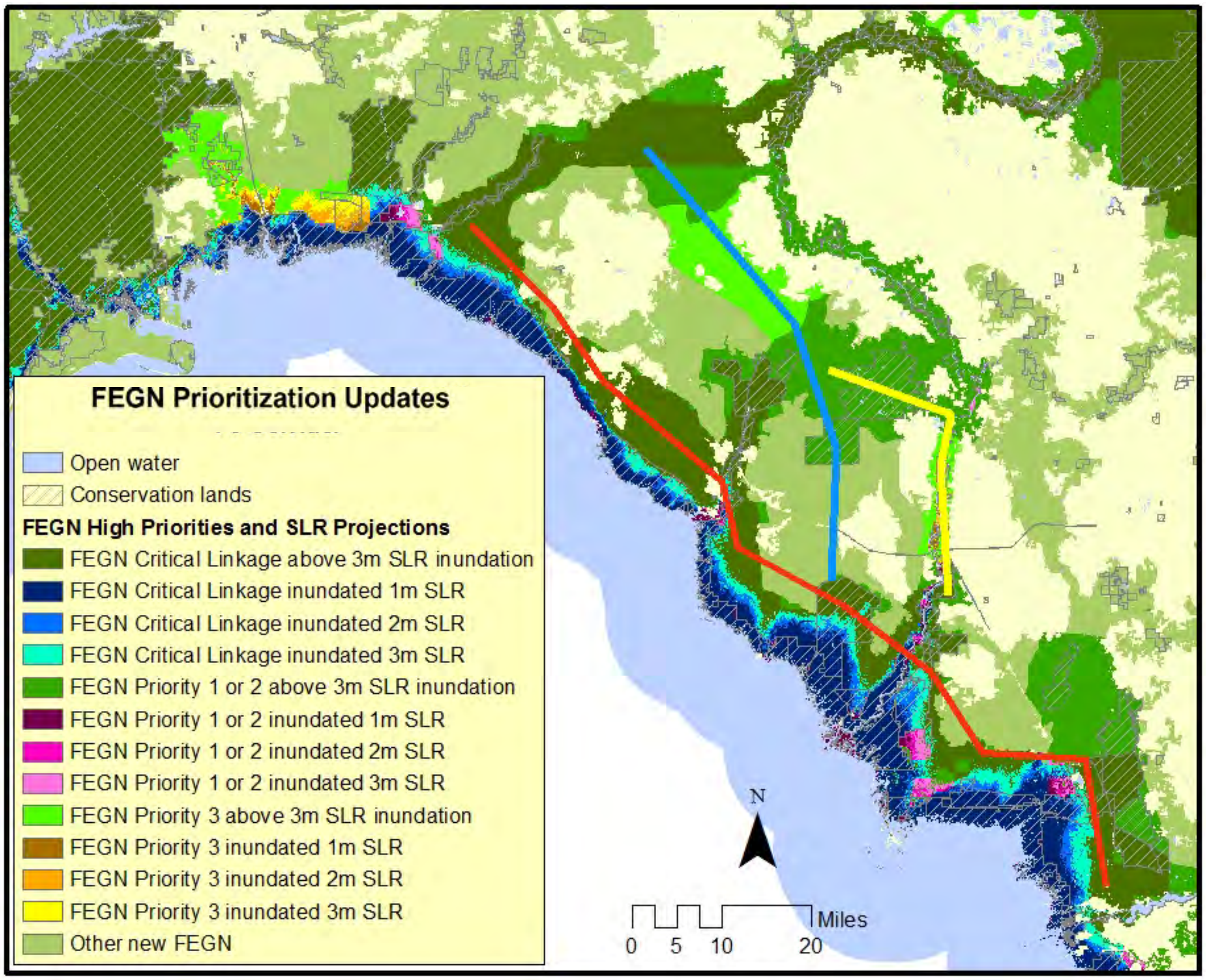


Figure 4. Options for addressing SLR impacts on the Big Bend Critical Linkage. The coastal expansion option is represented by the red line; the interior higher priority option is represented by the blue line; the Suwannee River corridor higher priority option is represented by yellow line.

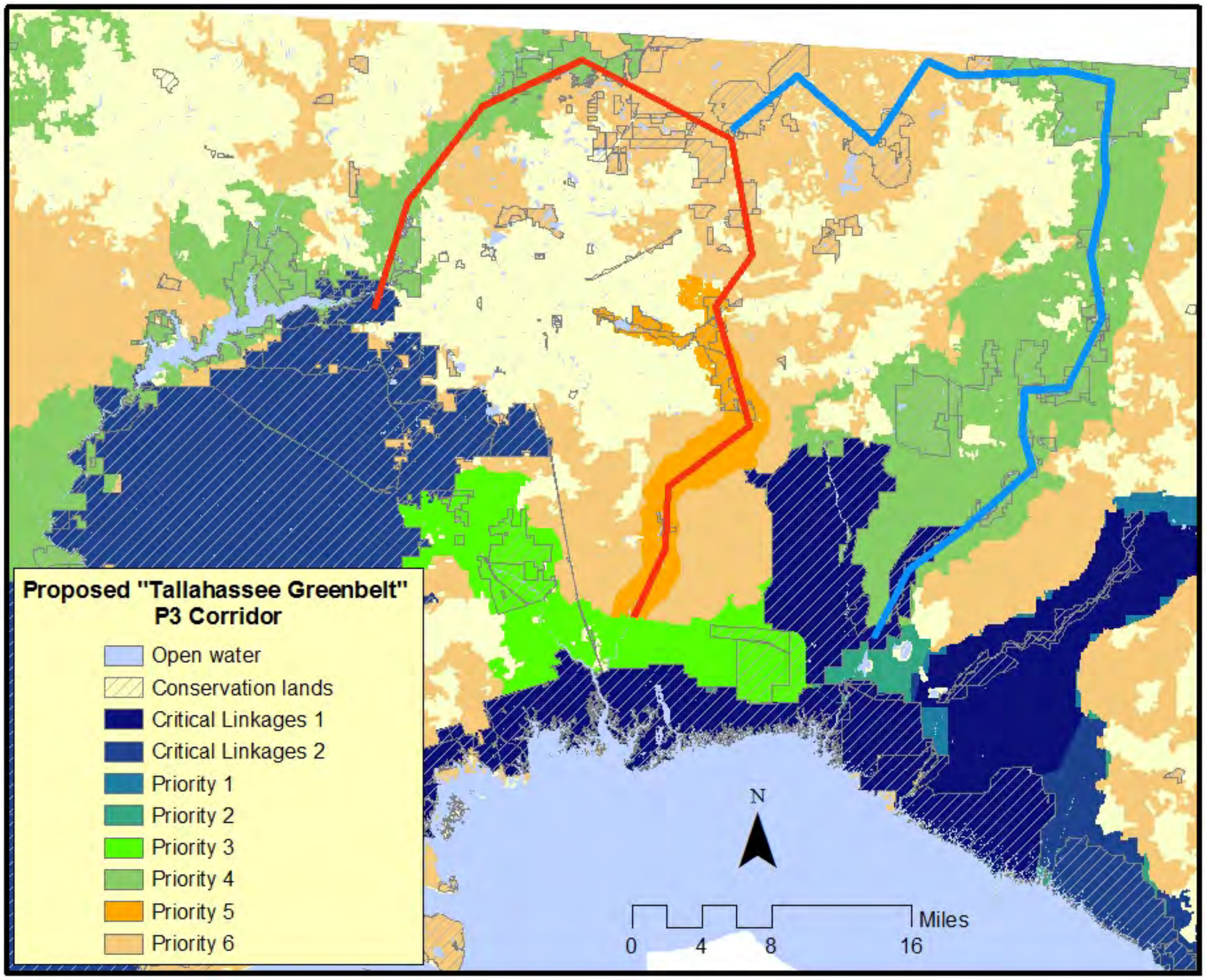


Figure 5. Options for addressing SLR impacts on the St Marks Critical Linkage. The St. Marks River option is represented by the red line; the Aucilla River option is represented by the blue line.

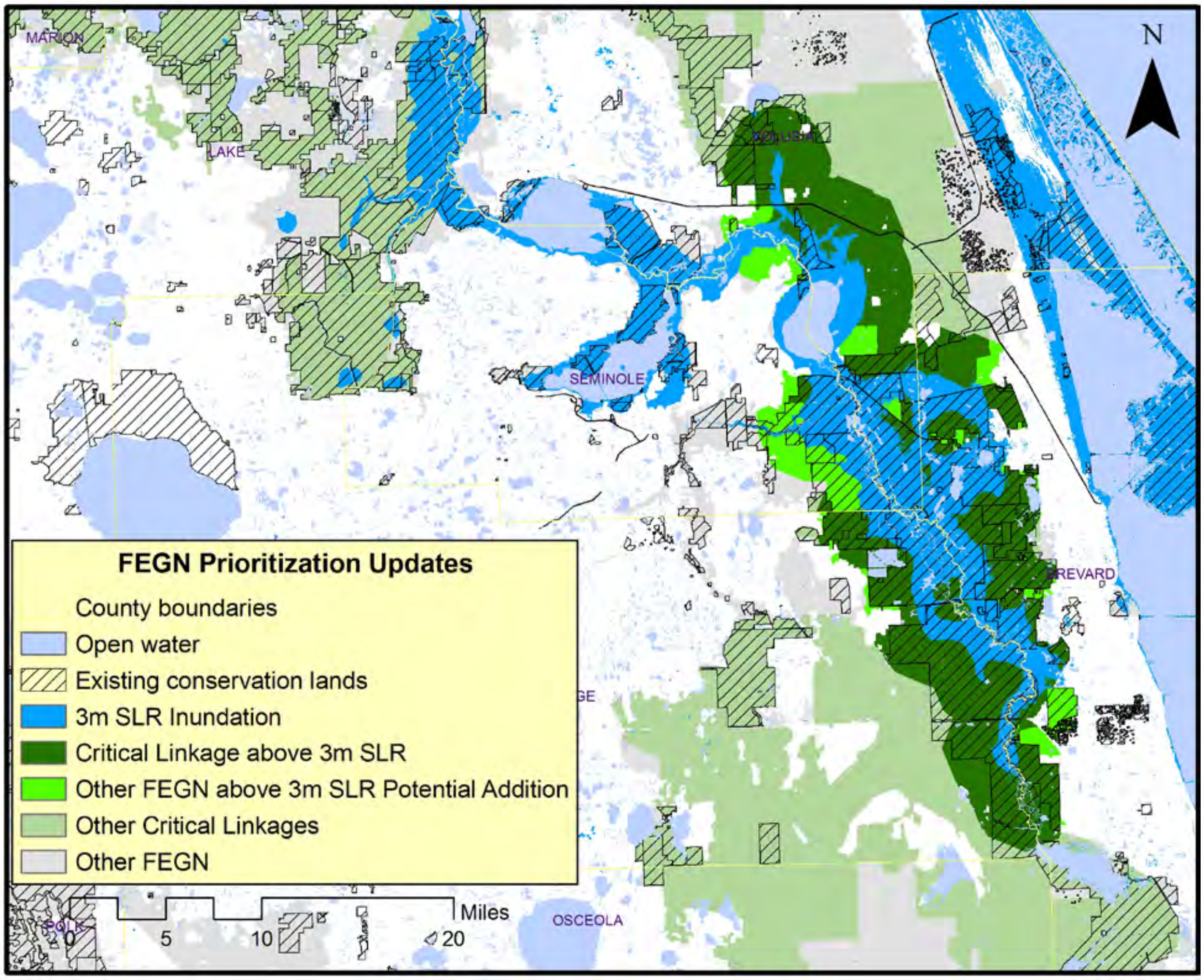


Figure 6. Options for addressing SLR impacts on the middle St. Johns River.

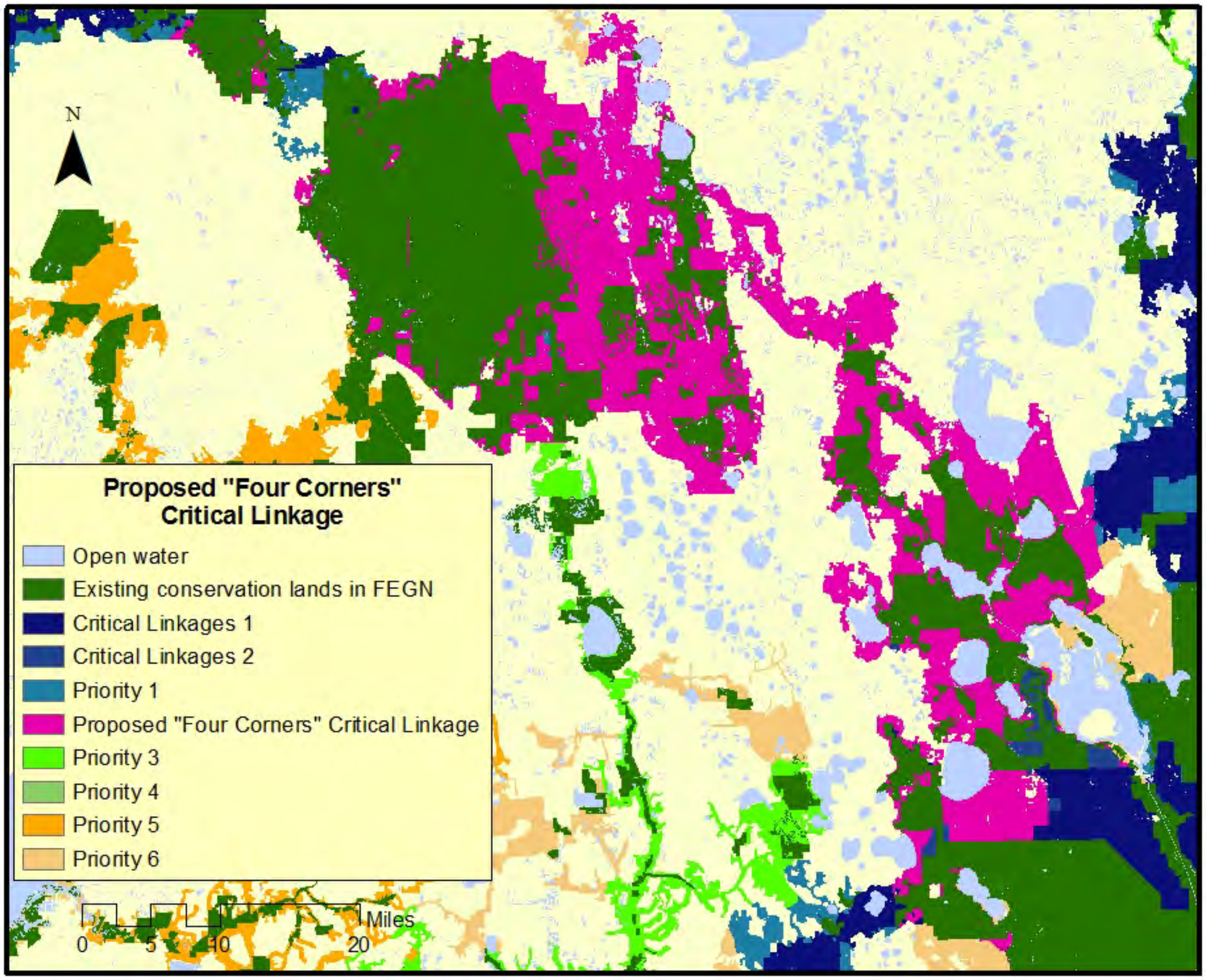


Figure 7. Potential Reedy Creek to Green Swamp Critical Linkage in pink.

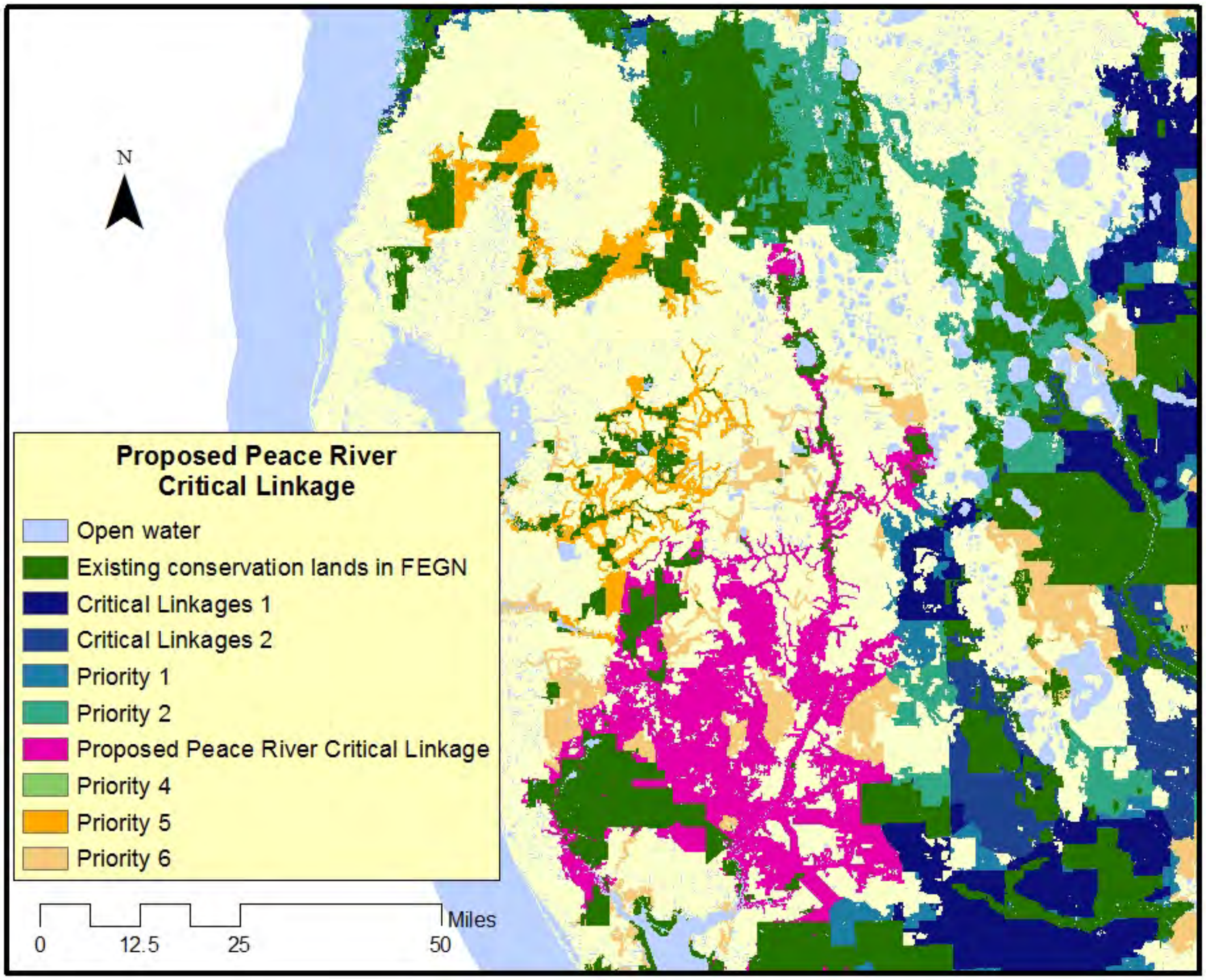


Figure 8. Potential Peace River Critical Linkage in pink.

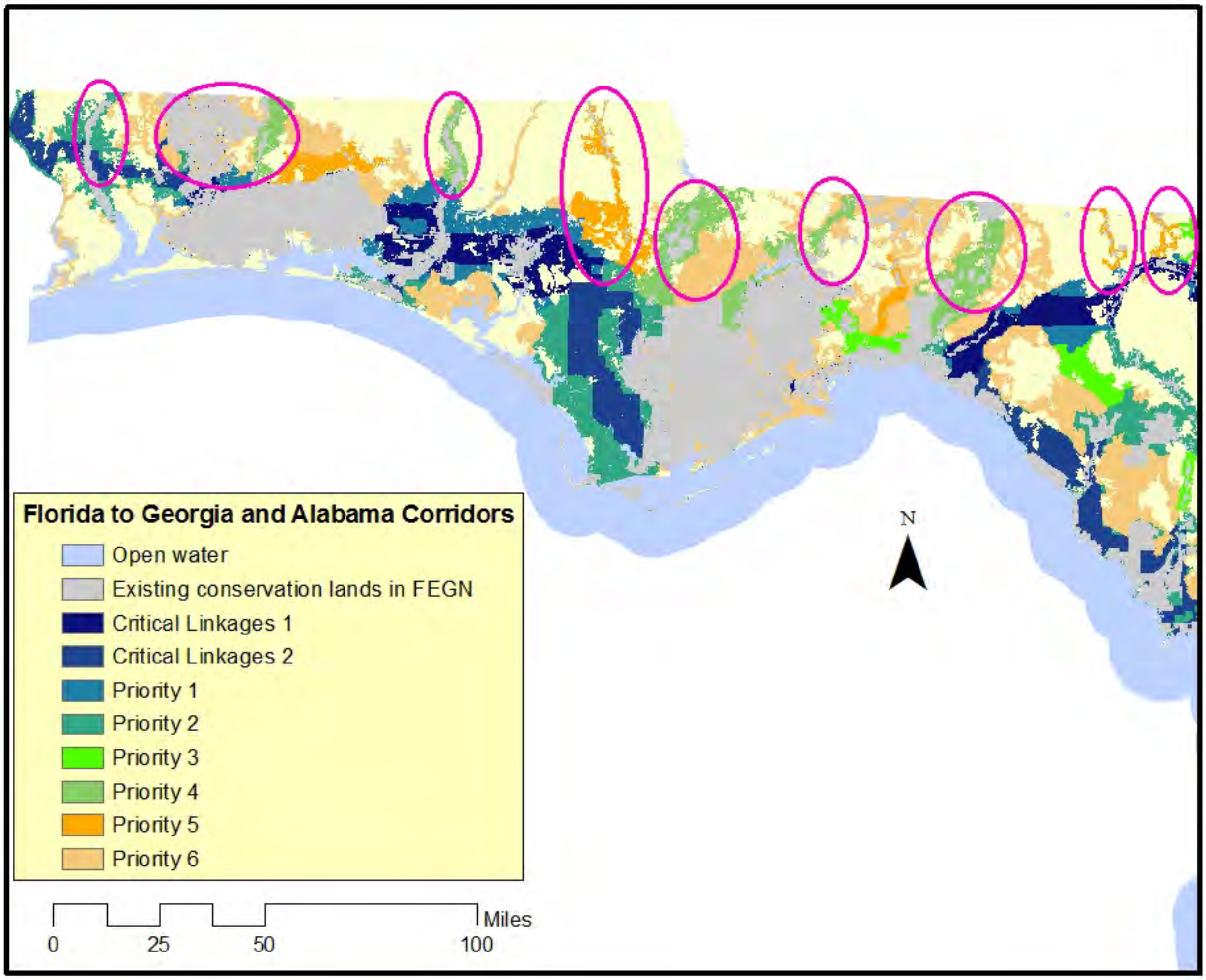


Figure 9. Options for assigning higher priority to south to north corridors within north Florida that connect to areas of conservation significance in Georgia and Alabama.

FEGN Priority clean up edits could occur anywhere in the state. This was primarily an automatic process to identify high priorities that are either isolated from primary corridors or occupy dead ends such as “peninsulas” or fragmented areas that are not essential for protecting a functional corridor. Additions to the FEGN base boundary were considered in only a few key areas where additions appear to be essential for addressing corridor functionality including consideration of SLR impacts described above. Candidate areas included the Big Bend, middle St. Johns River, and the narrow areas in the Critical Linkage north of Panama City.

All of the proposed edits were presented to the CLIP TAG in March 2015.

<u>TAG Recommendations</u>

After discussion at the March 2015 TAG meeting, the TAG recommended the following actions to update the FEGN priorities:

1) Expand the Big Bend Critical Linkage inland beyond a 3m SLR.
2) Elevate the inland Big Bend priority corridor alternative to a Priority 2 or 3 as appropriate.
3) Expand the St. Marks Critical Linkage to include current lower priority areas between the Aucilla and Wakulla conservation areas.
4) Add a Priority 2 corridor north of the St. Marks Critical Linkage south of Tallahassee.
5) Elevate the upper St. Marks River, Aucilla River, Red Hills region, and upper Ochlockonee River corridors to a Priority 2 alternative to the coastal St. Marks-Wakulla Critical Linkage.
6) Expand the middle St. Johns River Critical Linkage where feasible to the east and west (possibly including the Lower Econlockhatchee River) to provide more buffer from development as the river potentially widens due to SLR.
7) Elevate the various south to north rivers in North Florida that are currently Priority 4 or 5 to Priority 2 as important connectors to Georgia and Alabama IF they connect to existing conservation lands in those states and/or have significant riparian corridors. Also consider upland corridors into Georgia and Alabama such as the Red Hills region if they connect, or could connect, to important conservation areas in those states.
8) Table any elevation of the Peace River corridor beyond its current status as a Priority 3.
9) Table any elevation of the Four Corners corridor connecting the upper Kissimmee River basin to the Green Swamp from its current status as a Priority 2.

<u>Final Process</u>

A. Big Bend Coastal

We used a Lidar-based 3 meter sea level rise projection overlaid with FEGN Critical Linkages along the Big Bend coast from Crystal River north and west to the west end of the St. Marks National Wildlife Refuge to identify all intact land cover connected to the outer edge of the 3 meter SLR projection within the Critical Linkage and within 2 miles of this edge to expand the FEGN to two miles inland beyond the 3 meter SLR. This included both areas that were within existing lower priority areas of the FEGN and some areas not currently within the FEGN but in compatible natural or low-intensity land uses (such as pine plantations). All such areas were added to the revised Big Bend Critical Linkage (**Figure 10**).

