Florida Forever
Conservation Needs Assessment

Technical Report

Version 4.4

November 2018

prepared by the

Florida Natural Areas Inventory

CONTENTS

LIST OF APPENDICES

LIST OF ACRONYMNS

BOT	Board of Trustees
BMP	Best Management Practices
CAMA	Office of Coastal and Aquatic Managed Areas
CARL	Conservation and Recreation Lands
CLIP	Critical Lands & Waters Identification Project
CLC	Cooperative Land Cover
DEP	Department of Environmental Protection
DHR	Division of Historical Resources
DLG	Digital Line Graph
DOF	Division of Forestry
DRP	Division of Recreation and Parks
E	Endangered
EO	Element Occurrence
ESRI	Environmental Systems Research Institute, Inc.
FFCNA	Florida Forever Conservation Needs Assessment
FEMA	Federal Emergency Management Agency
FLUCCS	Florida Land Use Land Cover Classification System
FNAI	Florida Natural Areas Inventory
FNAIHAB	FNAI Rare Species Habitat Conservation Priorities model
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information Systems
GRANK	Global Rank
NRAP	Natural Resources Acquisition Report

NRCS	Natural Resources Conservation Service (U. S. Dept. Agriculture)
NWFWMD	Northwest Florida Water Management District
NWI	National Wetlands Inventory
OES	Office of Environmental Services
OFW	Outstanding Florida Water
PNA	Potential Natural Area
RCW	Red-cockaded Woodpecker
SFHA	Special Flood Hazard Area
SFWMD	South Florida Water Management District
SHCA	Strategic Habitat Conservation Area
SJRWMD	St. Johns River Water Management District
SLER	Bureau of Submerged Lands and Environmental Resources
SRWMD	Suwannee River Water Management District
SSC	Species of Special Concern
SWFWMD	Southwest Florida Water Management District
T	Threatened
USGS	United States Geological Survey
WMD	Water Management District

INTRODUCTION

At the beginning of the Florida Forever program, the Florida Natural Areas Inventory was contracted by the Department of Environmental Protection to develop a Florida Forever Conservation Needs Assessment (FFCNA) to assist the Florida Forever Advisory Council in establishing priorities and measures of progress for the Florida Forever program. The FFCNA is a geographic analysis of the distribution of certain natural resources and resource-based land uses that have been identified by the Council and Florida Legislature as needing increased conservation attention. Work on the FFCNA began in April 2000, and in December 2000 the Summary Report (Florida Natural Areas Inventory 2000), including color maps, was submitted to the Advisory Council. We were able to draw on the expertise of resource professionals around the state, who helped to interpret the Florida Forever measures and to develop methods for creating representative data layers (see Appendix J). This Technical Report provides detailed documentation for the primary data developed for the FFCNA. Additional data and analyses are documented in the Project Ranking Support Analyses (RSA) Documentation.

The data and analyses described in this Technical Report apply only to Version 4.4 of the Florida Forever Conservation Needs Assessment, as completed in November 2018. Rather than a static series of maps, the FFCNA continues to be an ongoing process that is revised as additional lands are acquired, the data are reviewed, and as better information becomes available (Appendix H outlines these revisions). We continue to work with experts around the state to make the FFCNA as informative and useful to the Florida Forever program as possible.

<u>Overview of FNAI Florida Forever Work</u>

Since its founding in 1981, the Florida Natural Areas Inventory has played an active role in scientific evaluation of potential environmental land acquisition projects. When the Florida Forever program began in 2000, that involvement grew to multiple roles that are summarized in Figure 1. FNAI supports land acquisition decisions in two complementary ways. First, FNAI conservation planners and GIS analysts compile, prioritize, and analyze natural resource information from a primarily data-driven perspective, which includes the Florida Forever Conservation Needs Assessment documented in this report. Second, FNAI staff biologists review in-house data to prepare Preliminary Evaluation Reports on all Florida Forever proposals. They then conduct site visits and final evaluations on each proposal voted forward by the Acquisition and Restoration Council (ARC). These two general efforts support each other, with scientists referring to prioritized natural resource models developed as part of the FFCNA, and GIS modelers updating data as needed based on information gathered from site visits.