B. Big Bend Inland

We used ARCGIS Cost Path to identify an approximately 5 mile wide corridor within the existing FEGN boundary between the Forest Systems Conservation Easement and Mallory Swamp as a new Priority 3 corridor. The Cost Surface for running Cost Path included all areas of compatible natural and semi-natural land use with CLIP Land Use Intensity values from 6-10 (the top scoring half of the CLIP Land Use Intensity data layer). A 5 mile width was selected simply to match the existing Priority 3 corridor to the north between Mallory Swamp and San Pedro Bay. In addition, the lower Suwannee River Corridor was elevated from a Priority 3 to a Priority 2 (**Figure 11**).

C. Middle St. Johns River Critical Linkage Expansion

We used a Lidar-based 3 meter sea level rise projection overlaid with the FEGN Critical Linkage along the Middle St. Johns River from Lake Harney south to Lake Winder. We identified all intact land cover connected to the outer edge of the 3 meter SLR projection within the Critical Linkage and within 2 miles of this edge to expand the FEGN to two miles inland beyond a 3 meter SLR. This included both areas that were within existing lower priority areas of the FEGN and some areas not currently within the FEGN but in compatible natural or low-intensity land uses (such as pine plantations). All such areas were added to the revised St. Johns River Critical Linkage (**Figure 12**). In addition, areas to the west of the St. Johns River south of Lake Winder were also added to the St. Johns River Critical Linkage to further widen the corridor to address both potential SLR and future development impacts (**Figure 13**). This revision was based on a TAG discussion of the final proposed changes to the FEGN priorities in February 2016.

D. Aucilla-St. Marks-Red Hills-Ochlockonee Corridor

These revisions were simple re-assignments of lower priorities already with the FEGN. All areas south of Tallahassee were reassigned to Priority 2. In addition, the riparian corridors around the Aucilla, St. Marks, and Ochlockonee Rivers were all elevated to Priority 2. Finally, the conservation lands in the Red Hills and compatible private lands between them and these three rivers that were also already in the FEGN were also elevated to Priority 2 to create the new Aucilla-St. Marks-Red Hills-Ochlockonee Corridor (**Figure 14**).

E. Northern Florida River Corridor Priority Revisions

This was also an elevation of areas currently within the FEGN to Priority 2 corridor status. Each of the north Florida rivers that begin in either Alabama or Georgia were assessed for their connections to existing conservation lands and/or larger areas of natural or low intensity land uses in these other two states. All rivers that provided such connections were elevated to Priority 2 including: the Escambia River, Yellow River, Choctawhatchee River, Apalachicola River, Withlacoochee River, and Wacissa River (**Figure 15**). The only river not elevated after this analysis was the Chipola River, which did not provide an opportunity for significant ecological connectivity into Alabama.

F. Widening the Apalachicola-Sand Mountain Critical Linkage

One of the goals of this FEGN priorities update was to consider adding additional areas either within the FEGN or not currently within the FEGN that may be relevant for ensuring the functionality of higher priority corridors within the FEGN. The one additional location not addressed in the revisions already discussed above that needed revision to better ensure the opportunity to protect functional ecological connectivity was the Apalachicola-Sand Mountain Critical Linkage in the Florida panhandle. In the previous version of the FEGN completed in 2013, this Critical Linkage narrowed around Econfina Creek north of Panama City (**Figure 16**). To widen this corridor, we identified all compatible natural and low intensity land uses within gaps in the current Critical Linkage. All such land that was connected to and surrounded by the current Critical Linkage was added to the new Critical Linkage, which resulted in a significantly wider corridor in the area around Econfina Creek (**Figure 17**).

G. Other Prioritization Edits

1) Clean up of higher priorities: any isolated patches of higher priorities (greater than priority 6) not connected to larger, functional corridors were identified and demoted to the adjacent lower priority (usually priority 6). These isolated priority areas were the result of the original methods to update the priorities in the 2013 version of the FEGN, where the first step in the reassignment of priorities was to assign the new FEGN base boundary (unprioritized) the priority of the overlapping or closest highest priority in the previous FEGN version. In some cases, this resulted in small areas of higher priorities that did not show in state-scale maps and were small in total acres but were not functionally significant. This clean up process reduces the likelihood of any confusion when using the FEGN for planning purposes at regional to local scales.
2) As the priority updates were discussed, it became clear that a number of Priority 4 corridors were likely to be elevated to higher priorities. Based on this outcome, and the desire to further simplify the FEGN priorities, the CLIP team and TAG agreed that the FEGN 2013 Priority 4 and Priority 5 corridors should all be combined into a new Priority 4, with the resulting 5 priority classes:

   2013 Priority 1 = Priority 1
   2013 Priority 2 = Priority 2
   2013 Priority 3 = Priority 3
   2013 Priority 4 = Priority 4
   2013 Priority 5 = Priority 4
   2013 Priority 6 = Priority 5

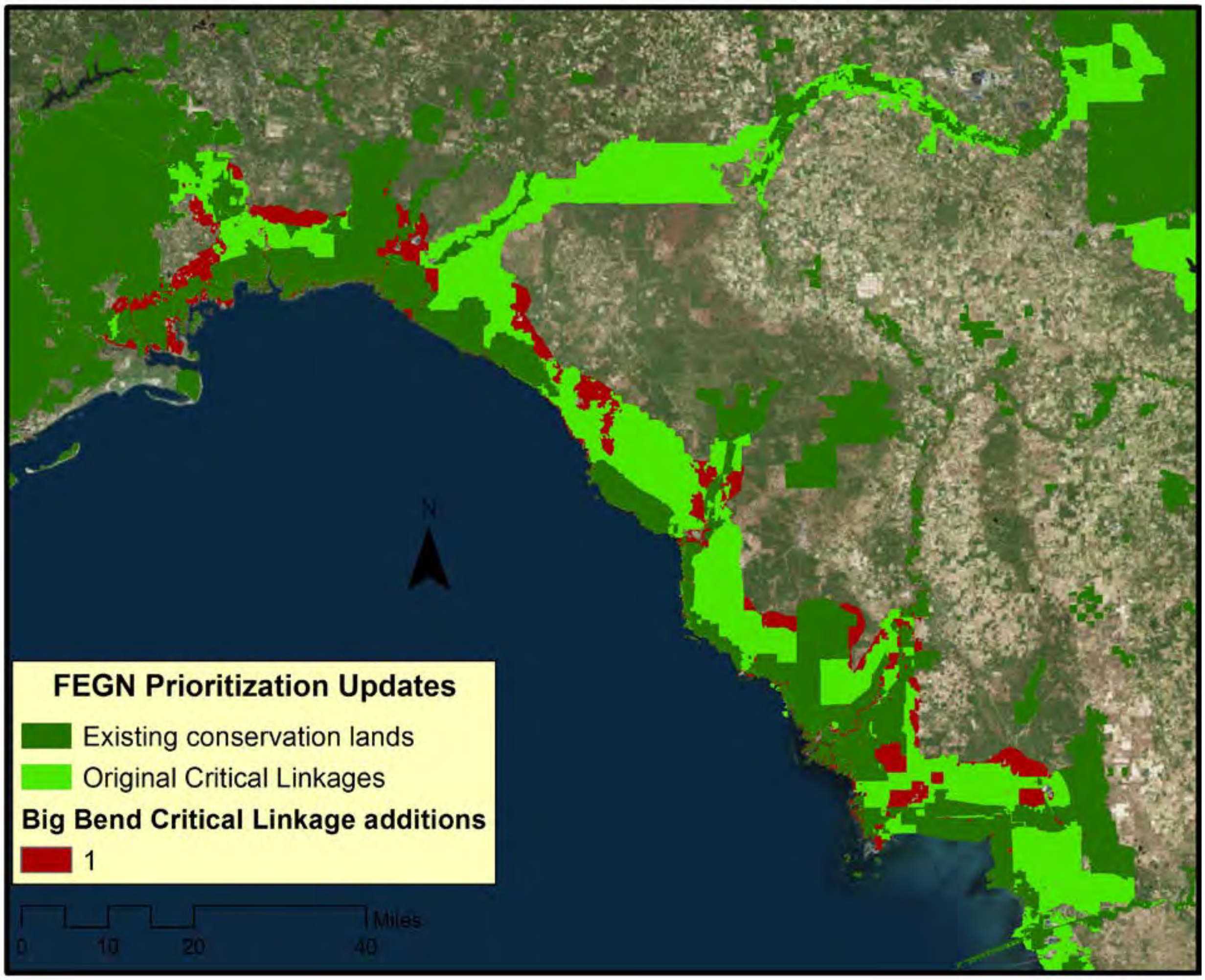


Figure 10. Additions to the Big Bend Critical Linkage.

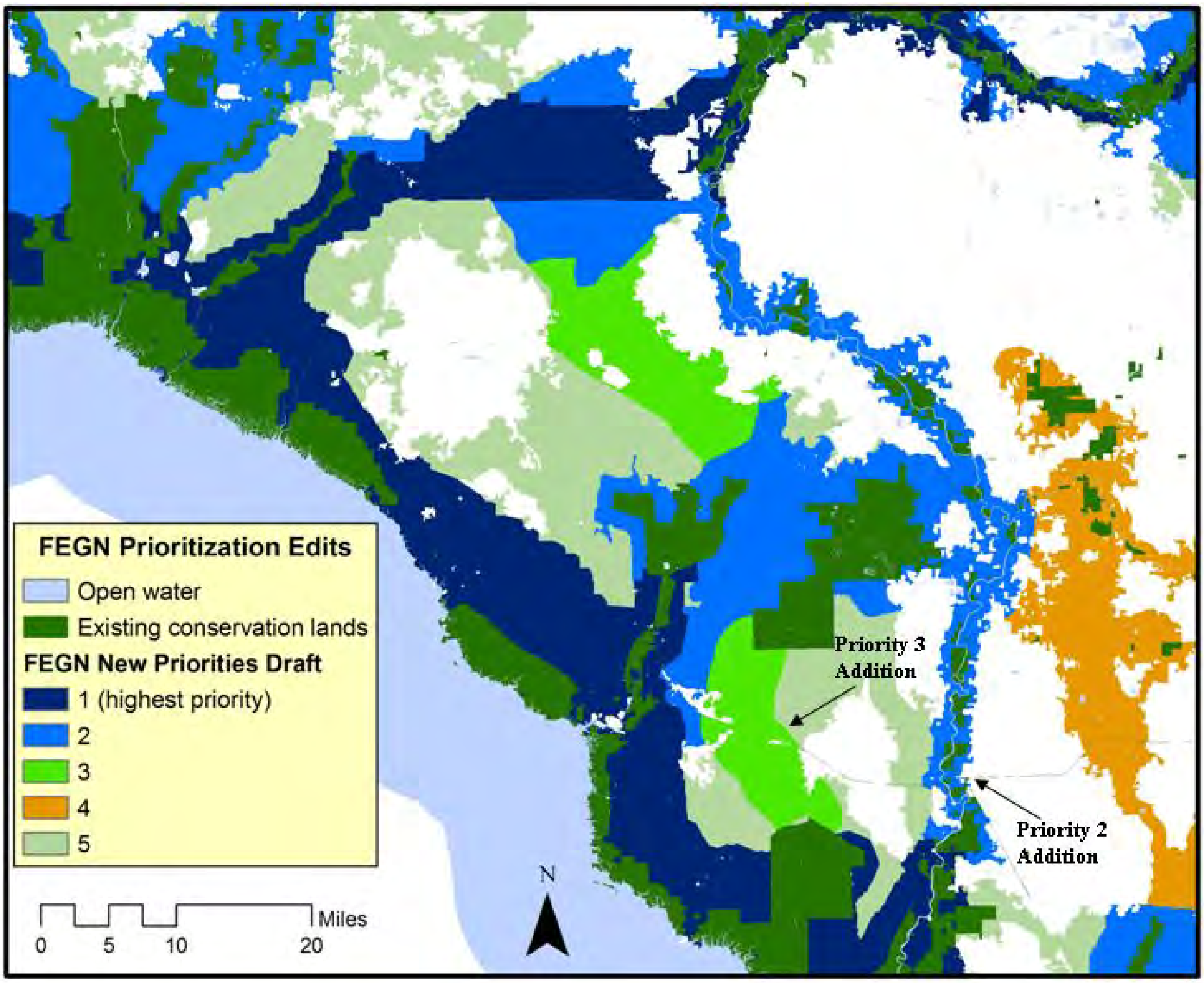


Figure 11. Additions to the Inland Big Bend Priority 2 and Priority 3 corridors.

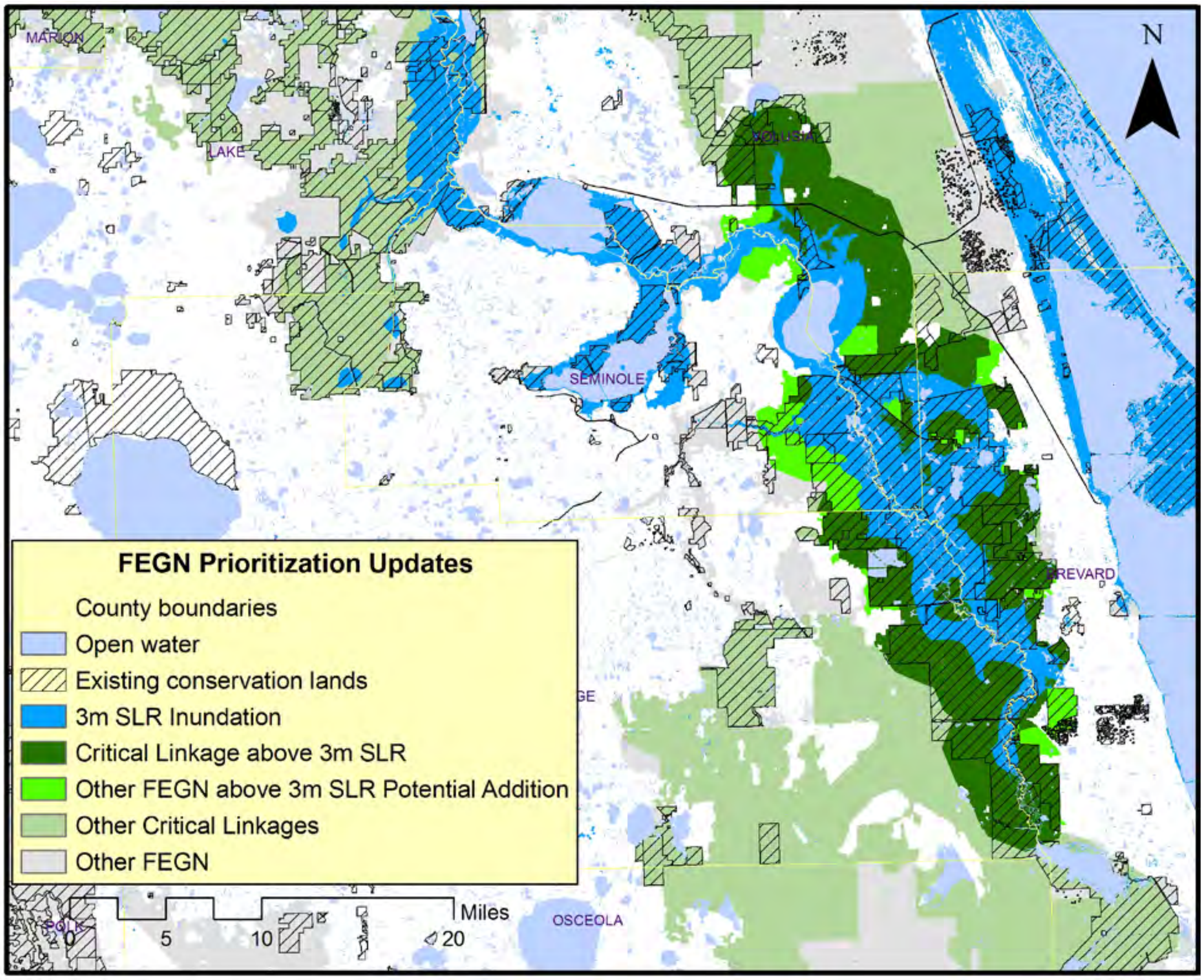


Figure 12. The areas in bright green represent the additions to the St. Johns River corridor between Lake Harney and Lake Winder.

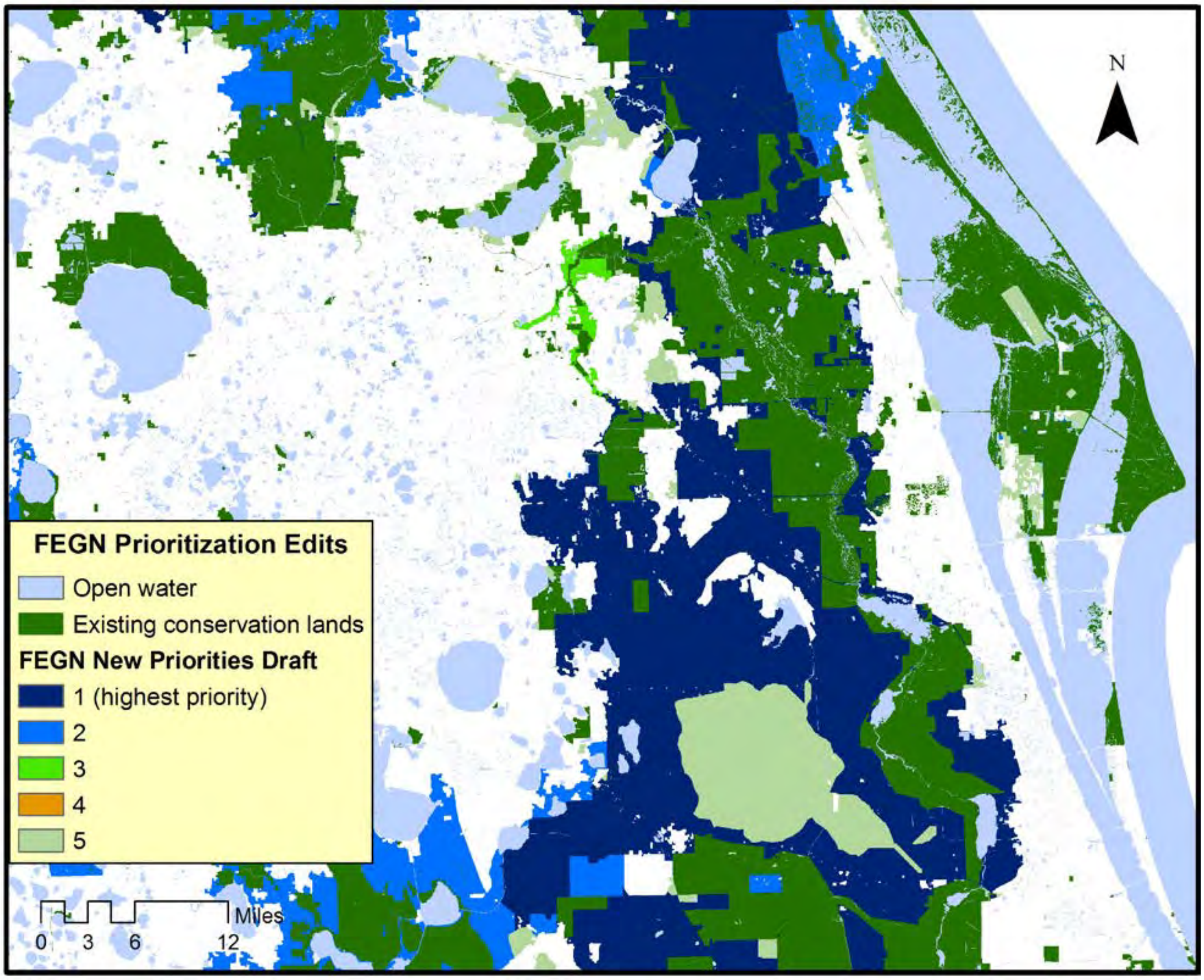


Figure 13. The expanded Critical Linkage south and west of Lake Winder.

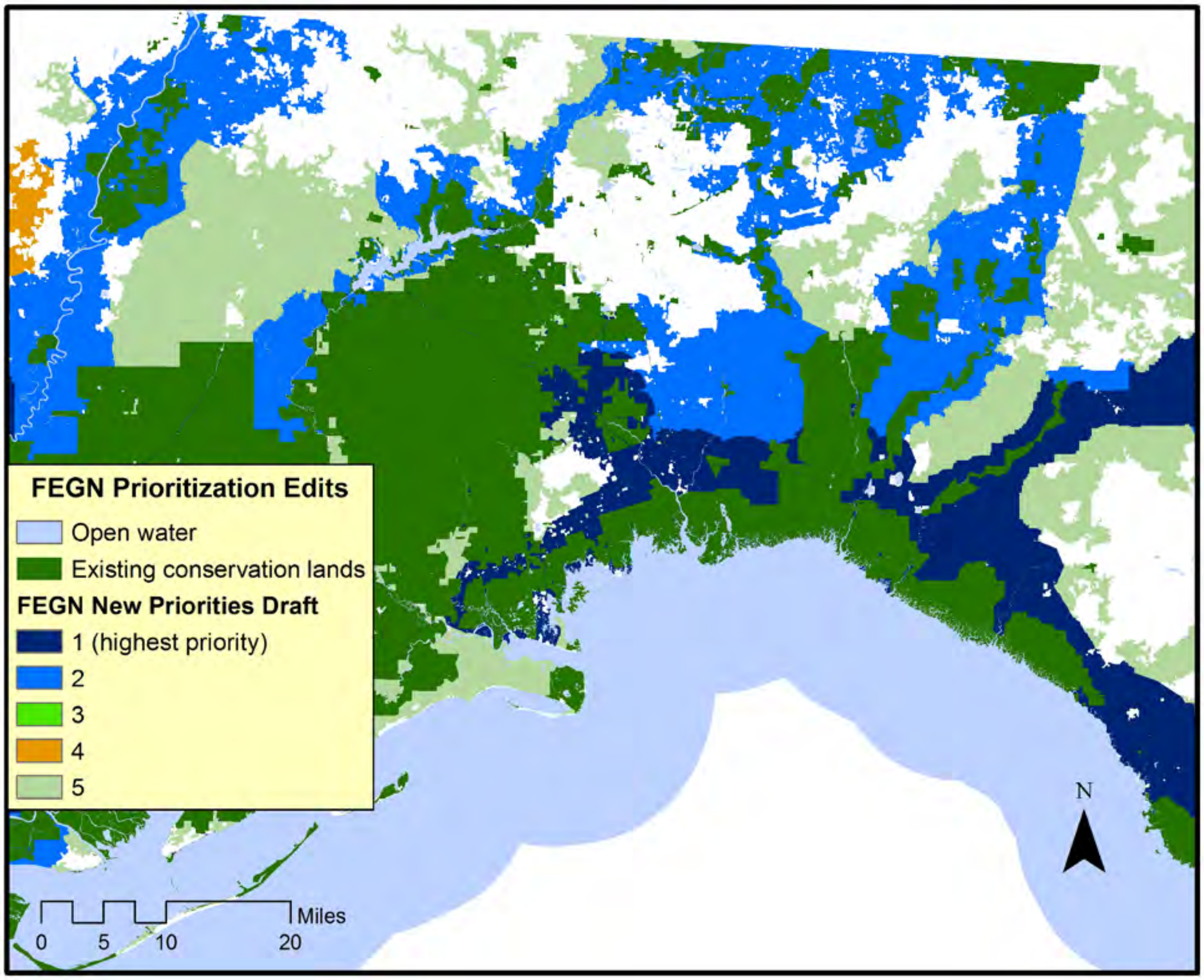


Figure 14. The new Aucilla-St. Marks-Red Hills-Ochlockonee Priority 2 Corridor.

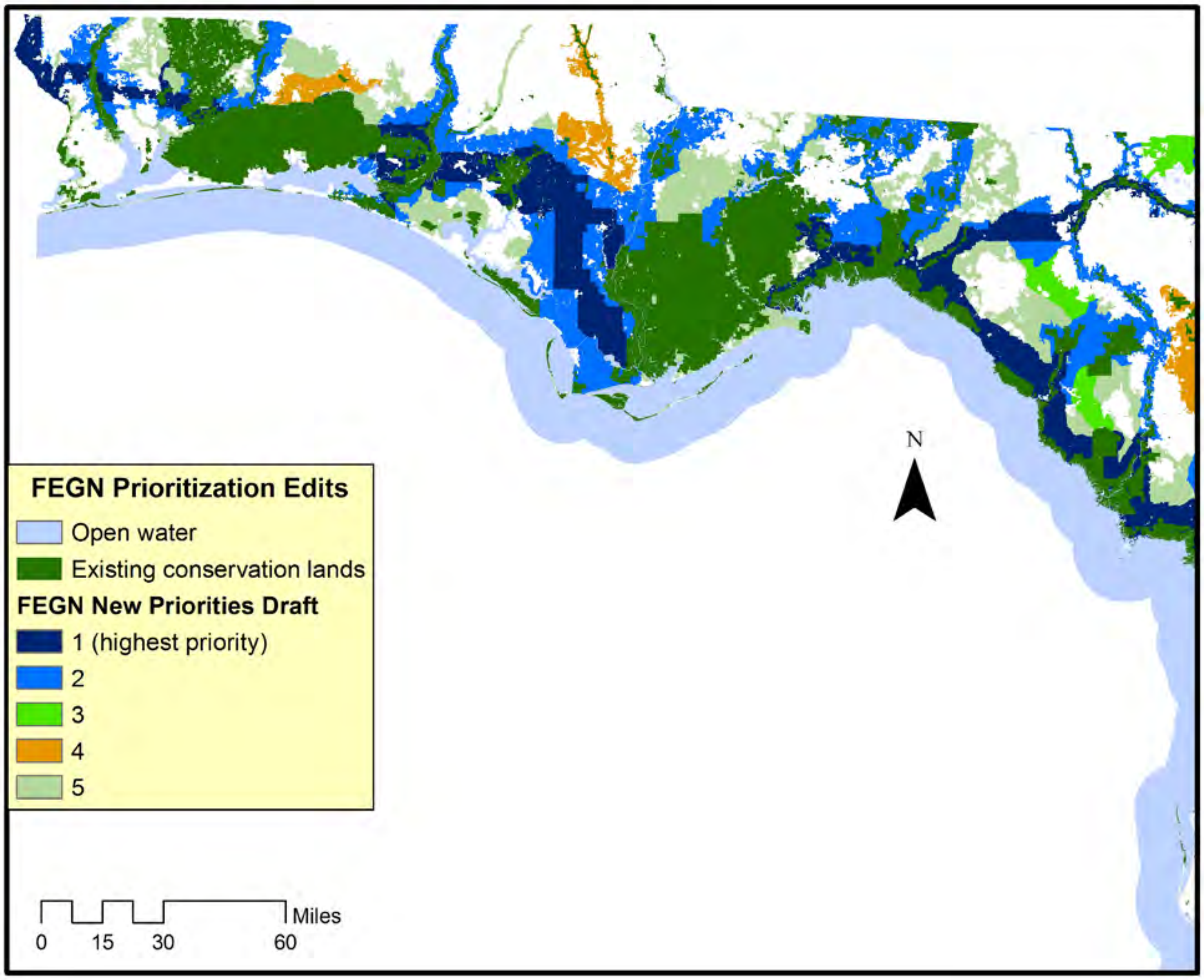


Figure 15. The new Priority 2 river corridors connecting the FEGN to conservation lands and/or significant areas of natural and semi-natural land in Alabama or Georgia.

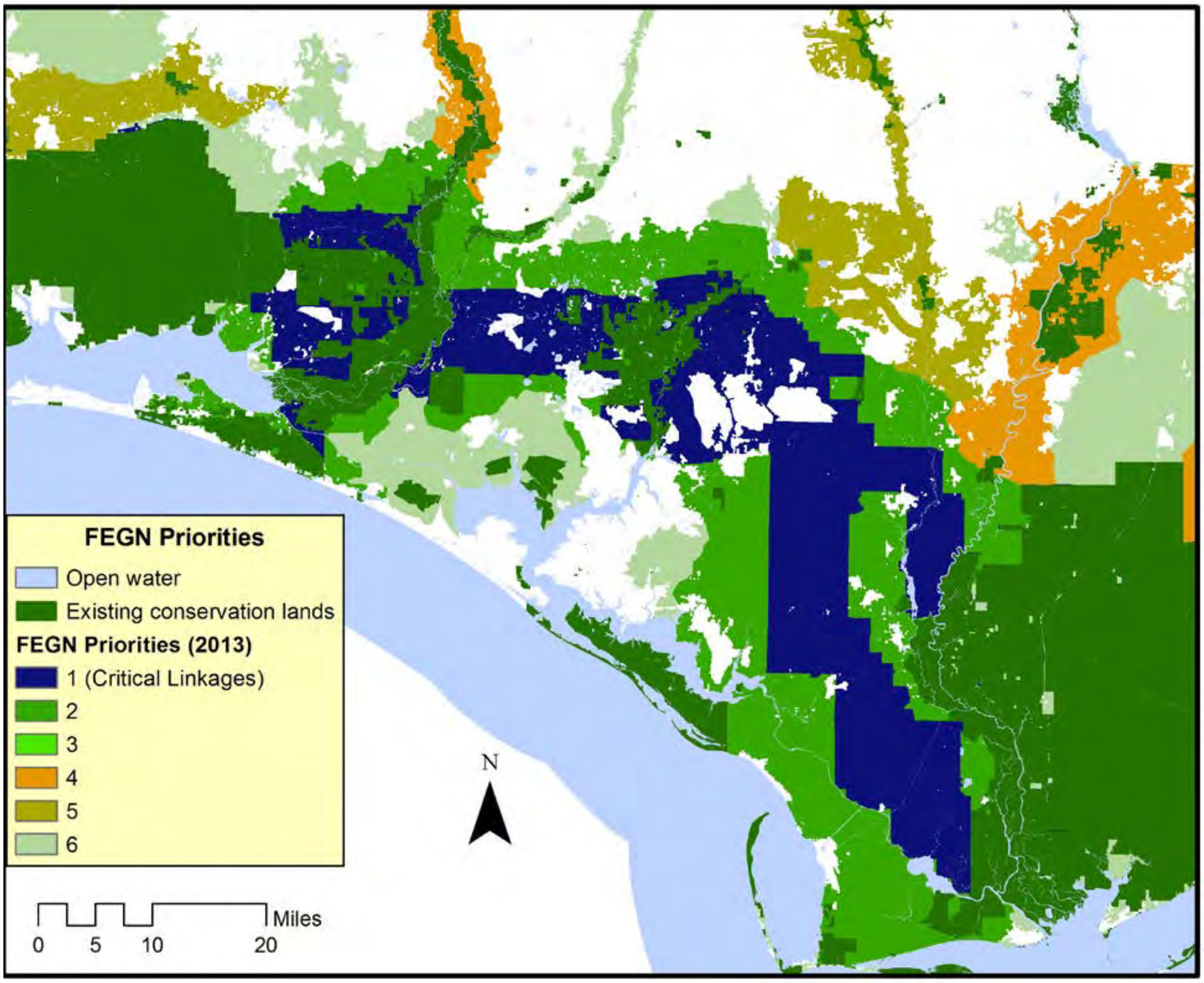


Figure 16. The 2013 version of the Apalachicola-Sand Mountain Critical Linkage, which narrows near Econfina Creek north of Panama City.

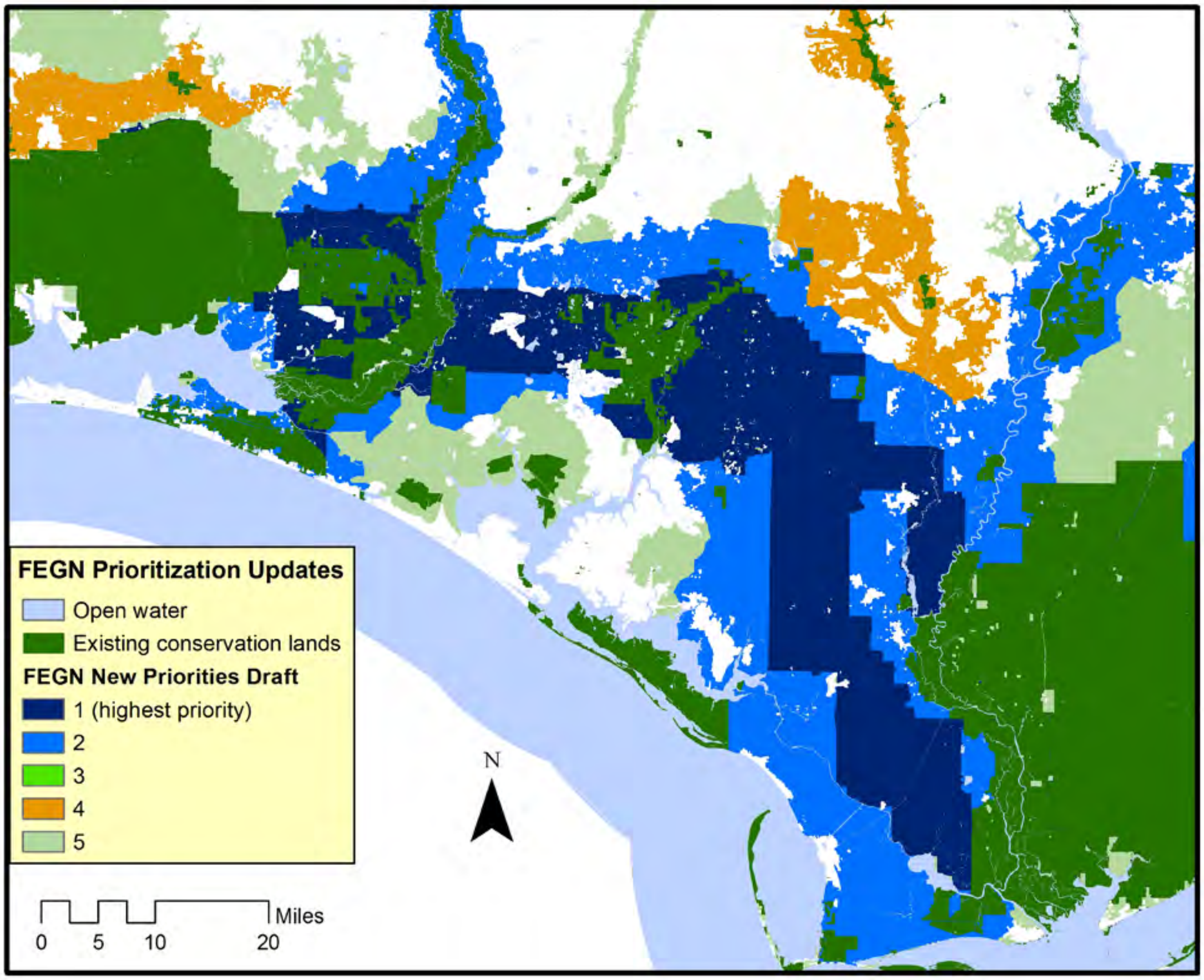


Figure 17. The new Apalachicola-Sand Mountain Critical Linkage.

Results and Discussion

These collective priority updates resulted in significantly wider Critical Linkages in the Big Bend region, the middle St. Johns River, and in the Econfina Creek area north of Panama City. In addition, there were significant additions to Priority 2 corridors with the elevation of most riverine corridors in north Florida that connect the FEGN to conservation lands and other ecologically significant areas in Alabama and Georgia (**Figure 18**; **Figure 19**; **Figure 20**). These revisions led to increases in areas included in higher FEGN priorities (See **Table 1**, **Table 2**, and **Table 3**), but these increases are intended to provide better opportunities to avoid impacts from sea level rise, more functional corridor widths, address the need for functional connectivity to other states, and better reflect the areas that should be considered high priorities for corridor protection statewide. The new CLIP 4.0 FEGN accomplishes these goals.

Table 1. Comparison between 2013 FEGN priority acres and the new FEGN.

FEGN 2013	ACRES	FEGN 2016	ACRES
PRIORITY 1 (CRITICAL LINKAGE)	11,431,127	PRIORITY 1 (CRITICAL LINKAGE)	11,609,395
PRIORITY 2	4,387,857	PRIORITY 2	5,023,951
PRIORITY 3	1,216,983	PRIORITY 3	1,237,751
PRIORITY 4	1,047,758	PRIORITY 4	1,523,566
PRIORITY 5	1,083,726	PRIORITY 5	3,638,401
PRIORITY 6	3,795,054		

Table 2. The land category statistics for the two highest priorities in the 2013 FEGN.

LAND USE CATEGORY	FEGN PRIORITY LEVEL	ACRES
OPEN WATER	PRIORITY 1 (CRITICAL LINKAGE)	1,078,086
EXISTING CONSERVATION LANDS	PRIORITY 1 (CRITICAL LINKAGE)	7,278,356
FLORIDA FOREVER PROJECTS	PRIORITY 1 (CRITICAL LINKAGE)	939,537
OTHER PRIVATE WETLANDS	PRIORITY 1 (CRITICAL LINKAGE)	669,474
OTHER PRIVATE LAND	PRIORITY 1 (CRITICAL LINKAGE)	1,465,675
OPEN WATER	PRIORITY 2	266,906
EXISTING CONSERVATION LANDS	PRIORITY 2	1,102,105
FLORIDA FOREVER PROJECTS	PRIORITY 2	450,427
OTHER PRIVATE WETLANDS	PRIORITY 2	769,167
OTHER PRIVATE LAND	PRIORITY 2	1,799,252

Table 3. The land category statistics for the two highest priorities in the new FEGN. Numbers in red represent the key differences between the 2013 FEGN and the new version.

LAND USE CATEGORY	FEGN PRIORITY LEVEL	ACRES
OPEN WATER	PRIORITY 1 (CRITICAL LINKAGE)	946,636
EXISTING CONSERVATION LANDS	PRIORITY 1 (CRITICAL LINKAGE)	7,315,712
FLORIDA FOREVER PROJECTS	PRIORITY 1 (CRITICAL LINKAGE)	1,054,290
OTHER PRIVATE WETLANDS	PRIORITY 1 (CRITICAL LINKAGE)	730,757
OTHER PRIVATE LAND	PRIORITY 1 (CRITICAL LINKAGE)	1,561,999
OPEN WATER	PRIORITY 2	188,895
EXISTING CONSERVATION LANDS	PRIORITY 2	1,420,256
FLORIDA FOREVER PROJECTS	PRIORITY 2	571,620
OTHER PRIVATE WETLANDS	PRIORITY 2	864,675
OTHER PRIVATE LAND	PRIORITY 2	1,978,505

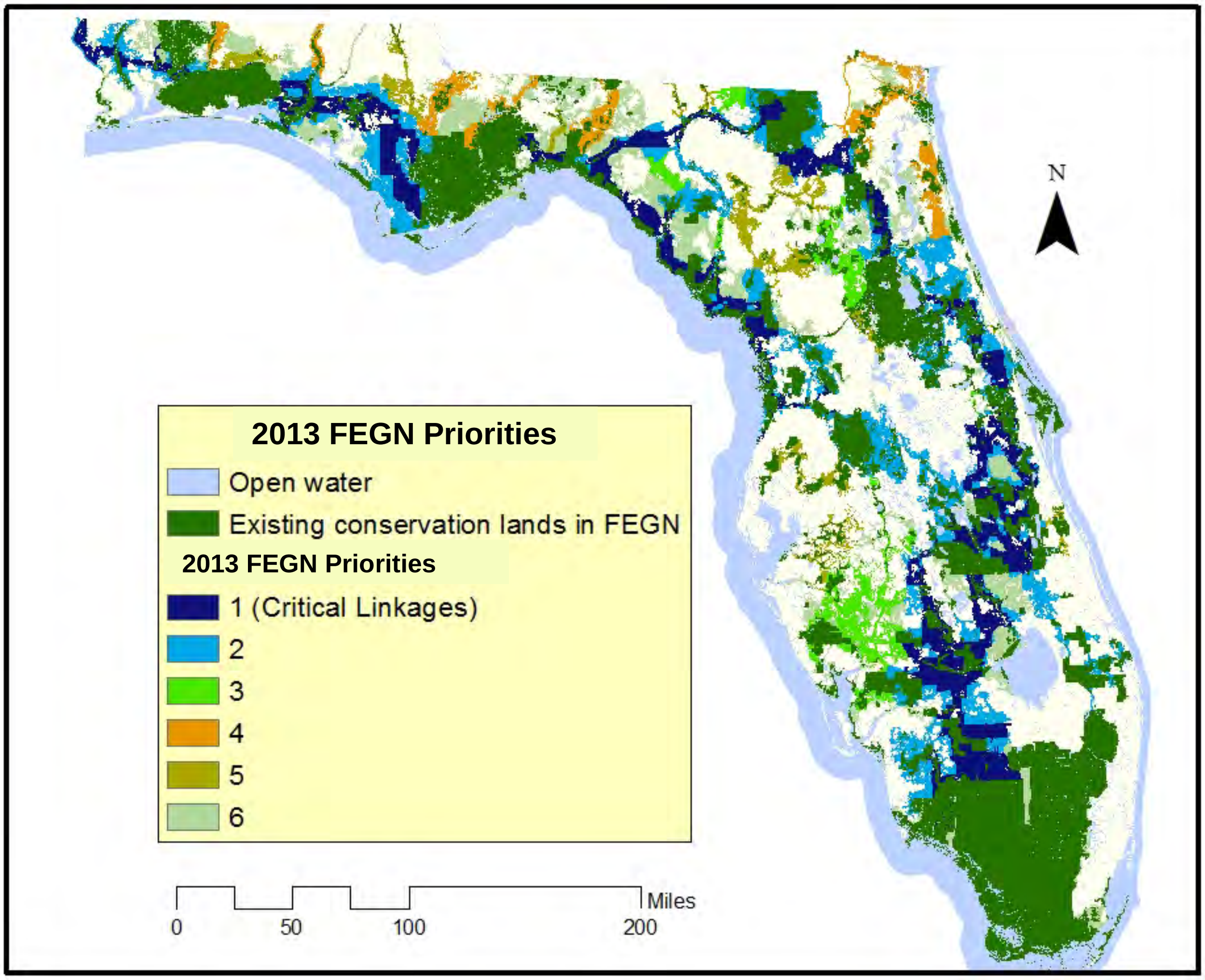


Figure 18. The 2013 FEGN version provided for reference.

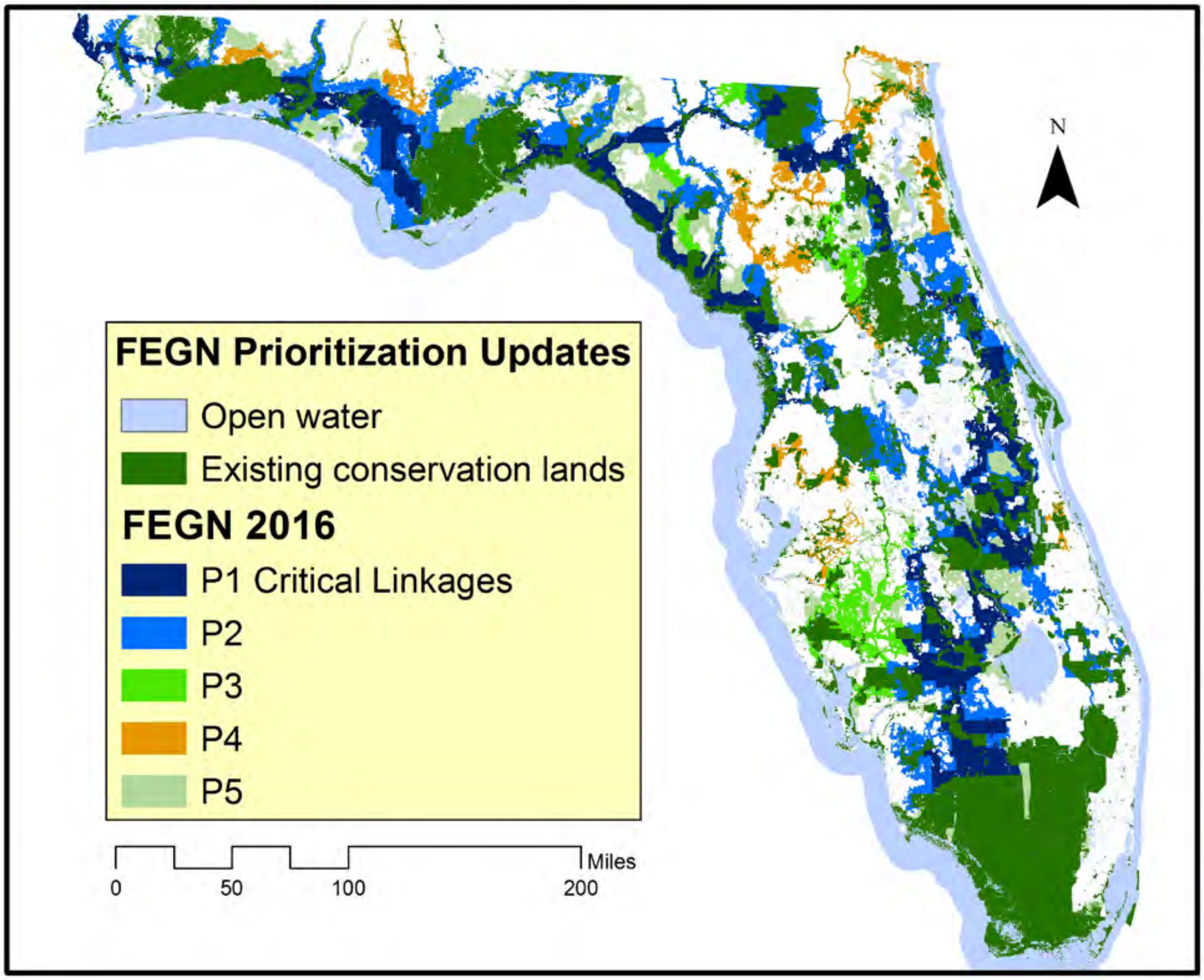


Figure 18. The new FEGN with the revised priorities.

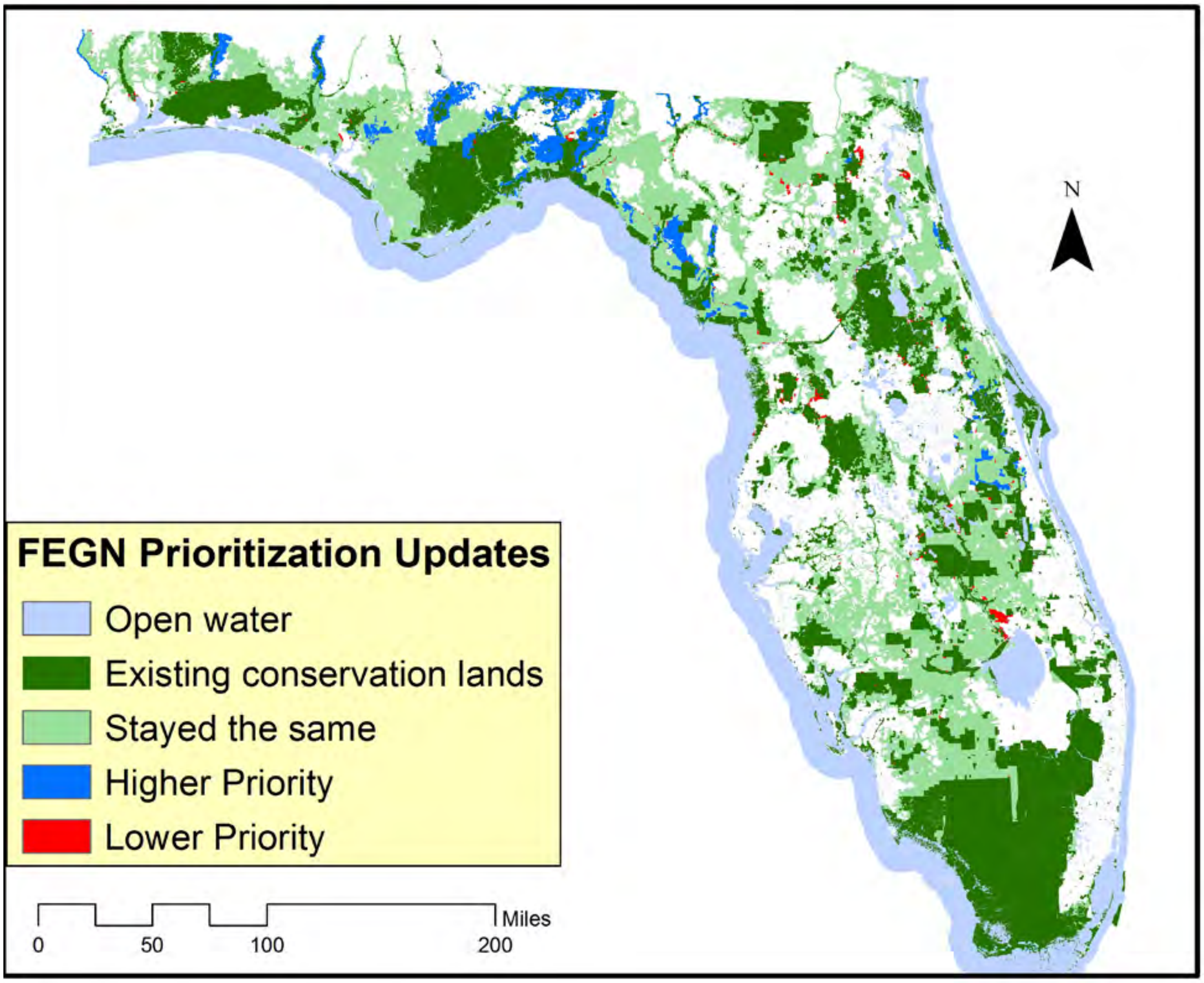


Figure 19. Comparison of the 2013 FEGN priorities with the new priorities, where brighter blue represents FEGN areas (and additions) that are now a higher priority, and red represents areas where the priority is now lower.

Citations

Hoctor, T., M. Volk, and M. Spontak. 2013. Updating the Florida Ecological Greenways Network. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL.

CLIP4.0 Surface Water Restoration Category

1. Introduction

The goal of the CLIP 4.0 Surface Water Restoration Category is to identify areas in the state that are important for restoring surface water quality and quantity. This includes identifying intensive land use areas where restoration or retrofitting would have the most benefit for reducing non-point source pollution and restoring natural hydrology. It also includes identifying natural or near natural areas that are important for maintaining water quality and natural hydrologic regimes, especially in impaired watersheds. Additionally, a regional sub-model was explored, identifying suitable sites with the highest potential for maximizing the value of dispersed water storage projects.

Previous work from the CLIP 3.0 Surface Water Restoration Category used a similar suitability analysis approach, but included only two metrics, water quantity and quality, to determine final model results. The quantity input accounted for physical features such as soil characteristics and elevation while the quality input accounted for water quality impairments and the influence of various land cover types. Final models assessed both restoration potential and natural protection priority.

The initial models in CLIP 3.0 used weighted overlay, while the models in CLIP 4.0 examined the use of the newer fuzzy membership and overlay tools in ESRI's ArcGIS. These tools use fuzzy logic, which is often used for decision-making in computer science and artificial intelligence applications. The fuzzy logic process applies a common scale of values to diverse and dissimilar set of inputs, creating an integrated analysis. In GIS, the fuzzy membership tool was used to create core data layers and the fuzzy overlay tool was used to combine inputs in varying configurations to determine model results for the Surface Water Restoration Resource Category priorities.

These modifications of the CLIP Surface Water Restoration Resource Category were made with guidance from a group of technical advisors from the Water Management Districts, Florida Department of Environmental Protection, Department of Agriculture and Consumer Services, and private consulting. Though these advisors agreed with the concept of a CLIP Surface Water Restoration Resource Category, there was not consensus among participants regarding the details of various core data layers developed in this iteration of the database. Therefore, there is not a CLIP Surface Water Restoration Resource Category added to the CLIP 4.0 database. However, the methods and results explored in this iteration of the analysis are provided here as documentation of the process and to serve as a starting point for any potential future revisions that might result in the inclusion of the CLIP Surface Water Restoration Resource Category in a later iteration of the CLIP database. However, all maps and other data provided in this appendix are not official CLIP products and should not be represented as such, nor are being endorsed by any entity including the CLIP team or our technical advisors.

2. Methods

The objectives of the surface water category were implemented through suitability analysis using Geographic Information Systems (GIS). Suitability models identify the best or most preferred locations for a specific use or future activity. Nine different metrics were created to assess a host of different water restoration purposes. Individual data inputs are defined as core data layers while the results of overlay models provide resource category priorities.

2.1 Core Data Layers

Core data layers are individual metrics that describe information that may be helpful in assessing restoration priorities. Since this information can come in varying forms, it cannot be easily used in suitability modeling unless it is converted to a uniform scale. Core data layers' raw data input was transformed to a uniform scale using fuzzy logic. This methodology transforms quantitative metrics to a scale ranging from zero to one, where a value of one defines the highest suitability. In ArcGIS, this is accomplished using the "fuzzy membership" tool. Most metrics are transformed using a linear scale, but distance metrics are transformed using the "fuzzy small" transformation method. This defines a fuzzy membership where the smaller input values (shorter distance) have membership closer to 1. The function is defined by a user-specified midpoint (which is assigned a membership of 0.5) with a defined spread. For continuity, these classifications' midpoint is defined at 1,000m, which ranks distances less than 1,000m favorably and areas very far away have little influence.

2.1.1 Agricultural intensity

The agricultural intensity core data layer attempts to estimate the relative influence of agricultural activities on surface water quality. Based on available statewide data, estimates of total nitrogen, total phosphorous and irrigated water uses were considered for the agricultural intensity core data layer.

Data for water usage was obtained from the Florida Department of Agriculture and Consumer Services Florida Statewide Agricultural Irrigation Demand (FSAID) 2015 Irrigated Lands Geodatabase (ILG). Water use per acre was calculated using attributes of water use (million gallons per day) divided by the land area associated with the polygon attribute. Base agricultural land use from FSAID was used from the statewide 2015 Agricultural Lands Geodatabase (ALG) instead of other land cover classification systems for congruity with irrigated lands data. A water use of zero was applied to lands in the base agricultural dataset, but not in the irrigated lands database.

Nutrient loading rates for total nitrogen (TN) and total phosphorous (TP) were estimated using event mean concentrations (Gao 2015). EMCs are based on empirical data, and used to estimate nutrient loading based on land cover type (Harper, Baker 2007). Nutrient loading rates, based on the table below, were assigned to the statewide agricultural land cover dataset.

Table 1 - EMC Loading Values

Land Use Category	Revised Values (mg/l)	
	Total N	Total P
Low Density Residential[1]	1.40	0.20
Single Family	1.87	0.30
Multi-Family	2.10	0.50
Low Intensity Commercial	1.07	0.18
High Intensity Commercial	2.20	0.25
Light Industrial	1.19	0.21
Highway	1.37	0.17
Agricultural		
Pasture	3.30	0.62
Citrus	2.07	0.15
Row Crops	2.46	0.49
Undeveloped/Rangeland/Forest	0.93	0.10
Mining/Extractive	1.18	0.15

1. Average of single-family and undeveloped values

In addition, statewide 2015 Best Management Practices (BMP) program enrollment data was also obtained from FDACS. All metrics were filtered through BMP enrollment data. If an area is enrolled in a BMP program, impacts were reduced by 30%. Each component was then transformed to a uniform scale using fuzzy membership. The final output is an arithmetic mean of water usage and nutrient loading metrics for TN and TP.

2.1.2 Distance to Hydric Soils

Hydric soils were used as: (1) an identifier for potential wetland soils for restoration and (2) estimating the influence of subsurface flow on surface waters. Distance to hydric soils, those classified as “hydric” under hydric rating attribute of United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database, were used as an identifier of potential wetland soils. Path distance was calculated from hydric soils using the UF Composite LIDAR DEM. This accounts for buffer areas around hydric soils at a decreasing value as distance becomes greater. Additionally, this distance accounts for surface elevation. Distance was filtered through a fuzzy membership (small) with a midpoint at 1,000m. This accounted for a buffer area around hydric soils at a decreasing value as distance becomes greater.

2.1.3 Distance to All Surface Waters and Connected Wetlands

Since we are trying to determine surface water restoration potential it is useful to determine an area’s proximity to surface waters for overland flow purposes. This metric combines natural waters, altered hydrologic systems such as canals and ditches, and connected wetlands to create a layer that considers all surface water connectivity. Connected wetlands are those abutting or within 300 feet of a waterbody, selected by National Hydrography Dataset (NHD) flowlines and Cooperative Land Cover (CLC), Version 3.1 water bodies. Flow path distance to these layers uses the UF Composite LiDAR DEM. Distance is filtered through a fuzzy membership (small) with a midpoint at 1,000m.

2.1.4 Distance to Natural Waters and Connected Wetlands

This layer serves as a metric to determine proximity to natural waterbodies and connected wetlands only. It can be used when protection of natural systems is a higher priority than considering all surface water systems. This layer includes wetlands connected (abutting or within 300 feet) to a natural waterbody, selected by NHD stream/river flowlines and CLC land cover natural water bodies and wetlands. Flow path distance to these layers uses the UF Composite LiDAR DEM. Distance was filtered through a fuzzy membership (small) with a midpoint at 1,000m.

2.1.5 Altered Hydrology

Since restoring natural hydrologic function is a priority, we needed some measure of if, or to what degree an areas' hydrology has been altered. To assess this, distance to, and density of, altered hydrologic features was considered. This calculated flow path distance to, and line density of NHD canals and ditches, where areas near areas with higher densities of canals and ditches were given higher values for level of watershed alteration. Distance is filtered through a fuzzy membership (small) with a midpoint at 1,000m.

2.1.6 Nutrient Impairments

To get the most out of restoration projects, it would be ideal to assign a higher priority to areas with degraded water quality. This layer considers only nutrient impairments (nitrogen and phosphorous). Flow path distance to each BMAP, TMDL and WBID nutrient impairment waterbody/watershed was calculated and transferred to a uniform scale. Then, the mean of all three components was computed.

2.1.7 Impervious Surfaces

Impervious surfaces are an important factor to consider when assessing stormwater management priorities. Greater impervious surface increases surface runoff and decreases infiltration capacity. Overland flow carries more sediment and pollutants, is not filtered as much as subsurface flow and has a higher intensity/shorter duration timing of flow, posing a higher risk to water quality. Impervious surface information was derived from EPA's Integrated Climate and Land Use (ICLUS) Project's dataset and transformed using linear fuzzy membership.

2.1.8 Pre-1975 Development

The destruction of wetlands and installation of drainage and stormwater structures was largely unregulated until the passage of the Clean Water Act in 1972. After which, Florida's regulatory framework adopted the use of the Wetlands Resource Permit (WRP) program, the Management and Storage of Surface Waters (MSSW) permit program and the Sovereign Submerged Lands program in the mid-1980s. These programs significantly improved the development process that reduced impacts on wetland and drainage, and therefore development approved since then tends to be in less need of infrastructure retrofits to slow down stormwater flow and to treat non-point source polluted water before it reaches natural water bodies. Since a complete statewide land cover dataset was not available for the mid-1980s, this variable uses 1974 USGS "urban or built up" land use classifications to identify areas that may have old or no stormwater systems. Any future version will be based on land use/land cover data that better matches a mid-1980s time frame.

2.1.9 Ecological Quality

In many of the resource category priority models, ecological integrity is a critical point to consider. These could be situations where areas of high ecological value need to be considered in conjunction with other hydrologic metrics. CLIP 3.0 Landscape Context priorities were used as a measure for ecological integrity in this case. Priorities from landscape context were transformed using a linear fuzzy membership.

2.2 Resource Category Priorities

There are often multiple reasons water quality may be degraded, and varying options for water restoration projects. A singular model for identifying water restoration priorities does not tell the whole story. The following resource category priorities describe eight different overlay models designed to address a number of restoration, enhancement or conservation/preservation scenarios relating to surface water restoration. These overlay models combine core data layers in varying configurations. The fuzzy overlay tool is designed to combine fuzzy membership outputs (individual core data layers). The closer the model output is to one, the greater the suitability. The closer the model output is to zero, the lower the suitability. These models include:

1. Wetland Restoration/Enhancement Potential for:
    a. All Restorable Land Cover Types
    b. Agricultural Lands
    c. Pine Silviculture
2. Agricultural Best Management Practice Targeting
3. Restoration of Natural Hydrology
4. Water Farming Regional Model
5. Urban/Suburban Stormwater Improvements
6. Conservation Land Acquisition

2.2.1 Wetland Restoration/Enhancement Potential

These three models' purpose is to rank water restoration potential (1) on all restorable landcover types, (2) on agricultural lands and (3) on pine plantations. Cooperative Landcover, Version 3.1 is used to determine these targeted landcover types.

2.2.1a All Restorable Types

All restorable upland and wetland land cover types (CLC land cover areas not in developed urban or suburban land use classes) were considered in this model, which uses the following layers:

1. Near hydric soils – to identify appropriate wetland soils and subsurface flow influence.
2. Near surface water bodies or connected wetlands – to determine landscape location in relation to surface waters.
3. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.
4. High landscape context value – to prioritize projects according to their adjacency to high quality habitat, which are more likely to support functional ecosystems.

2.2.1b Agricultural Lands

This model identifies agricultural areas that would be most appropriate for wetland/upland restoration and provide the most benefit to water quality.

1. High agricultural intensity – which identifies water usage and nutrient loading.
2. Near hydric soils – to identify appropriate wetland soils and subsurface flow influence.
3. Near surface water bodies or connected wetlands – to determine landscape location in relation to surface waters.
4. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.
5. High landscape context value – to prioritize projects according to their adjacency to high quality habitat, which are more likely to support functional ecosystems.

2.2.1c Pine Silviculture

This is the same model used on all restorable types, but limited to pine plantation land cover.

1. Near hydric soils – to identify appropriate wetland soils and subsurface flow influence.
2. Near surface water bodies or connected wetlands – to determine landscape location in relation to surface waters.
3. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.
4. High landscape context value – to prioritize projects according to their adjacency to high quality habitat, which are more likely to support functional ecosystems.

2.2.2 Agricultural Best Management Practice Targeting

This model targets agricultural areas that are not currently enrolled in BMP programs, prioritizing areas where applying BMPs would potentially provide the most benefit for surface water quality. It does not target poorly performing or ineffective BMPs since that data is not readily available.

1. High agricultural intensity – to prioritize the highest water usage and nutrient loading.
2. Near surface water bodies or connected wetlands – to determine landscape location in relation to surface waters.
3. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.

2.2.3 Restoration of Natural Hydrology

The purpose of this model is to restore a natural flow regime in river/stream systems. These areas could be river/stream/incised channel or buffer/wetland restoration. This analysis is also limited to restorable land cover types.

1. Near altered flow systems – to prioritize areas surrounding altered flow systems such as canals and ditches.
2. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.
3. High landscape context value – to prioritize projects according to their adjacency to high quality habitat, which are more likely to support functional ecosystems.
4. Near hydric soils – to identify appropriate wetland soils and subsurface flow influence.

2.2.4 Water Farming

The purpose of water farming is to reduce high volumes of freshwater from Lake Okeechobee entering the St. Lucie Estuary via the canal systems of the area. The water-farming model was performed at a regional scale due to its specific focus. The water farming suitability model identifies areas to store freshwater for peak/high flow attenuation to protect estuaries. Water farming sites are generally constructed on fallow citrus groves or other fallow crop types; fallow groves are the only areas considered in this model. Distance to major canals was included to prioritize areas adjacent to water sources and sinks. SSURGO drainage classes were considered to prioritize well-drained soils along with water table depth for greater soil water storage.

2.2.5 Urban/Suburban Stormwater Improvements

This model was designed to target areas that would benefit from stormwater retrofitting programs or infrastructure modernization.

1. On or near pre-1975 developed areas – to identify areas most likely having outdated or no stormwater systems.
2. High impervious area – to identify area where stormwater systems will be most prevalent.
3. Near surface water bodies or connected wetlands – to determine landscape location in relation to surface waters.
4. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.

2.2.6 Conservation Land Acquisition

This model prioritizes land that could be purchased as public conservation lands for water quality protection. It includes natural land cover types that are not on existing non-public lands and also removes existing Indian Reservations.

1. High landscape context value – to prioritize projects according to their adjacency to high quality habitat, which supports ecosystem connectivity.
2. Near natural water bodies or connected wetlands – to prioritize lands adjacent to natural surface waters or connected wetlands.
3. Near nutrient water quality impairments – to prioritize restoration projects in areas with impaired water quality based on nutrient enrichment.
4. Near hydric soils – to identify appropriate wetland soils and subsurface flow influence.

3. Results

Results are included below in the Map section.

4. Discussion and Conclusions

To date, most water restoration planning has been focused at the watershed or regional scale. The CLIP 4.0 Surface Water Restoration Category attempts to provide a useful framework for assessing statewide water restoration priorities. Acknowledging there are often multiple causes of degraded water quality and multiple solutions to restore degraded systems, the CLIP 4.0 Surface Water Restoration Category proposes a modular overlay analysis methodology to assess these issues. Individual core data layers provide important measures for assessing surface water quality and the resource category priorities provide examples to how core data layers can be combined to produce restoration priorities. This analysis is by no means perfect and identifies many gaps in data germane to making large-scale informed decisions about water restoration priorities.

During this process we met with a technical advisory group to provide input and direction for the project. This advisory group included experts from public and private institutions with expertise in water resources, engineering and conservation. As of yet, the status of the project was not deemed ready for inclusion in a final CLIP data release. Many of the issues concerned the use of agricultural use and impaired waters data. The general consensus of the TAG was to focus more on physical hydrology and less on water quality risks. In addition, though the use of fuzzy logic methods represents statistical techniques that are now used more frequently in decision support GIS and other fields, the TAG felt that more transparent methods for determining suitability would facilitate understanding of core data layers and potential incorporation into revised priority models.

The agricultural intensity core data layer assesses the magnitude of nutrient loading and irrigated water usage. However, this is a very simple assessment and does not account for site-specific conditions or operational practices. Additionally, the Everglades Agricultural Area shows up as medium intensity, which may generate criticism. This is likely due to the fact that the EAA's water is from surface water sources not accounted for in the irrigated lands database. The EAA is also enrolled in BMP programs so the impact is automatically reduced by 30%. Furthermore, data on site-specific BMP performance is not available statewide.

Hydric soils are used as (1) an identifier for potential wetland soils and (2) determining influence of subsurface flow. Distance to hydric soils are the final metric used in this core data layer. This accounts for buffer areas around hydric soils at a decreasing value as distance becomes greater. Additionally, this distance accounts for surface elevation. In some cases this may not represent reality. Other factors such as water table, soil permeability or other characteristics may aid in creating a more dynamic core data layer for assessing subsurface flow influence.

Nutrient loading estimates from Event Mean Concentrations are a valuable tool. However, EMC loading data does not always correspond neatly to GIS-based land use/land cover data. Generalized state level land cover data is often too broad to include all the different categories of loading measures. Site specific land cover data includes types that are hard to determine which category of nutrient loading they would fall into. Some assumptions had to be made in classifying these cases.

Assessment of water quality impairments in this analysis is relatively rudimentary. It uses the combined distance to TMDL, BMAP and impaired WBID areas. Ideally, loading data from water quality samples could be incorporated into future analyses. Florida has adopted its own numeric nutrient criteria for most of the inland waters including lakes, streams, and springs, and coastal estuary areas. Florida also has the most comprehensive ambient water quality database across the entire nation, the STORET database. Comparing the spatial distribution of the nutrient concentrations with the numeric nutrient criteria would be a more thorough way to identify degraded water quality.

The urban stormwater priority model attempts to identify outdated or lacking stormwater systems using historic land cover data. Classifying everything from pre-1975 development as not having proper stormwater can be misleading and misrepresented. If it were available, a complete land cover dataset from the mid-1980s would be more appropriate as it correspond better to environmental regulations of the time. We will explore obtaining and using the Florida Fish and Wildlife Conservation Commission's (FWC) 1987-1989 land cover data created through analysis of satellite imagery as potentially the best matching source for such data. Additionally, better data is needed on stormwater system presence, quality and functionality. Many municipal governments have this information but a statewide dataset has never been compiled.

Landscape context is used in many of the priority models to incorporate ecological suitability. There may be metrics that are more ideal for assessing ecological integrity. FWC Freshwater threats data was used in the past, but much of the data was not necessarily related to land use. If this project continues, we will work with FWC and other partners to develop a statewide landscape integrity GIS layer that more specifically addresses relevance to watershed integrity.

Water farming is a pilot program to mitigate high volumes of freshwater from Lake Okeechobee entering the St. Lucie Estuary via the canal systems of the area. The formula for identifying water-farming sites is conceptually simple: assess available sites' near source canals that can store the most water at the least cost. But estimating storage capacity and cost is difficult with broad-scale statewide data, and should require site-level data to make informed decisions. Storage includes the above ground volume, and also water that can be stored in the soil. A digital elevation model and the top of bank elevation for a site's berm are needed to determine the above ground storage capacity. Soil storage capacity and water table height is needed to estimate below ground storage. Cost is related to initial earthwork costs, operation and maintenance and annual payments.

Fuzzy logic was used in this project to perform suitability overlay analyses. An alternative to using fuzzy logic would be reclassification and weighted overlay. Reclassification transforms metrics into user-defined classes. The number of classes is left to the user and these classes can be delineated using varying methodologies. Both methods were assessed but fuzzy membership/overlay tools were selected instead, due to their simplicity. Fuzzy membership outputs can also be combined with the weighted overlay tool instead of using fuzzy overlay, or fuzzy overlay output can be reclassified later to any scale for uniformity with the rest of CLIP.

This analysis is focused on surface water restoration. Groundwater does have a major influence on surface water quality. However, since this analysis is landscape-focused it does not include the prioritization of groundwater resources or the importance of the surficial landscape on groundwater resources.

Overall, the CLIP 4.0 Surface Water Restoration core data layers and resource category priorities provide a framework for data-driven decision making. It provides an example of how GIS and suitability analyses could be use to provide efficient and large-scale conceptual assessments. Ultimately, once a set of consensus set of core data layers are finalized, the opportunity exists for managers to combine these layers as they see fit for their own management goals. With the current issues affecting watersheds and water quality in various parts of Florida, development of a statewide assessment of surface (and ground) water restoration priorities is an extremely important goal that needs to be achieved in the near future.

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Maps

1. Core Data Layers

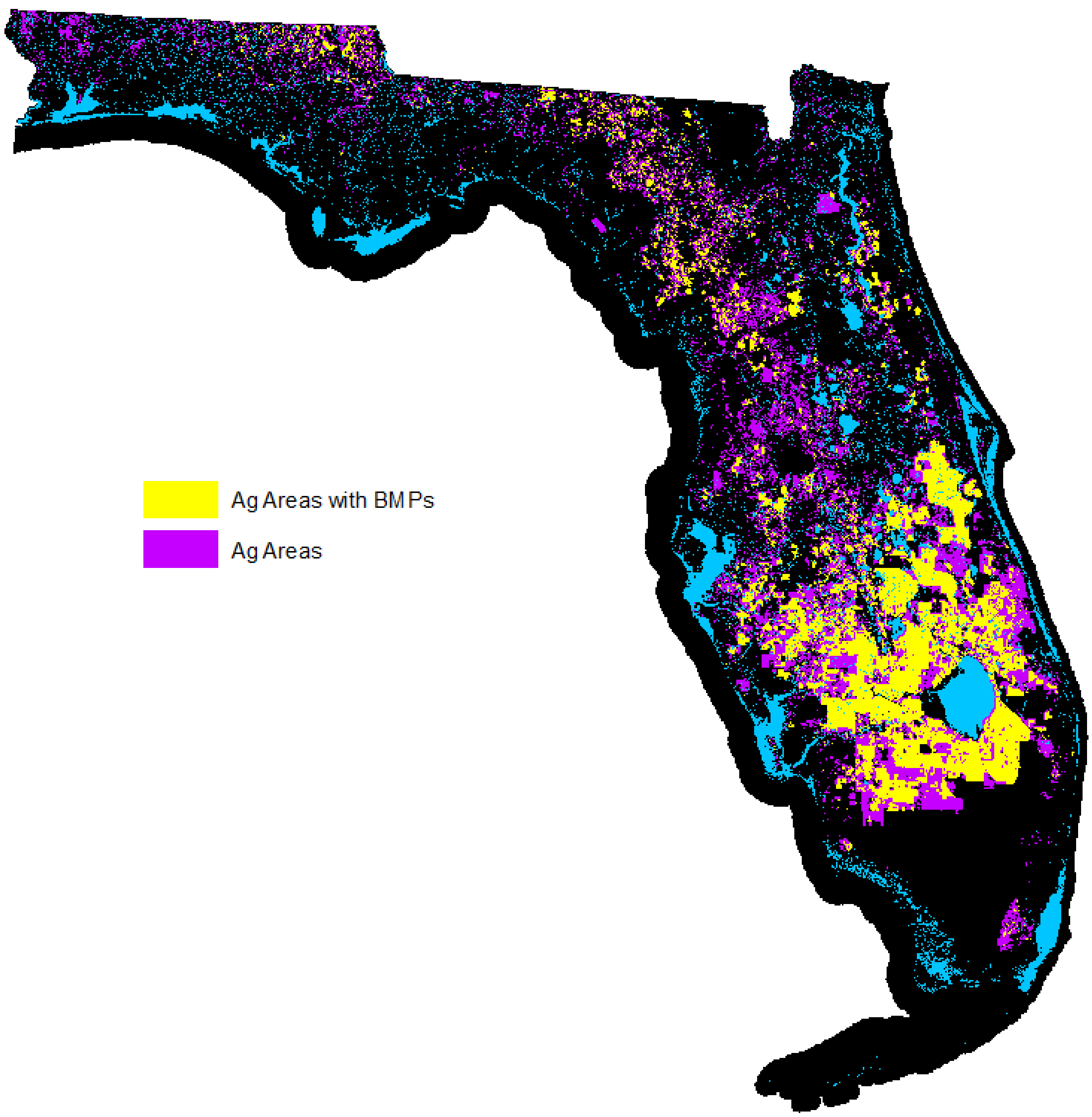


Figure 1 – Agricultural BMP Enrollment

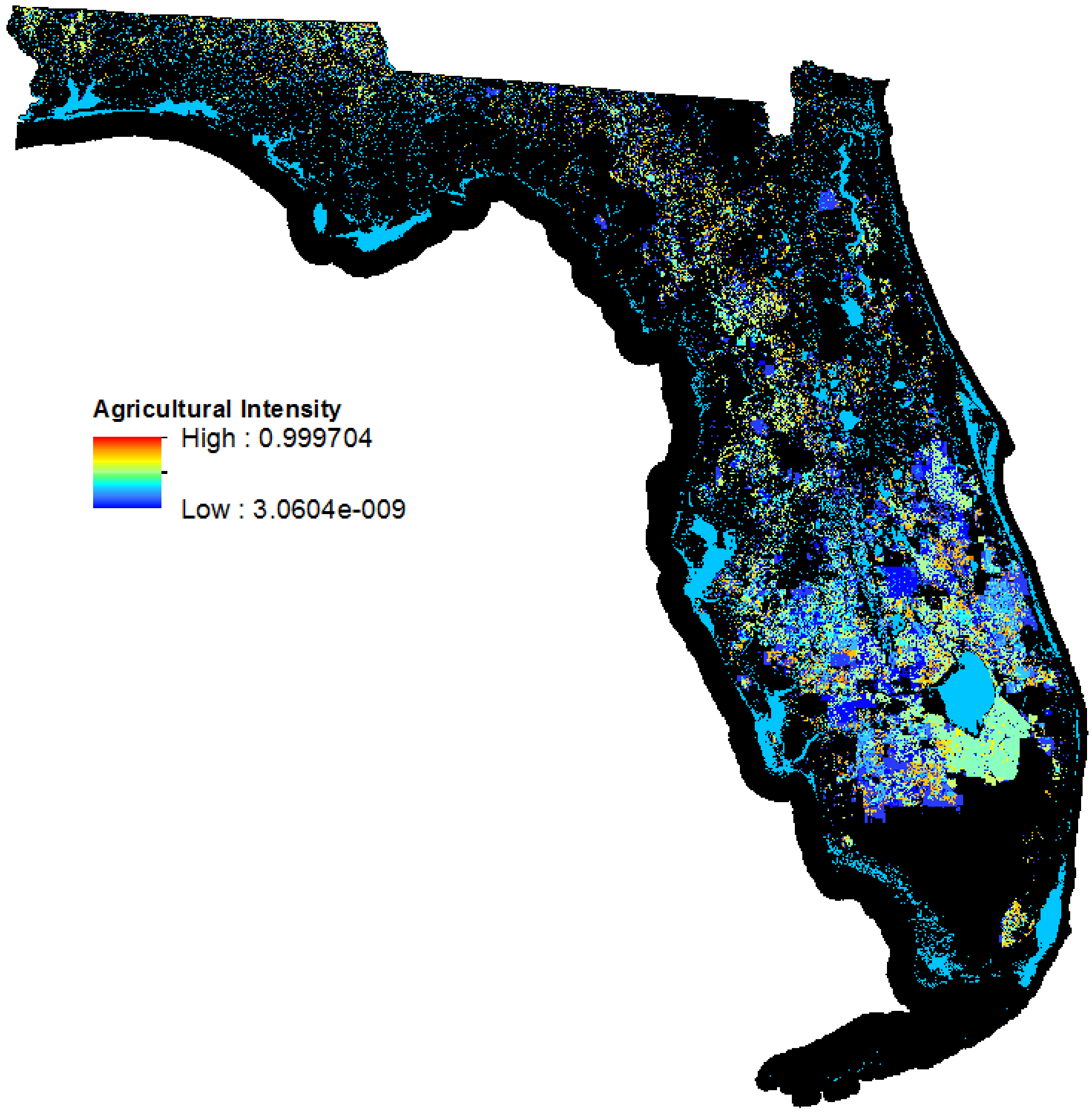


Figure 2 - Agricultural Intensity Core Data Layer

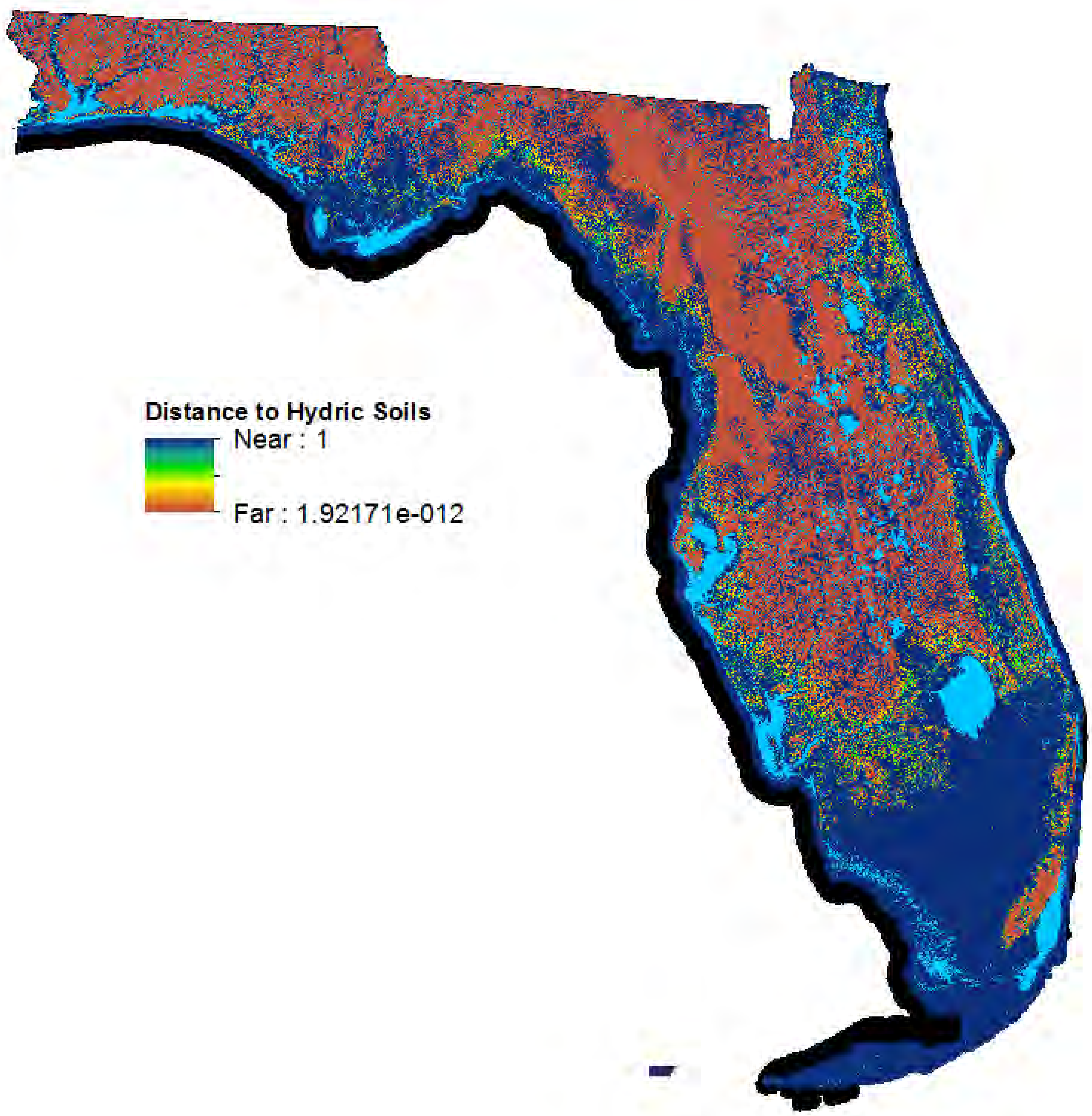


Figure 3 - Distance to Hydric Soils Core Data Layer

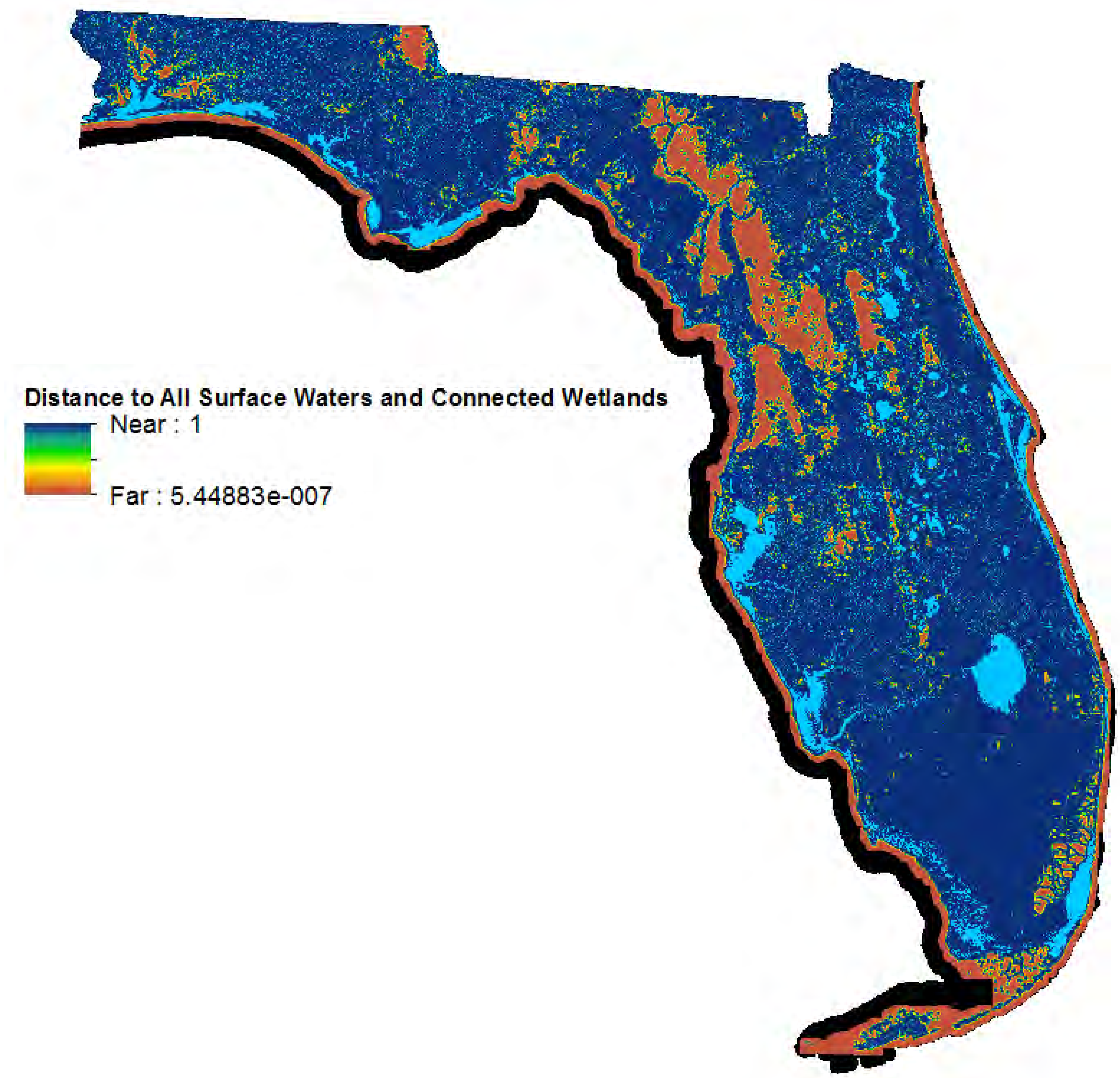


Figure 4 - Distance to All Surface Waters and Connected Wetlands Core Data Layer

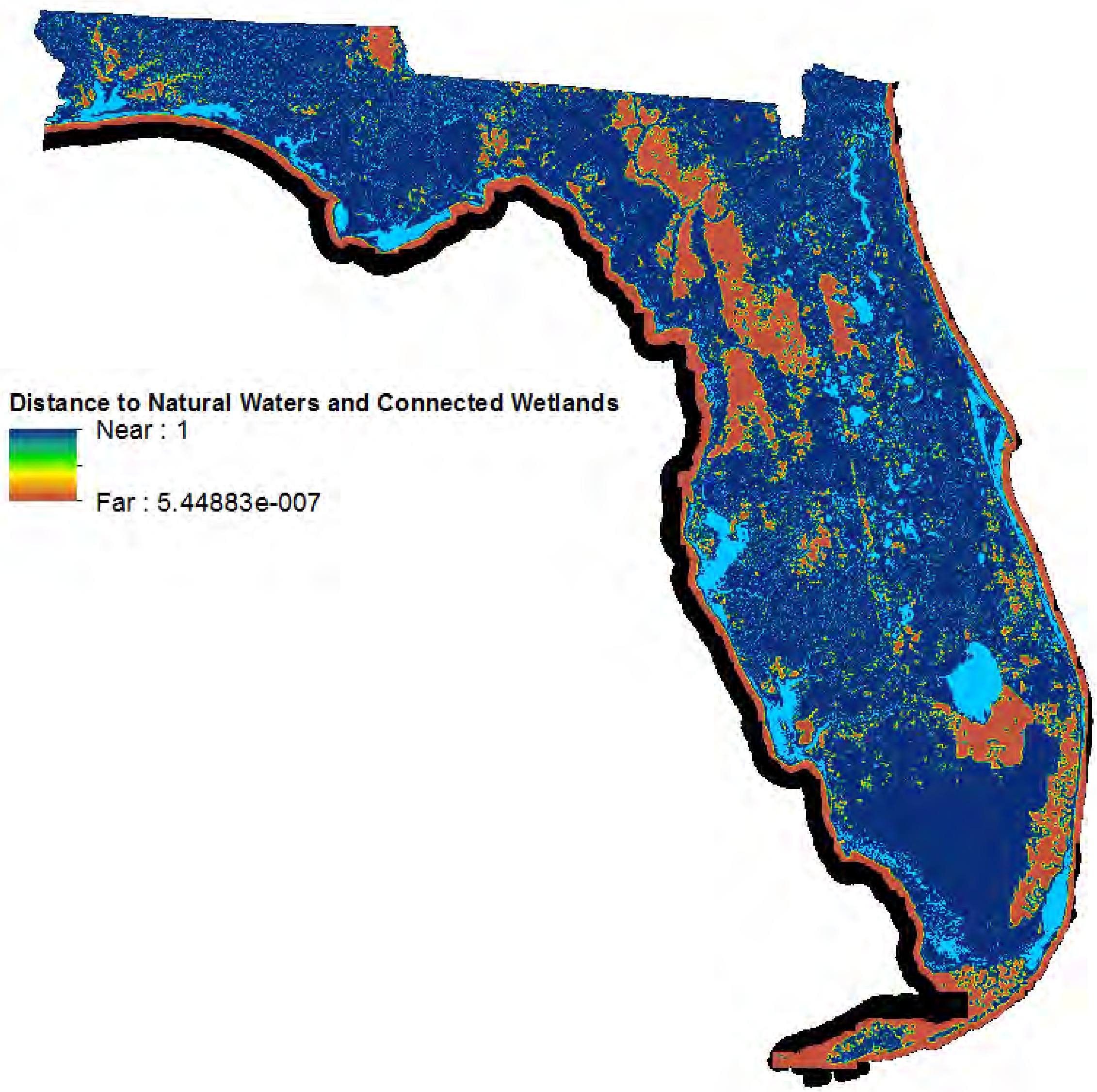


Figure 5 - Distance to Natural Waters and Connected Wetlands Core Data Layer

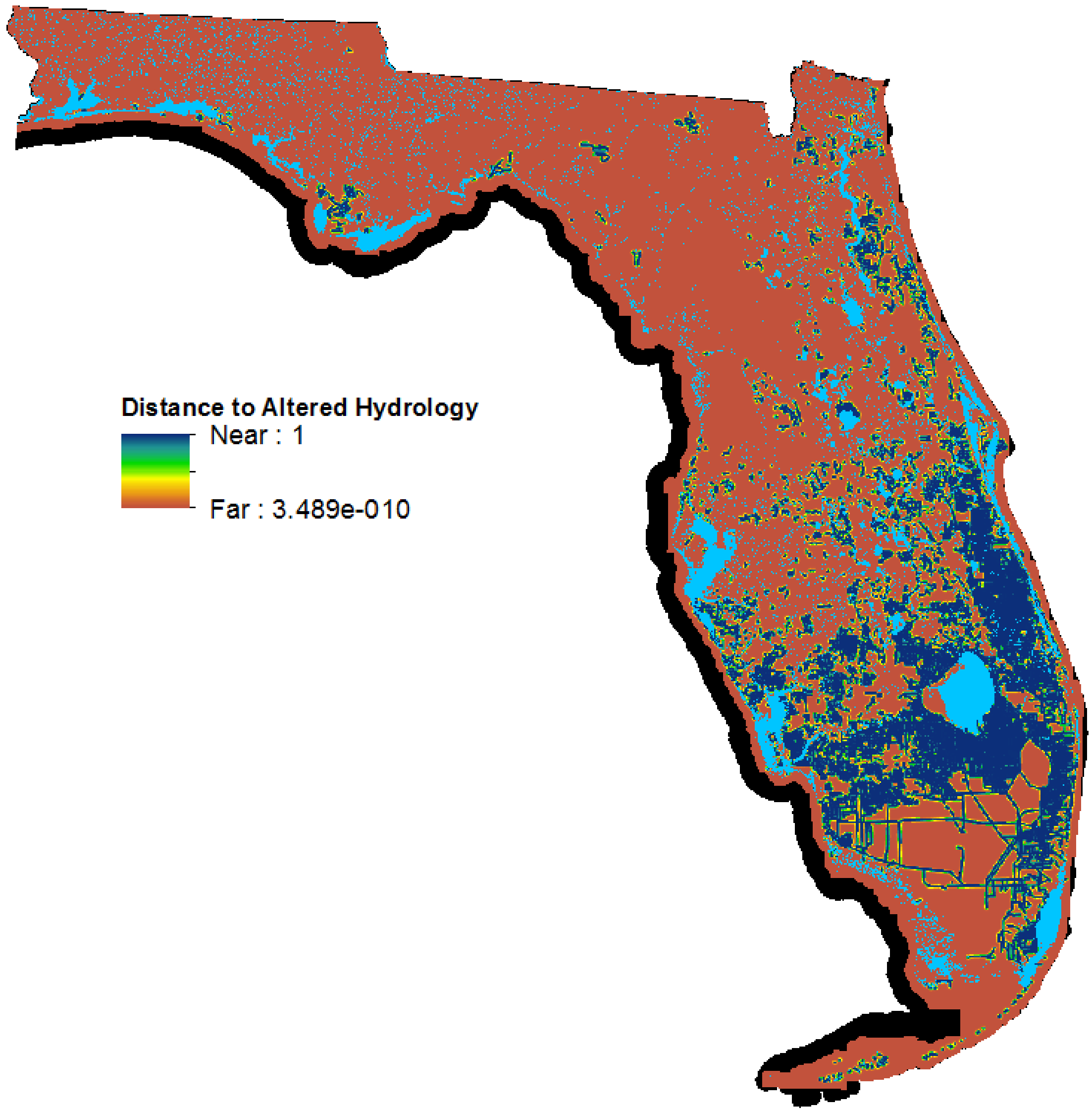


Figure 6 - Distance to Altered Hydrology Core Data Layer

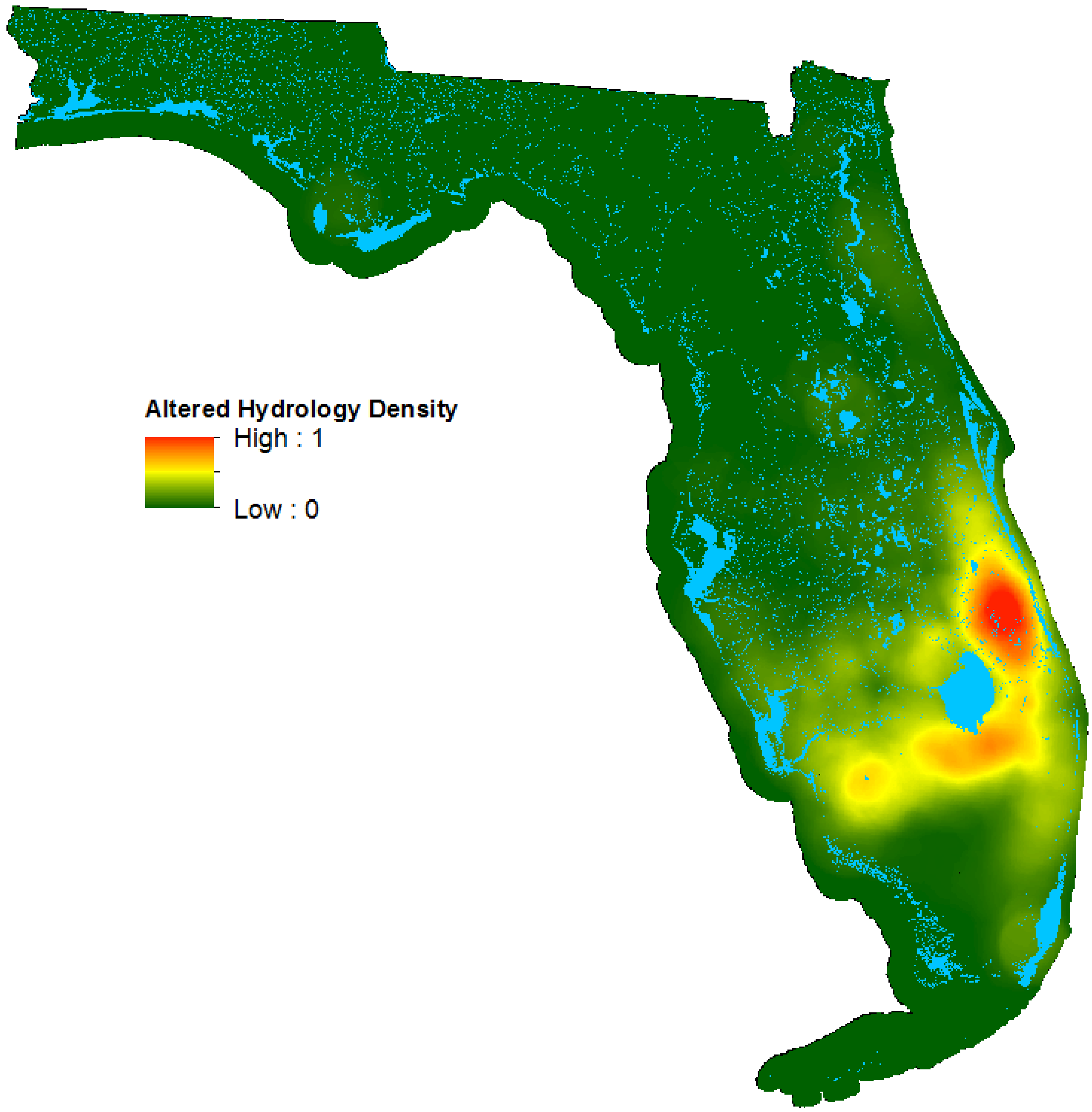


Figure 7 - Altered Hydrology Density Core Data Layer

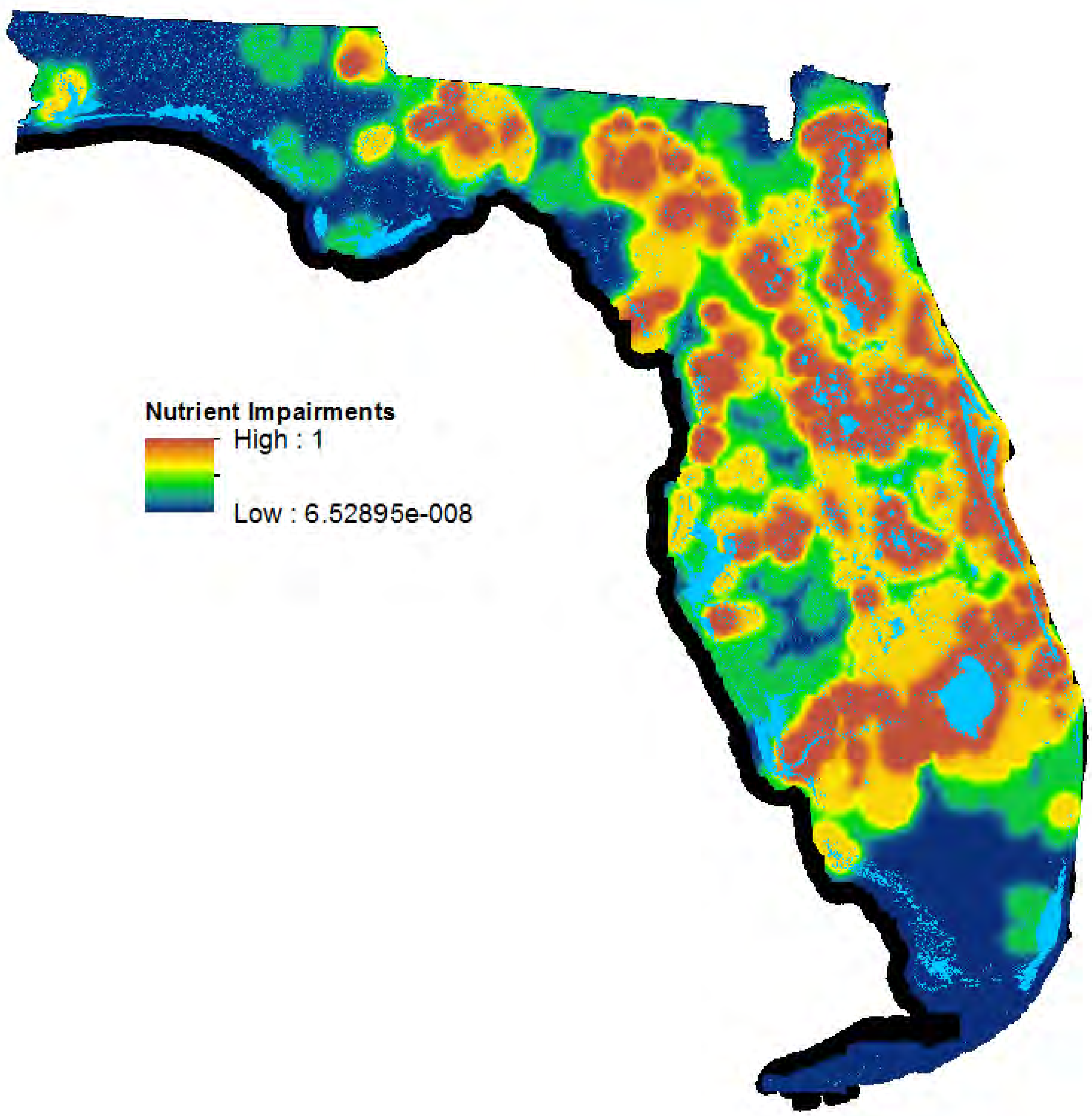


Figure 8 - Nutrient Impairments Core Data Layer

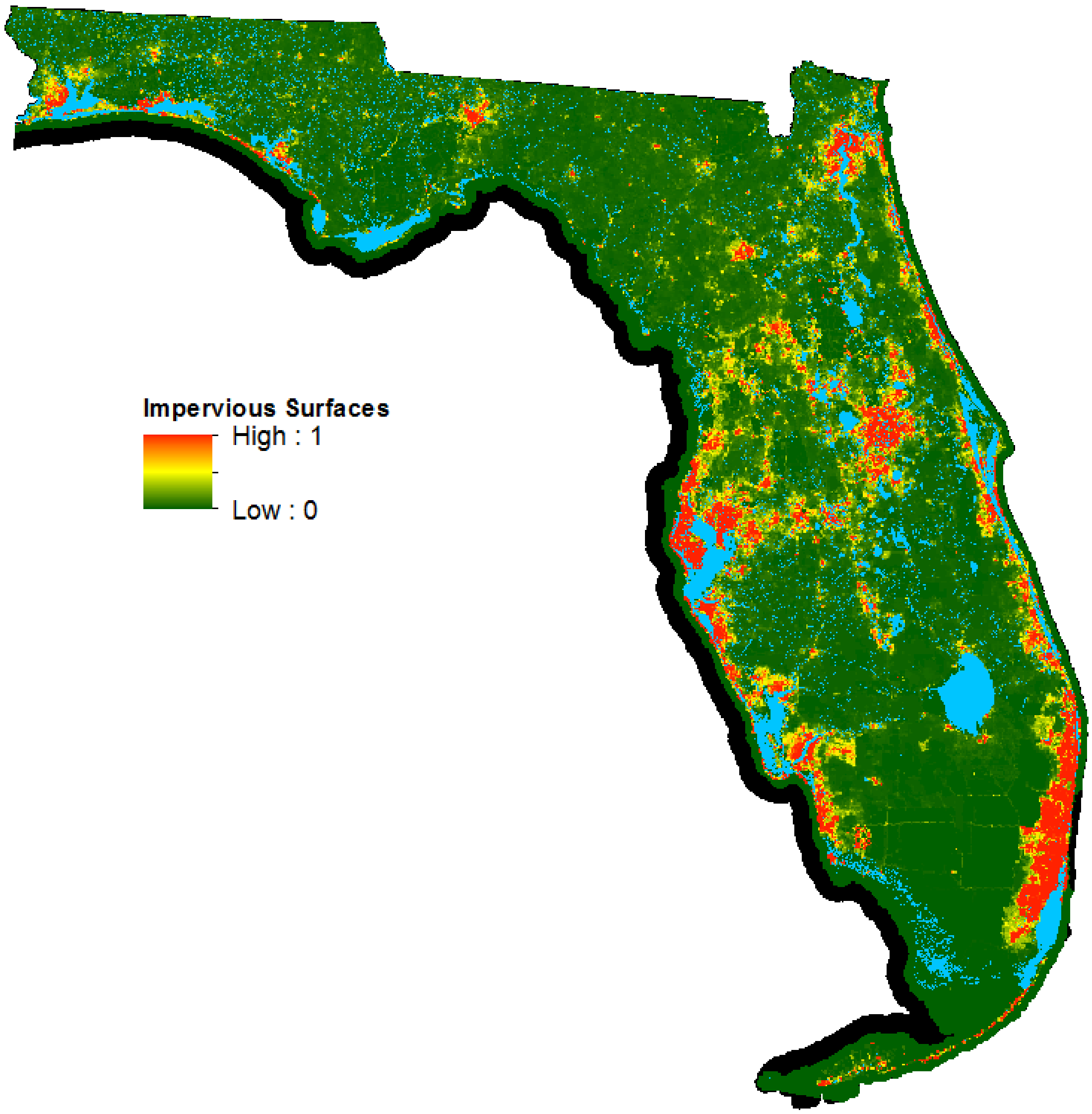


Figure 9 - Impervious Surfaces Core Data Layer

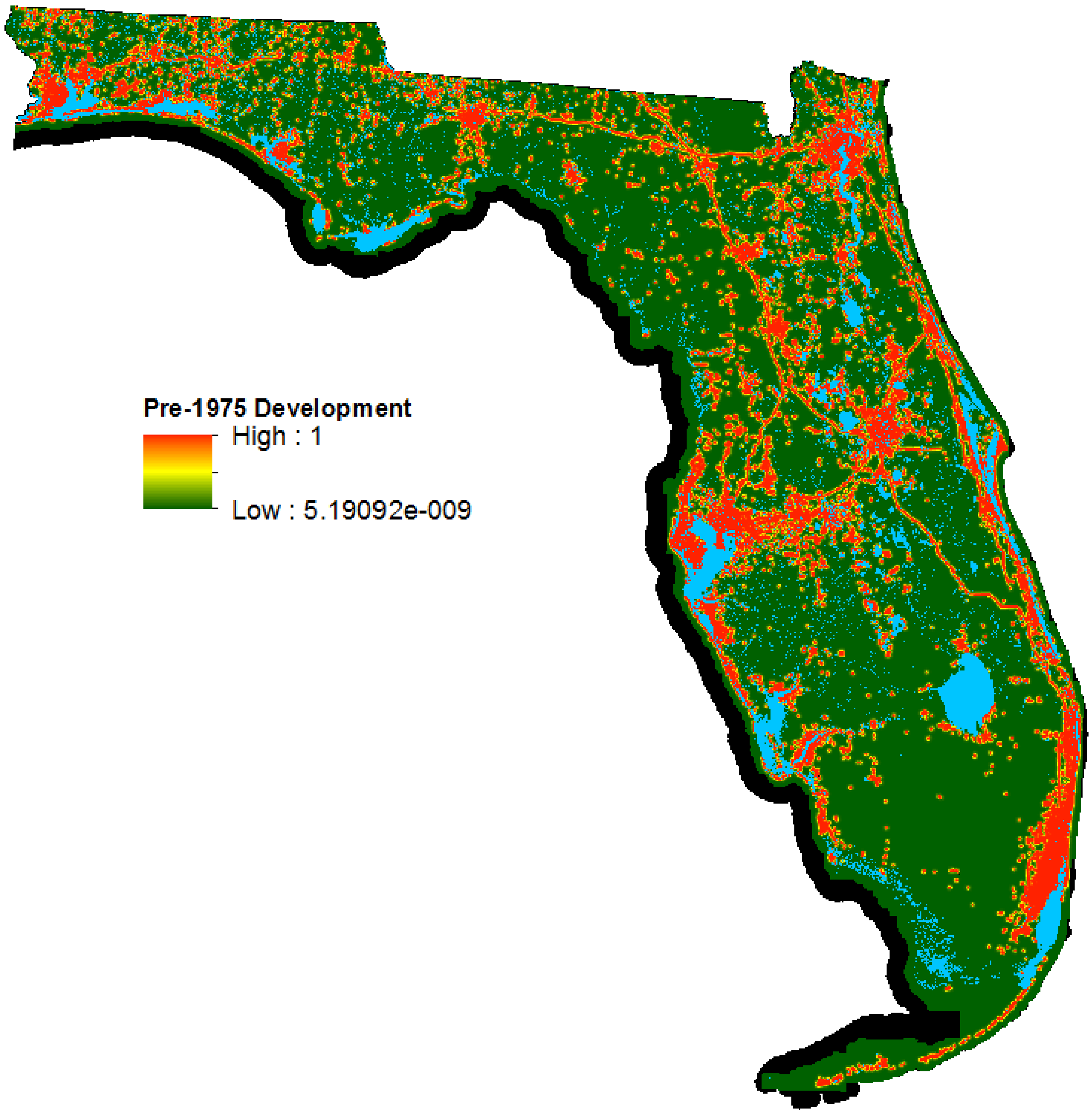


Figure 10 - Pre-1975 Development Core Data Layer

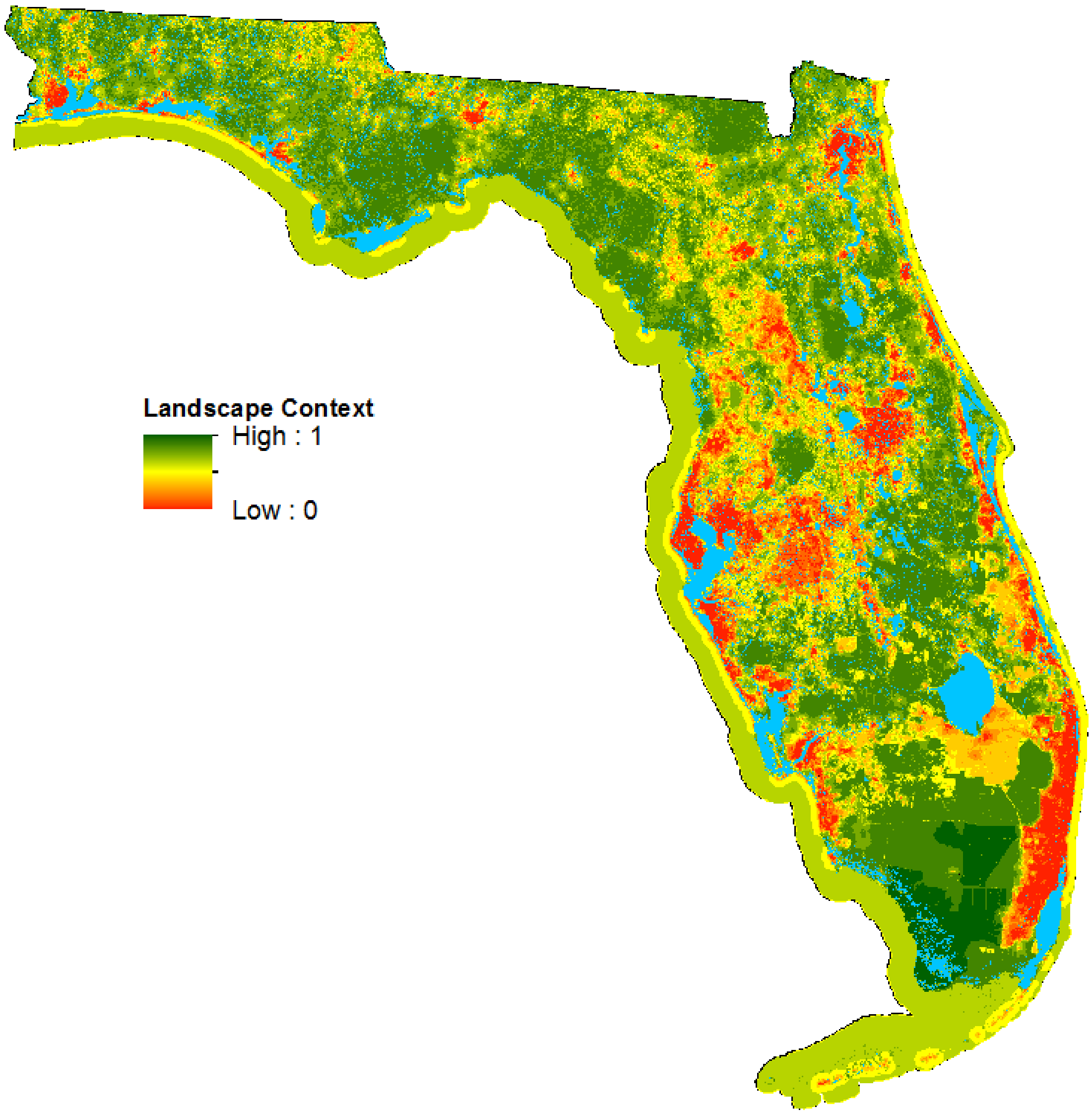


Figure 11 - Ecological Quality Core Data Layer

2. Resource Category Priorities

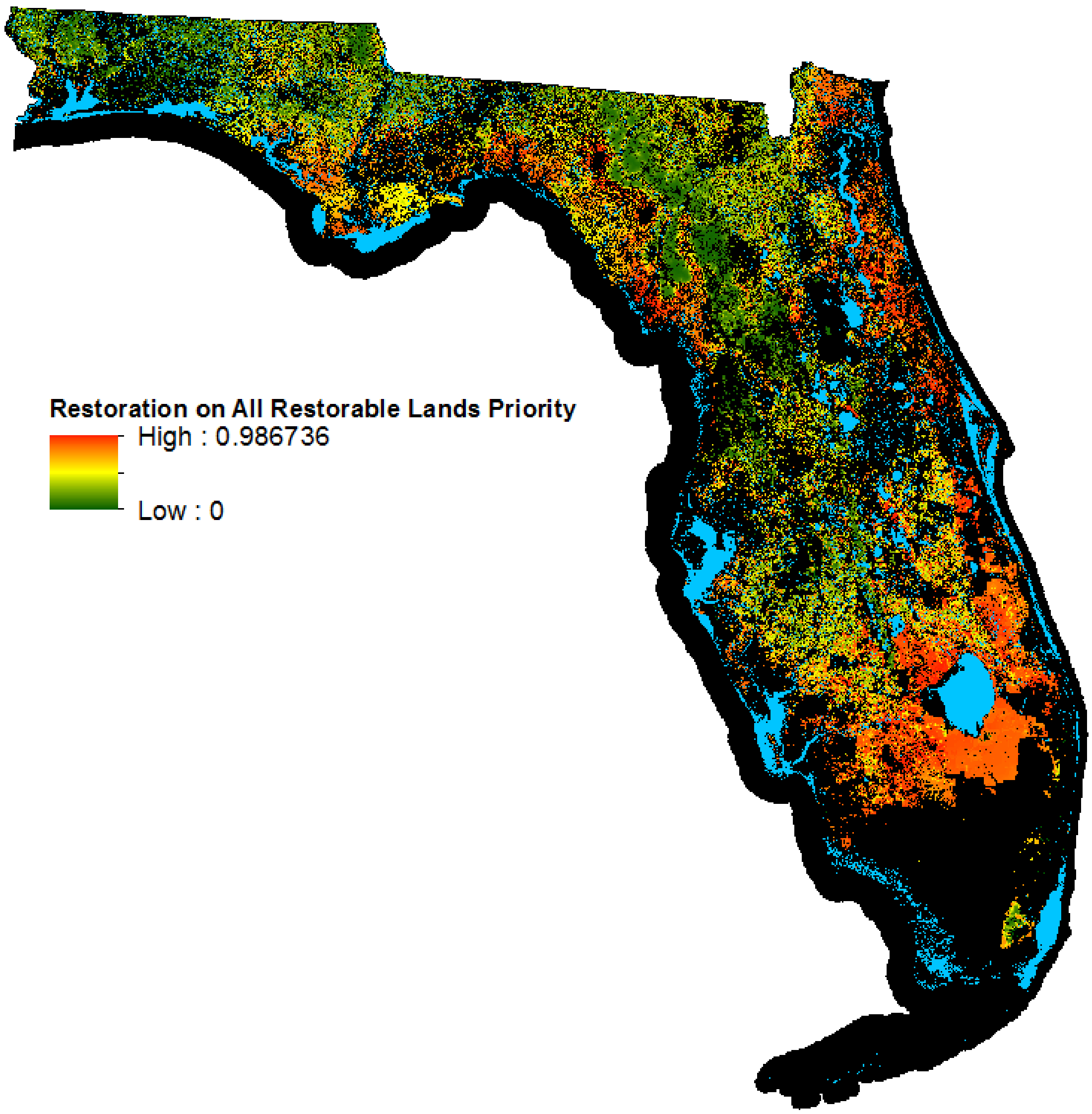


Figure 12 - Restoration on All Restorable Lands Priority Model

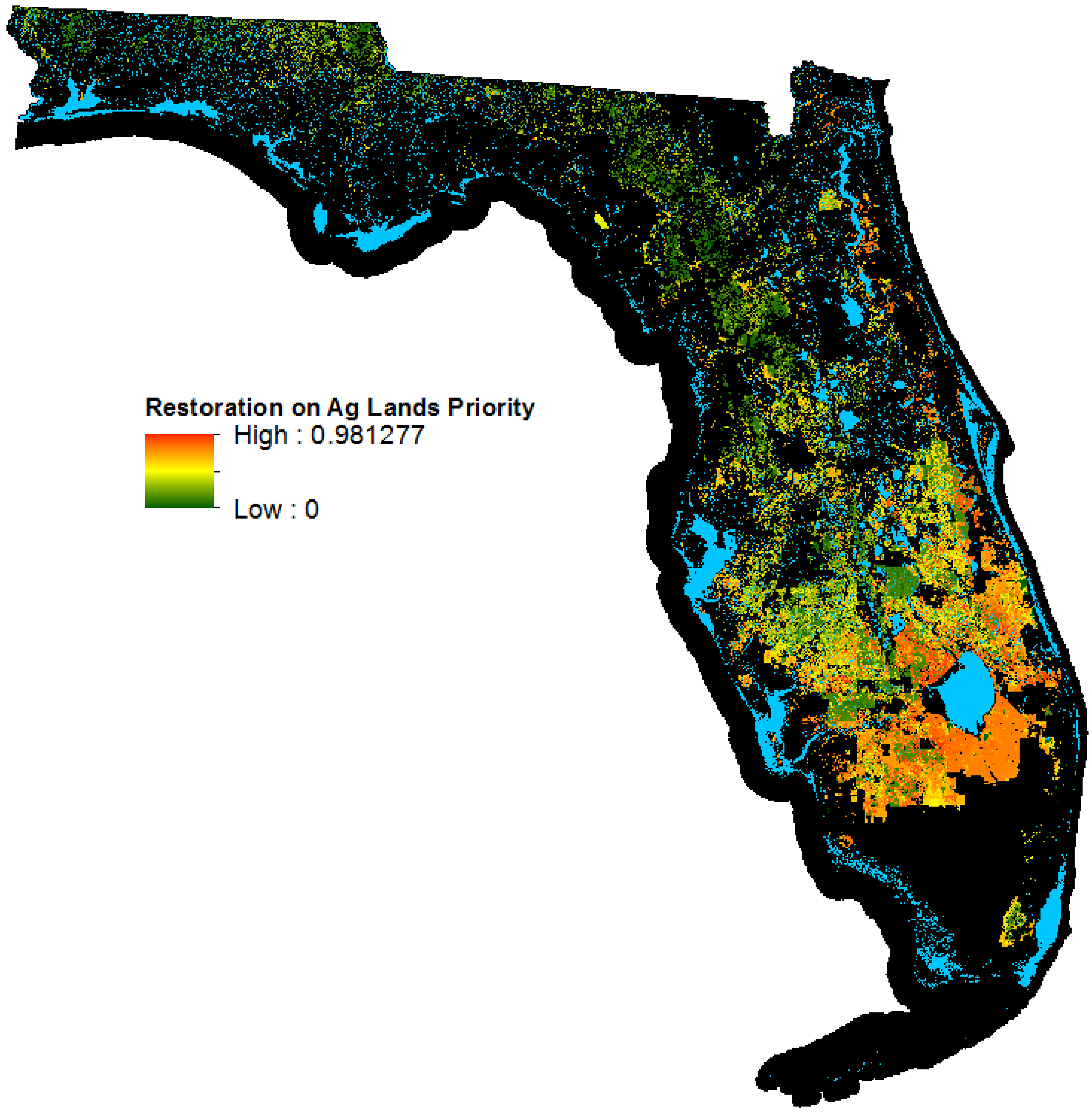


Figure 13 - Restoration on Agricultural Lands Priority

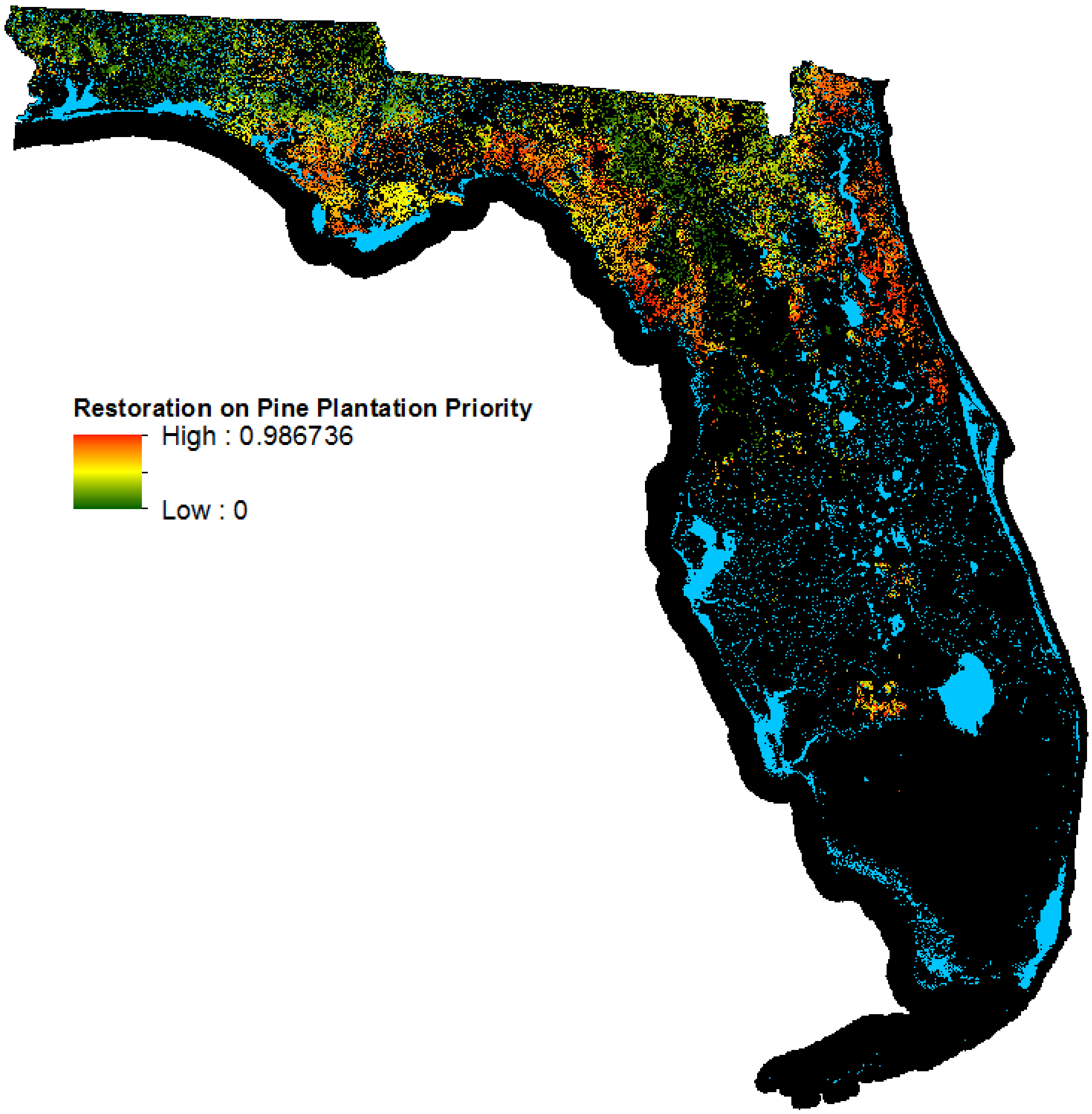


Figure 14 - Restoration on Pine Plantation Priority Model

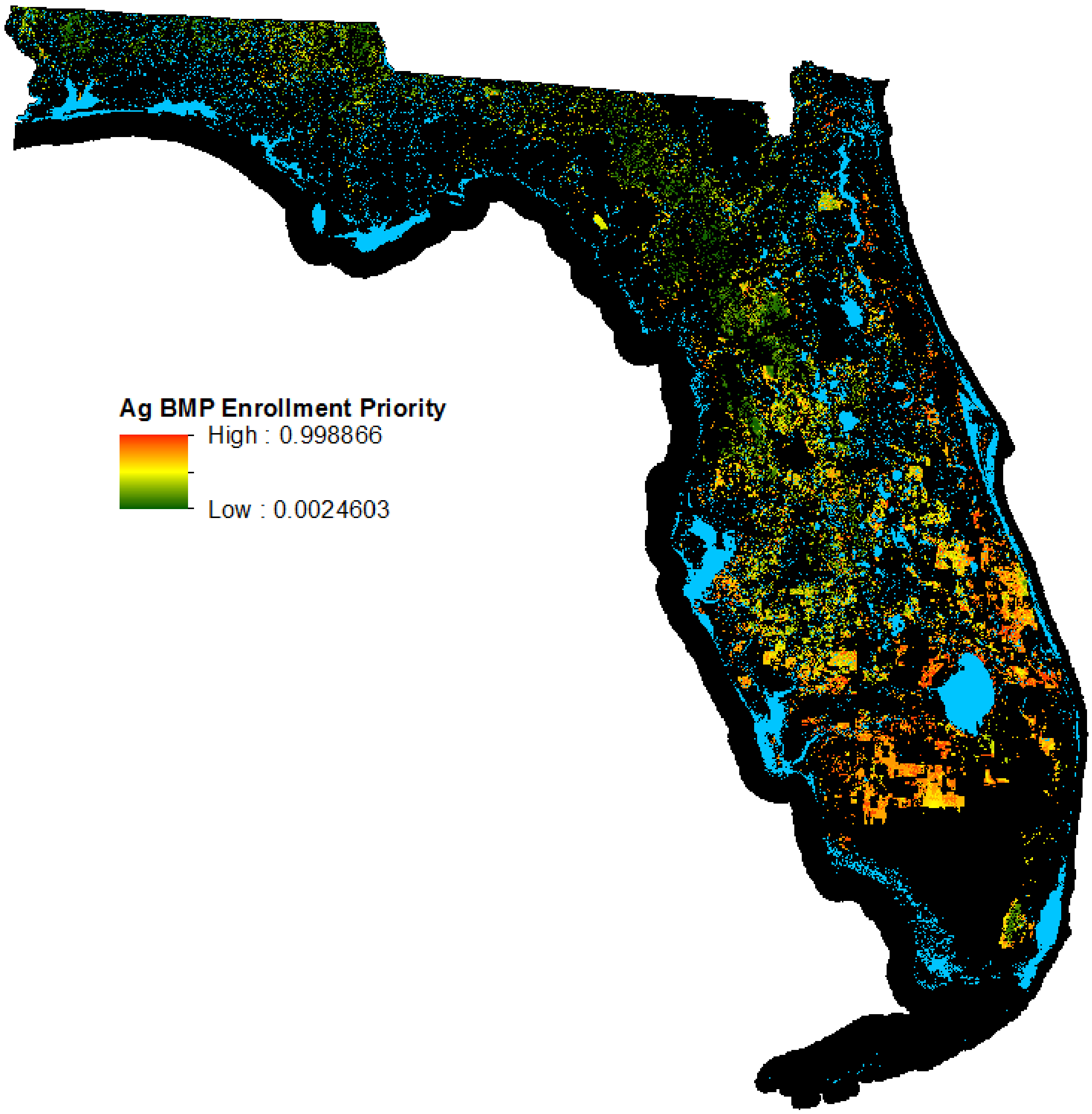


Figure 15 - Agricultural BMP Targeting Priority Model

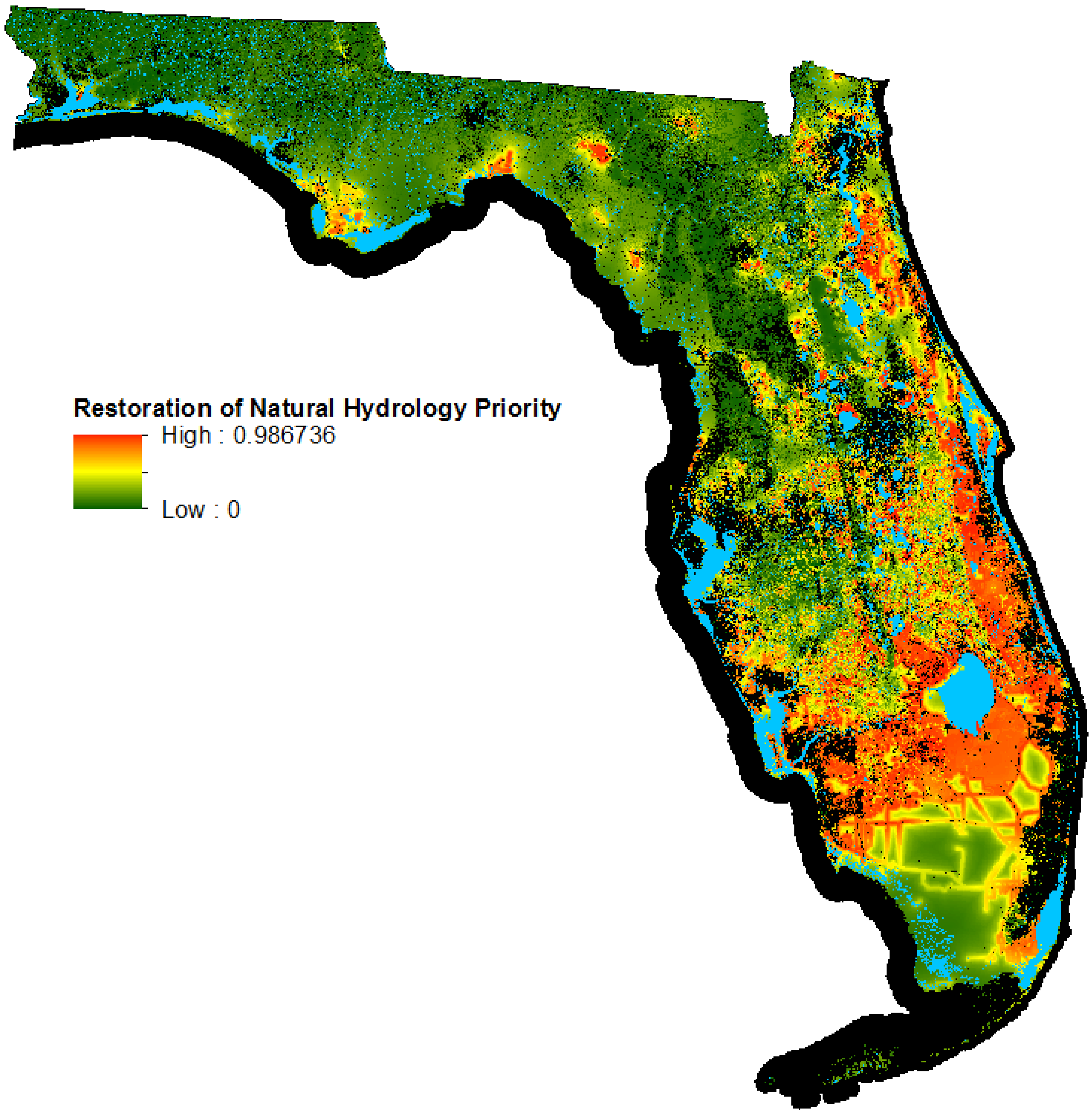


Figure 16 - Restoration of Natural Hydrology Priority Model

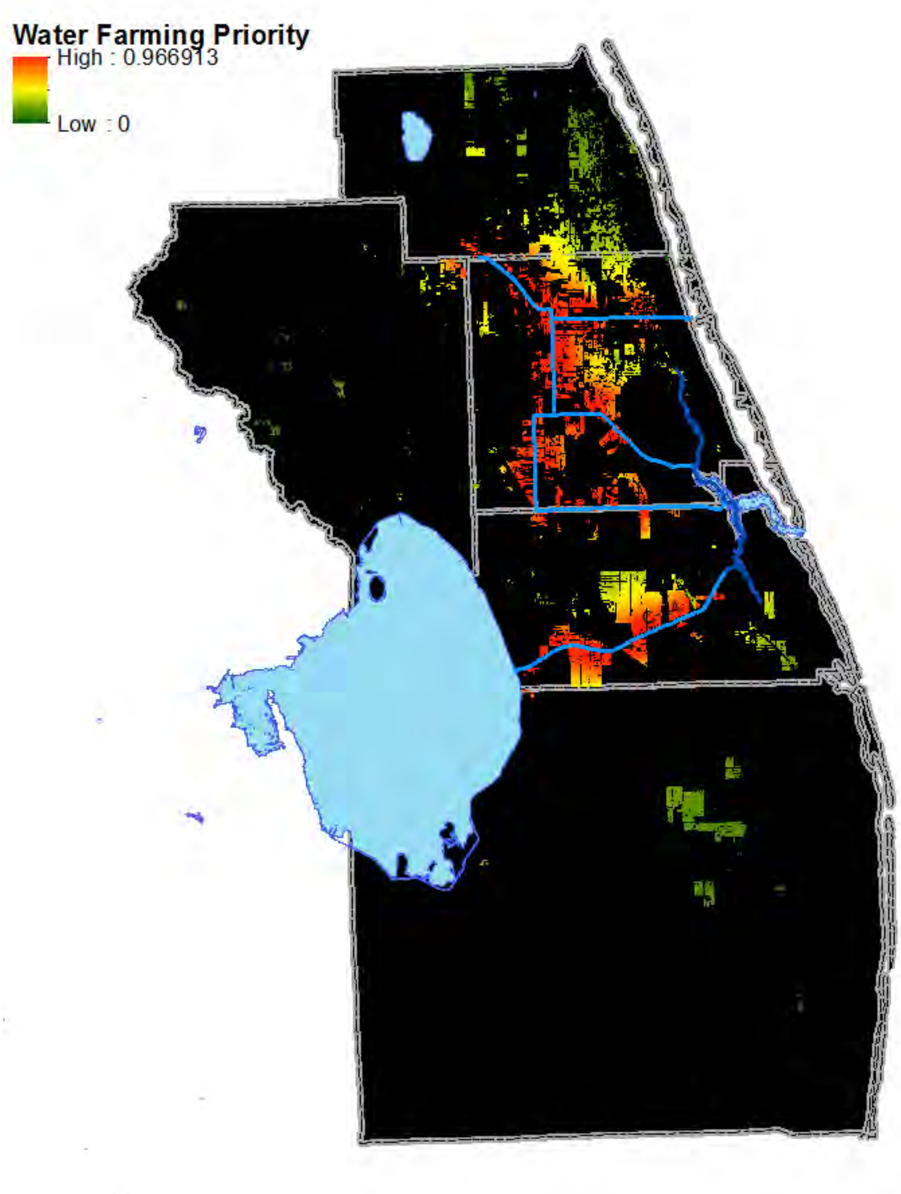


Figure 17 - Water Farming Regional Priority Model

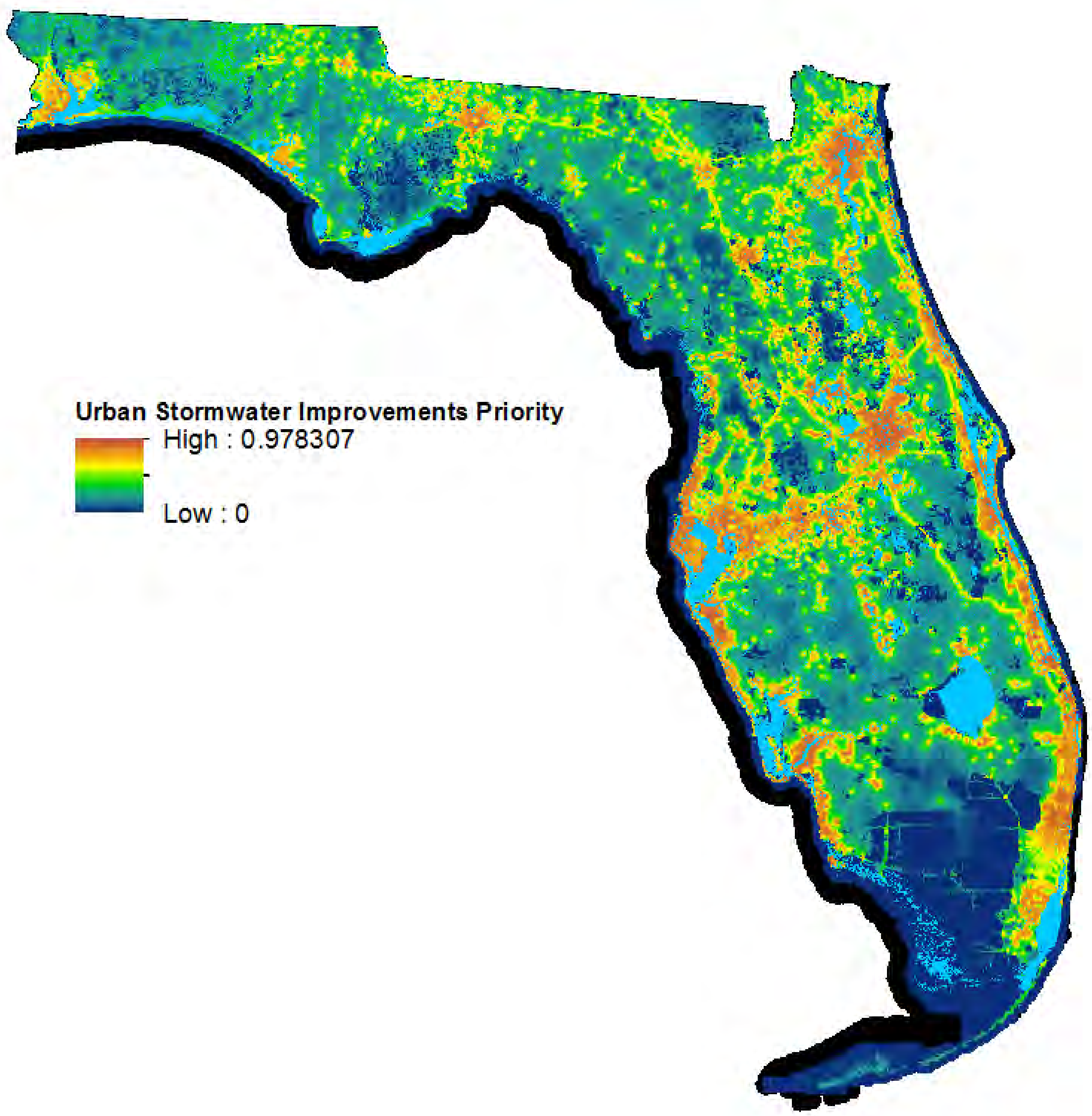


Figure 18 - Urban Stormwater Improvements Priority Model

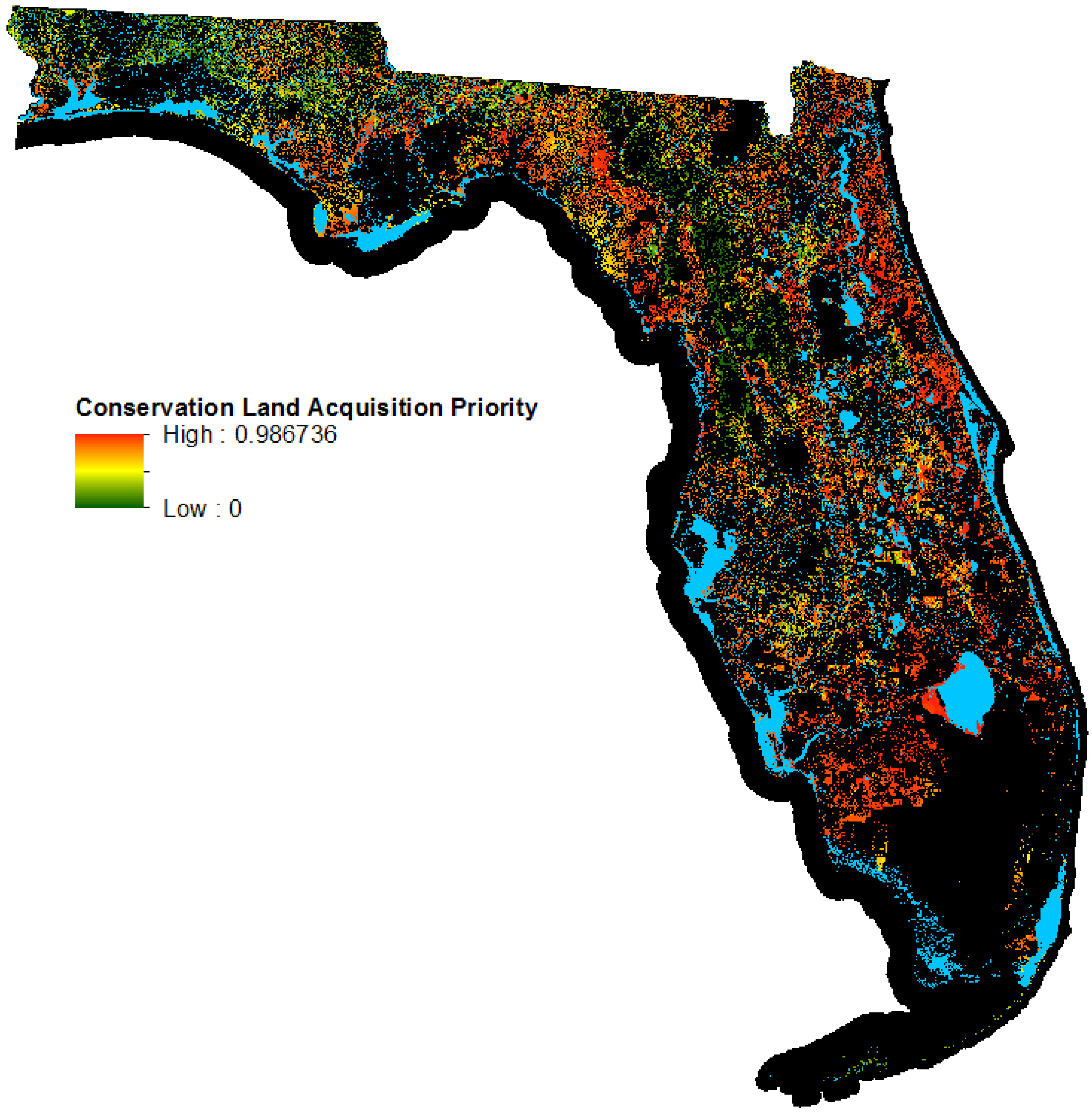


Figure 19 - Conservation Land Acquisition Priority Model

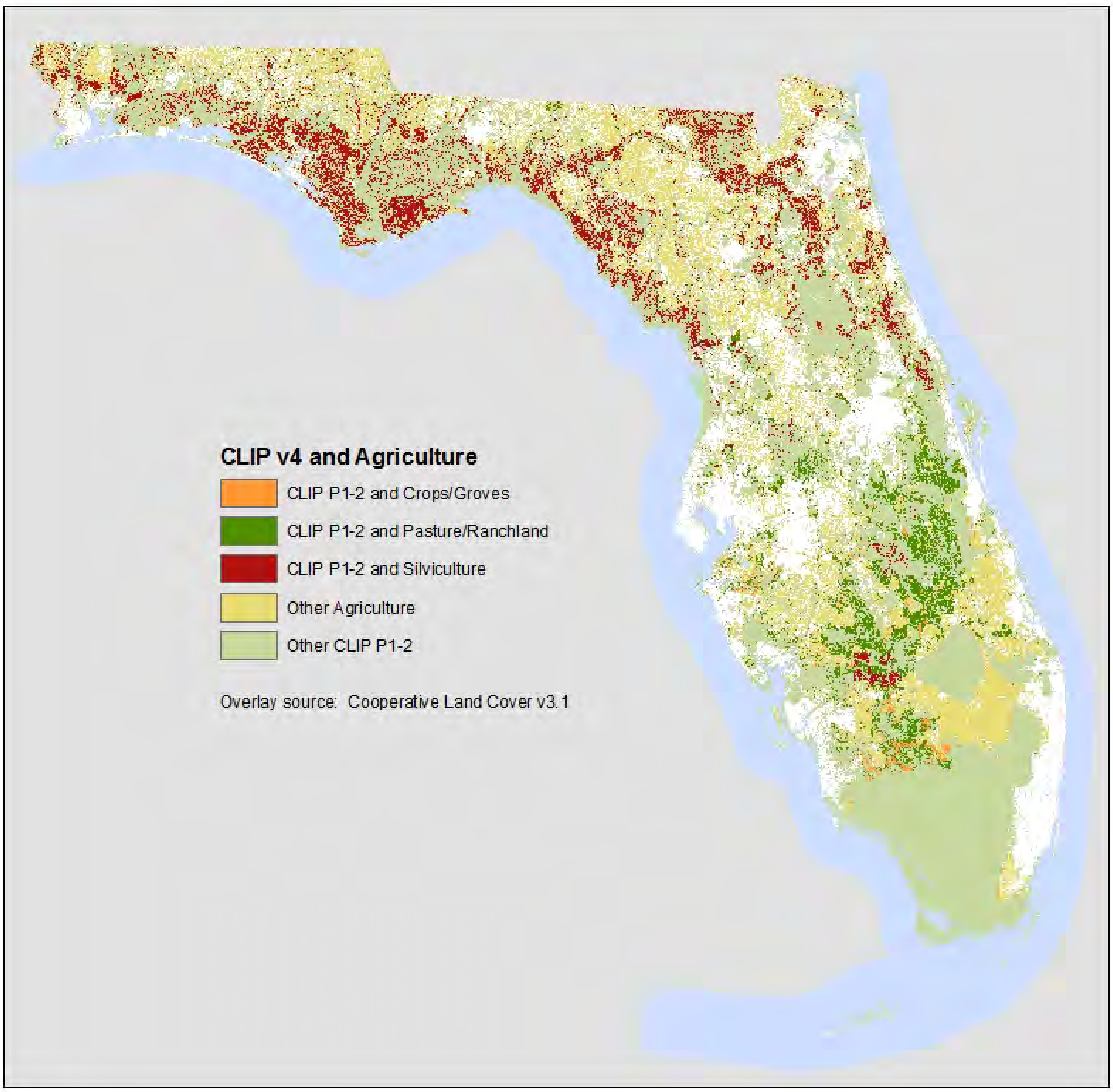
APPENDIX G.

CLIP Overlays

One way to demonstrate the value of the CLIP database is to overlay CLIP conservation priorities on other land use and natural resource issues. Here we offer some examples of this approach primarily for demonstration, there is no limit to the data and/or issues that could be compared to CLIP priorities to shed light on specific conservation issues and opportunities. For these maps we define CLIP high priorities as areas within either Priority 1 or Priority 2 in the CLIP Aggregated Priorities layer.

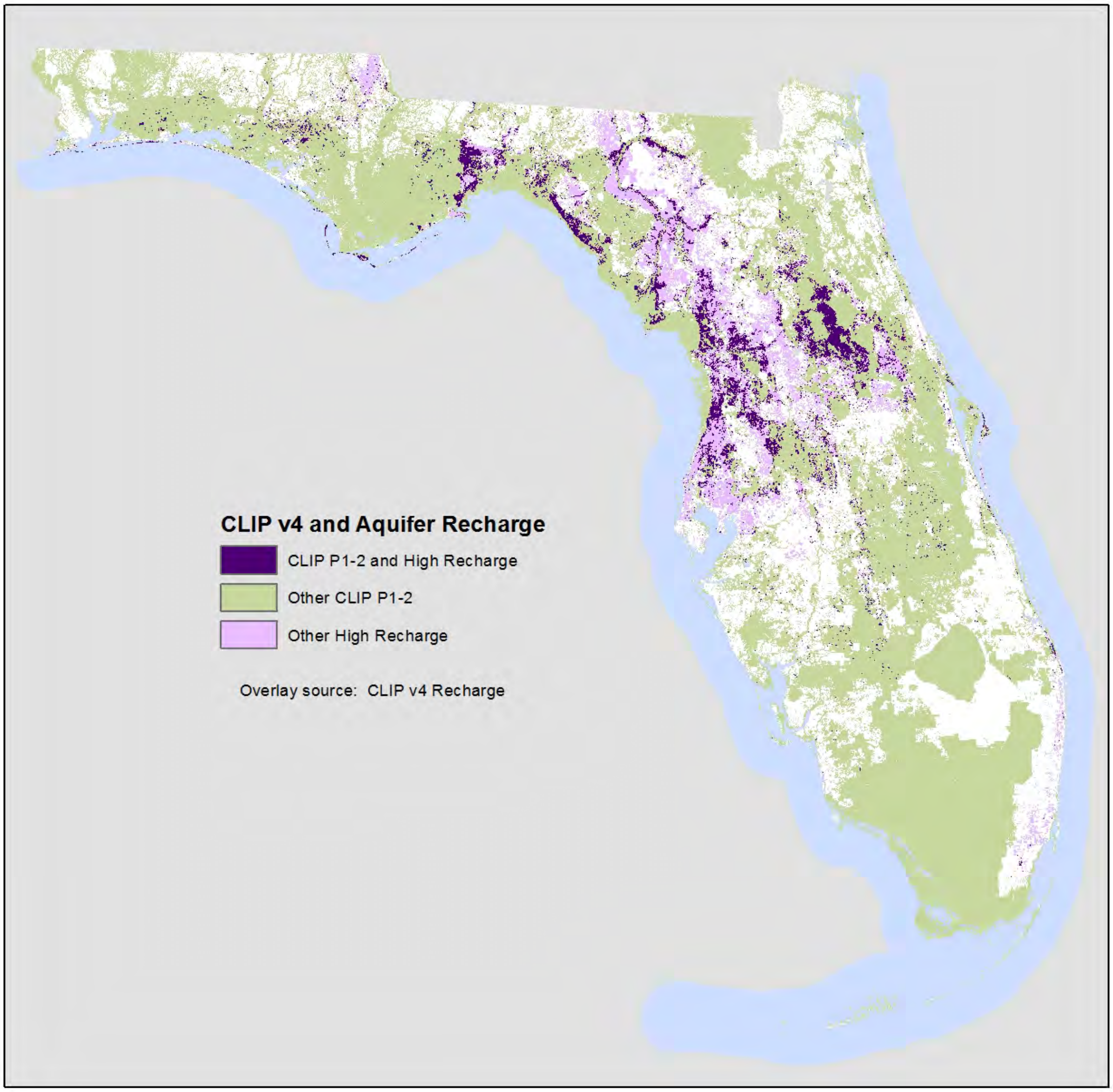
Agriculture

There is substantial overlap between CLIP Priorities 1-2 and agricultural lands in Florida. In north Florida this overlap is predominantly on silviculture (mainly pine plantation), with pasture/ranchland prominent in central and south Florida where ranchlands are important habitat for a variety of focal species, provide landscape connectivity, and with proper management can have an important role in protecting watersheds. There is less overlap of CLIP P1-2 with cropland and other higher-intensity agriculture, with a notable exception of panther habitat in southwest Florida, which overlaps orange groves and other cropland in some cases, where such lands can provide foraging habitat for prey and connectivity and buffers.



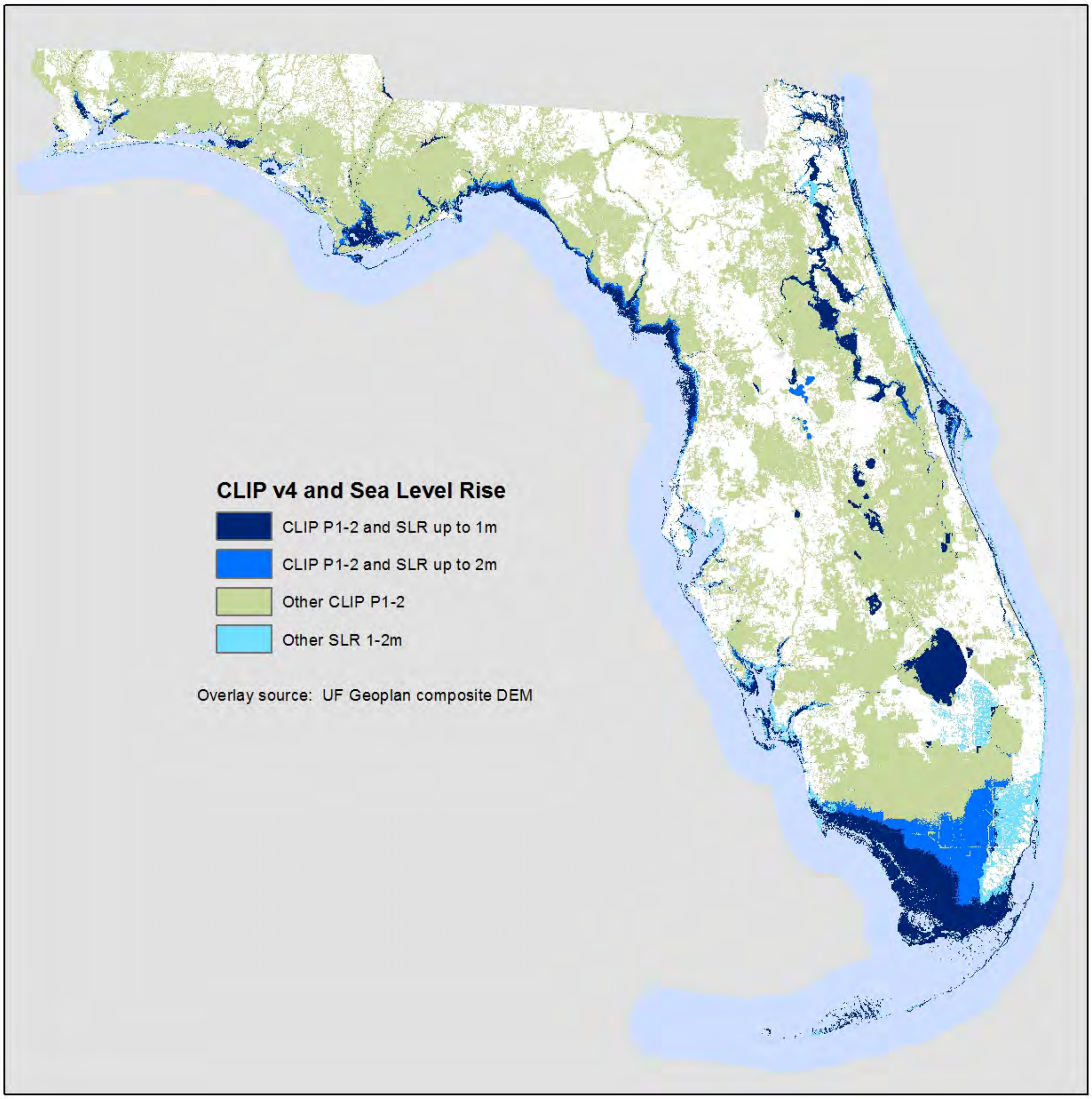
Aquifer Recharge

Since the Aquifer Recharge Resource Category is not included in the Aggregated CLIP Priorities model, it is useful to overlay CLIP priorities on areas of high recharge for comparison. While high recharge areas are found across the state, the highest priorities are primarily concentrated over the Floridan Aquifer in north central Florida.



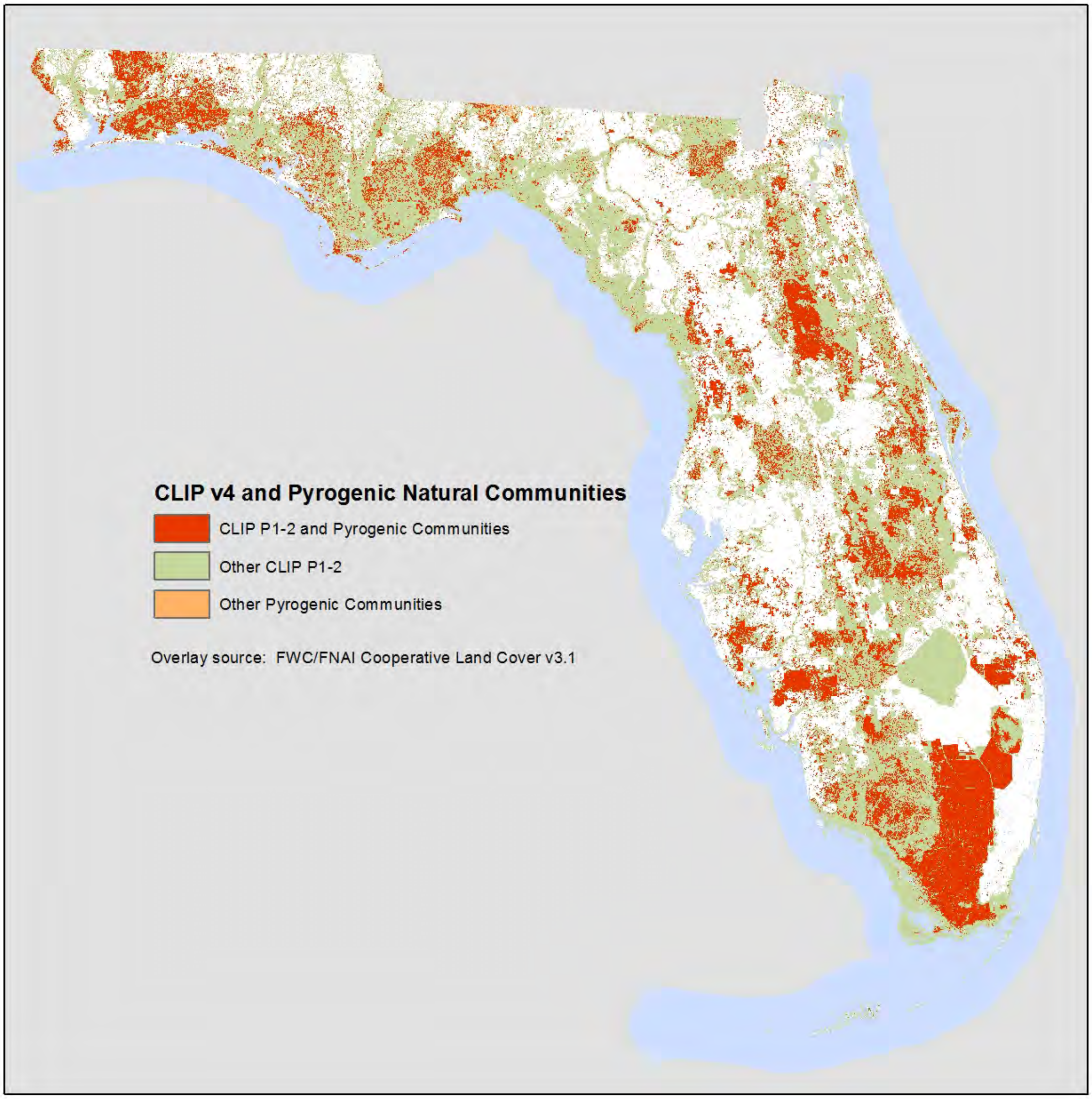
Sea Level Rise

Florida faces a significant threat from the potential for sea level rise in the coming century. The state's extended coastline and flat topography mean that a substantial portion of CLIP high priorities could be impacted by a sea level rise of one to two meters.



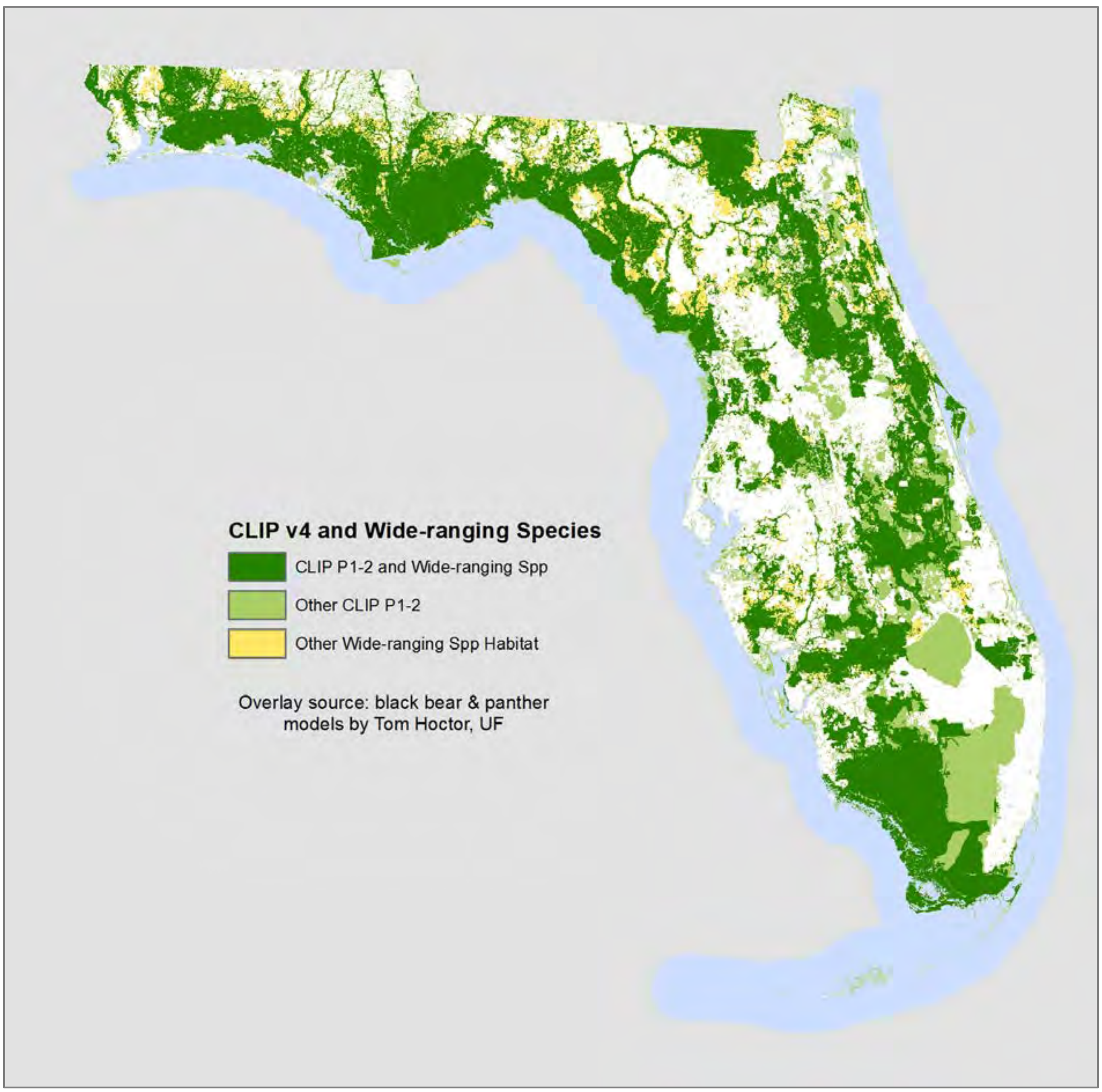
Pyrogenic Natural Communities

A large portion of Florida's natural communities are classified as pyrogenic, meaning that they are adapted to fire and require regular fire events to persist. These communities require not just acquisition or easements to be protected, but active management as well. Nearly all of the pyrogenic communities in Florida are included in CLIP Priorities 1 and 2.



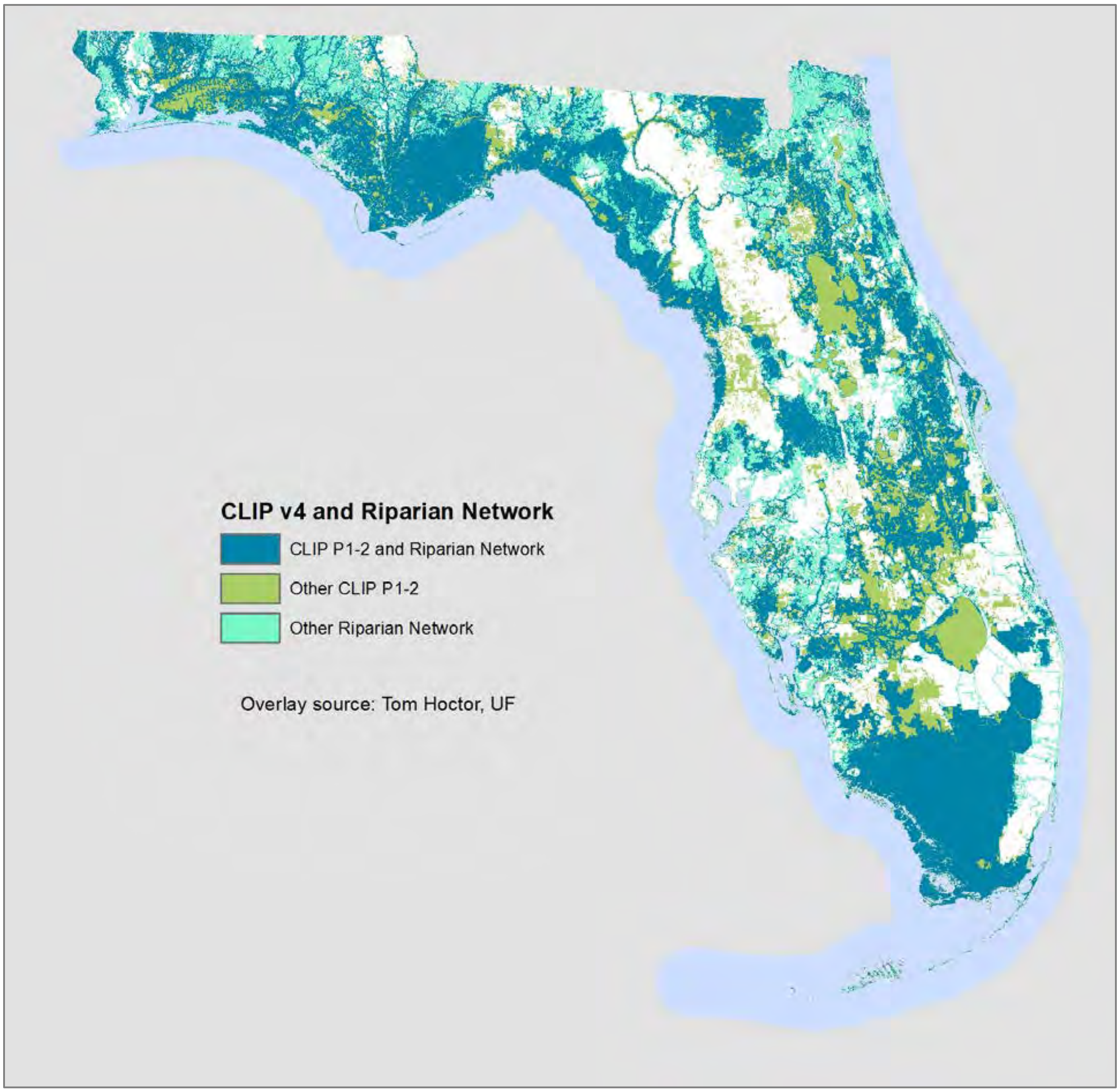
Wide-Ranging Species Habitat

Certain species, such as Florida black bear and Florida panther, are a focus of conservation in part because they range widely over a large area and require large expanses of habitat to persist. These species are considered priorities in multiple CLIP core data layers, including Strategic Habitat Conservation Priorities, Rare Species Habitat Conservation Priorities, and the Florida Ecological Greenways Network. As a result, there is close overlap between CLIP priorities 1-2 and habitat identified for black bear and panther. Wide-Ranging Habitat data source: Florida black bear Maxent habitat model from the FEGN Update Project (Hoctor et al. 2013) combined with a recently completed Florida panther habitat model done by Tom Hoctor at UF for the USFWS.



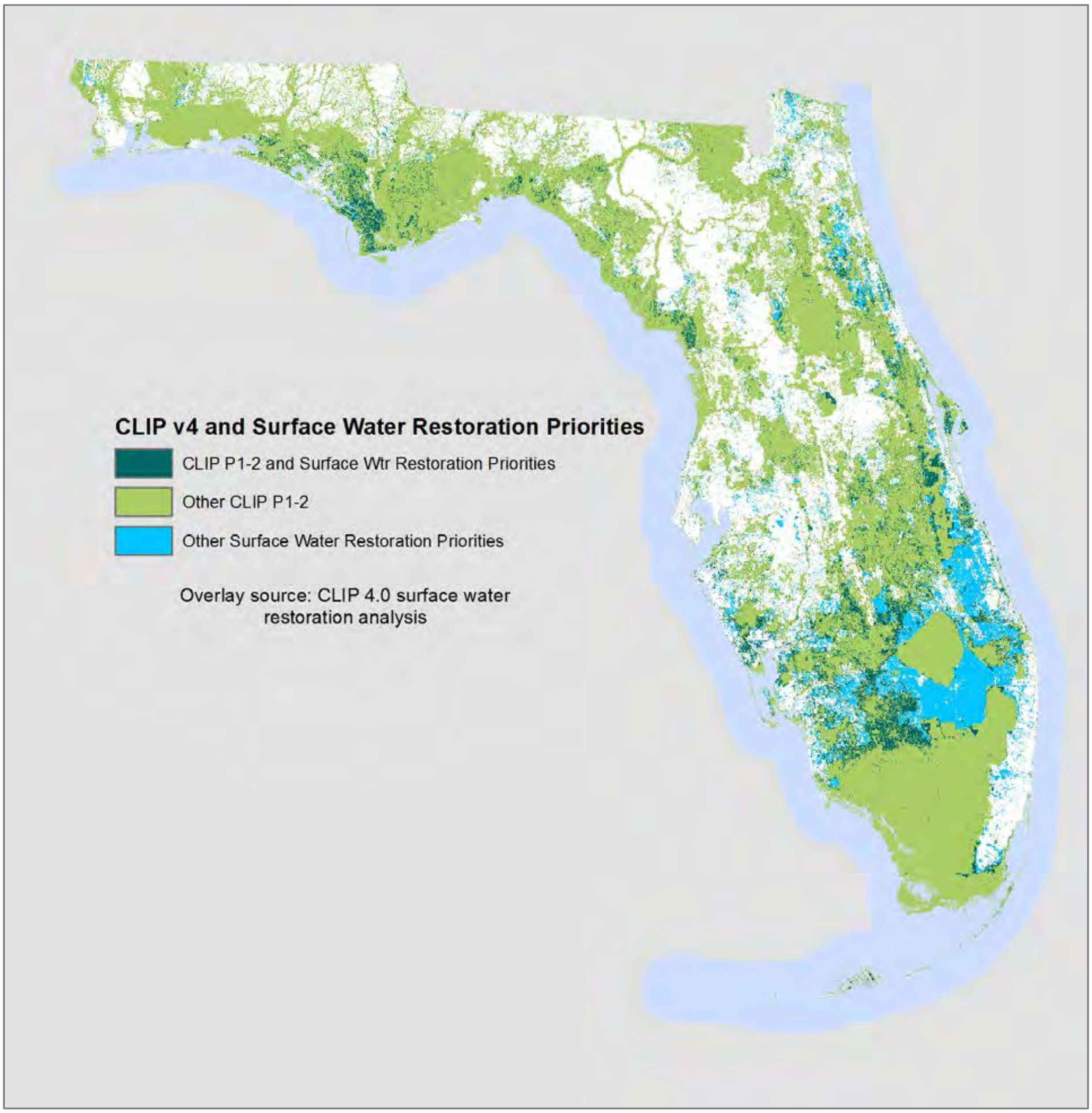
Riparian Network

For the purpose of this overlay, the riparian network includes all wetlands connected to natural waterbodies with a 300 meter buffer. These areas are well-identified by CLIP in the wetlands, floodplain, and surface waters data layers. The areas not included in CLIP Priorities 1-2 are generally found in lower CLIP priority levels.



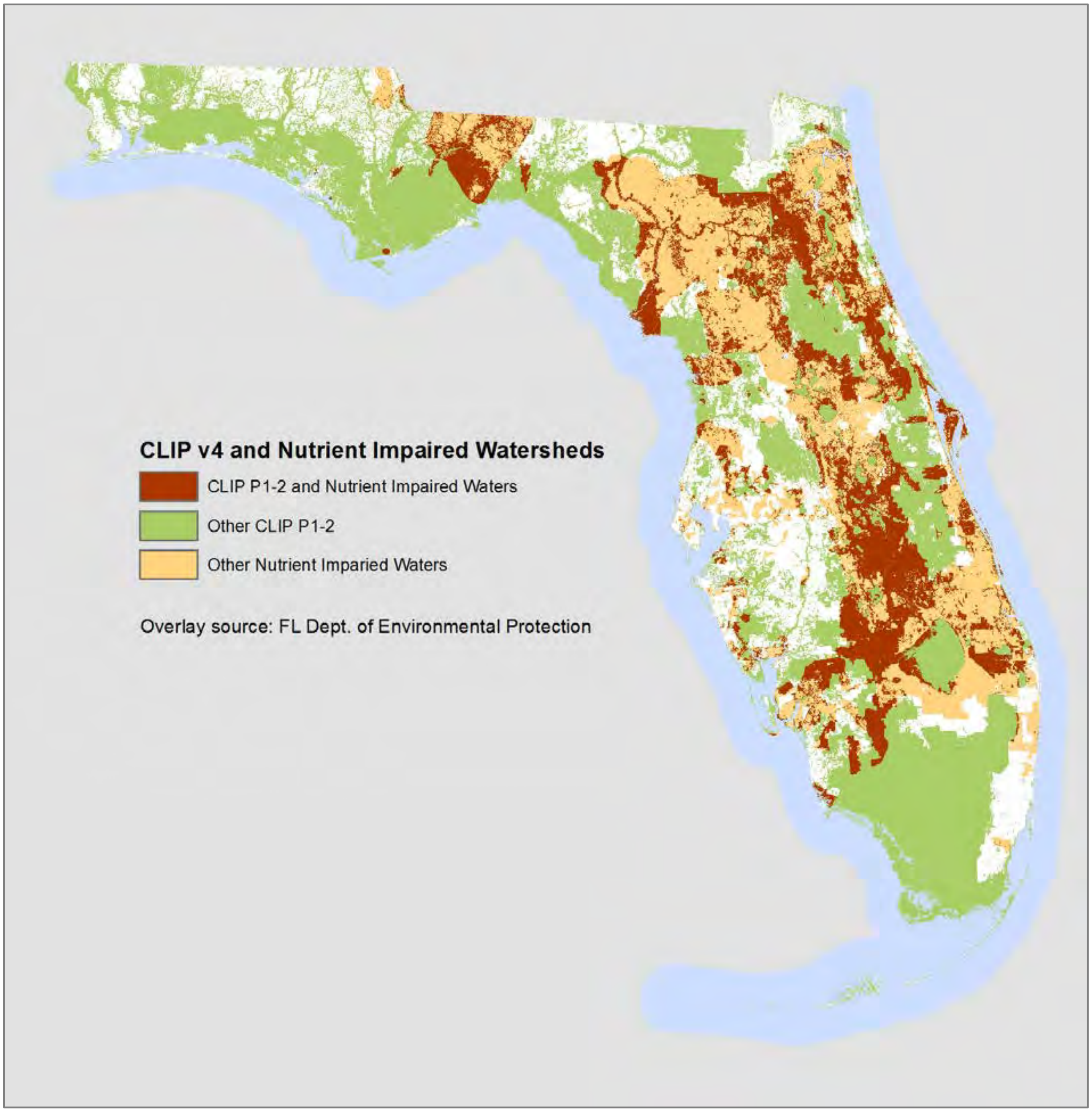
Surface Water Restoration Priorities

Most of the water resource priorities currently included in CLIP focus on intact natural water bodies in relatively good condition. We have long understood that additional areas are important for the restoration of currently impacted or degraded water resources. This overlay is useful in showing those additional areas and the relatively low overlap with current CLIP priorities. The Surface Water Restoration priorities used in this comparison are part of draft work included in this report and represent areas of existing and former wetlands in areas with high levels of watershed modification in the form of networks of drainage ditches and canals.



Nutrient Impaired Waters/Watersheds

Despite its focus on functioning natural water systems as noted above, CLIP does show a fair amount of overlap with watersheds designated as having nutrient impaired waters. The nutrient impaired watersheds in this comparison came from FDEP impaired waters and BMAP areas data.



Mitigation Banks

Many wetland mitigation banks have been established in Florida as sites for conservation to offset wetland impacts elsewhere within the state. Nearly all of these banks fall within in CLIP priorities 1 and 2. CLIP could be useful in evaluating how proposed areas benefit additional resources (such as biodiversity, wildlife corridors, protection of large, intact landscapes) that might higher priority or more mitigation credits.