Figure 2 outlines the Geographic Information Systems (GIS) data and analyses developed by FNAI in more detail, showing how the Florida Forever Conservation Needs Assessment relates to overall Florida Forever work. The FFCNA, consisting of a series of statewide models of natural resource priorities, forms the core of these efforts. These data feed directly into products including the Natural Resource Acquisition Progress Report (NRAP), and tables of resource statistics for new Florida Forever proposals and Boundary Amendments. The FFCNA also informs a series of analyses that score Florida Forever projects and new proposals based on their value for individual resources (Single Resource Evaluation) and across multiple resources (F-TRAC Analysis). Those Project Ranking Support Analyses are detailed in the RSA

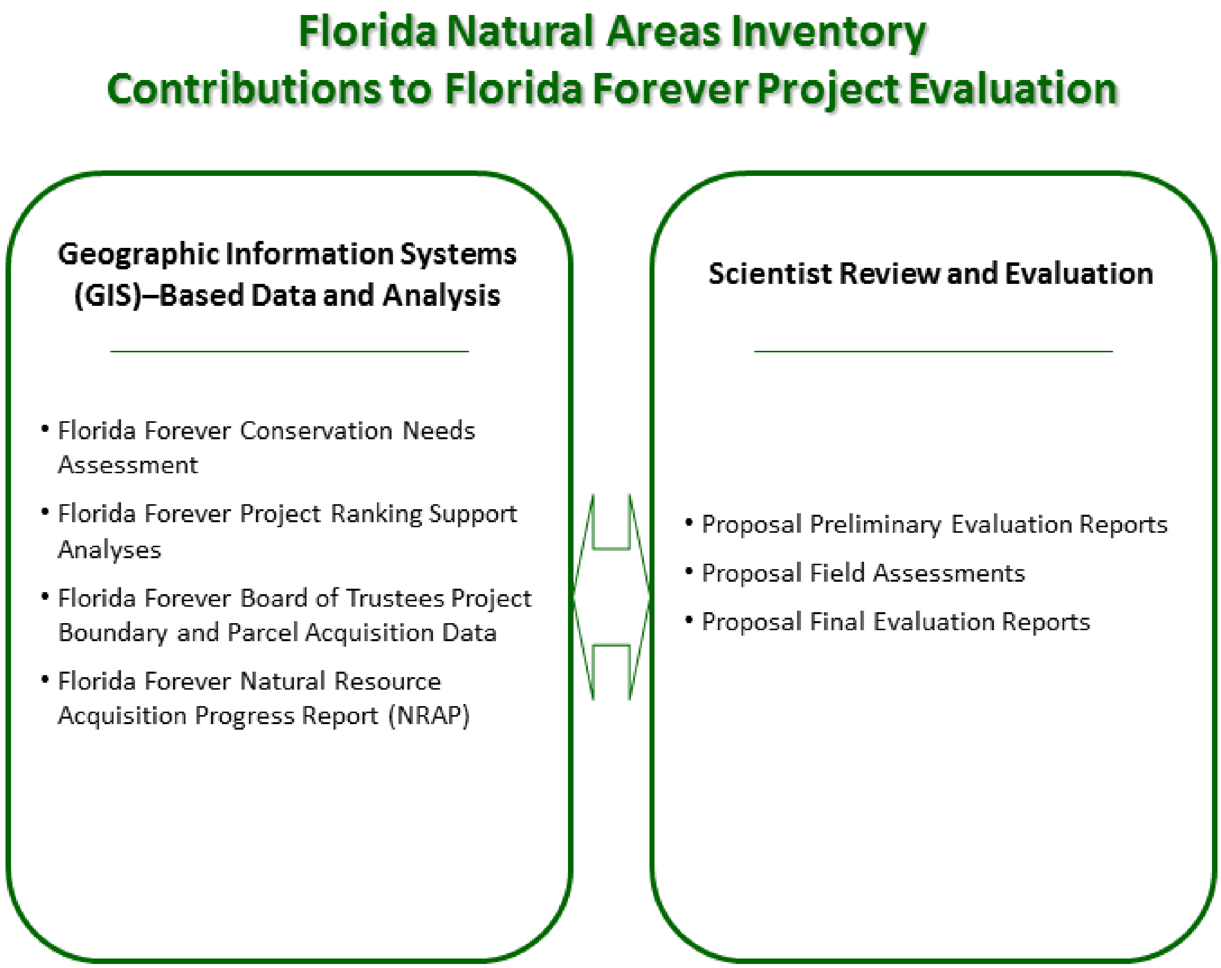


Figure 1. Florida Natural Areas Inventory contributions to Florida Forever Project Evaluation

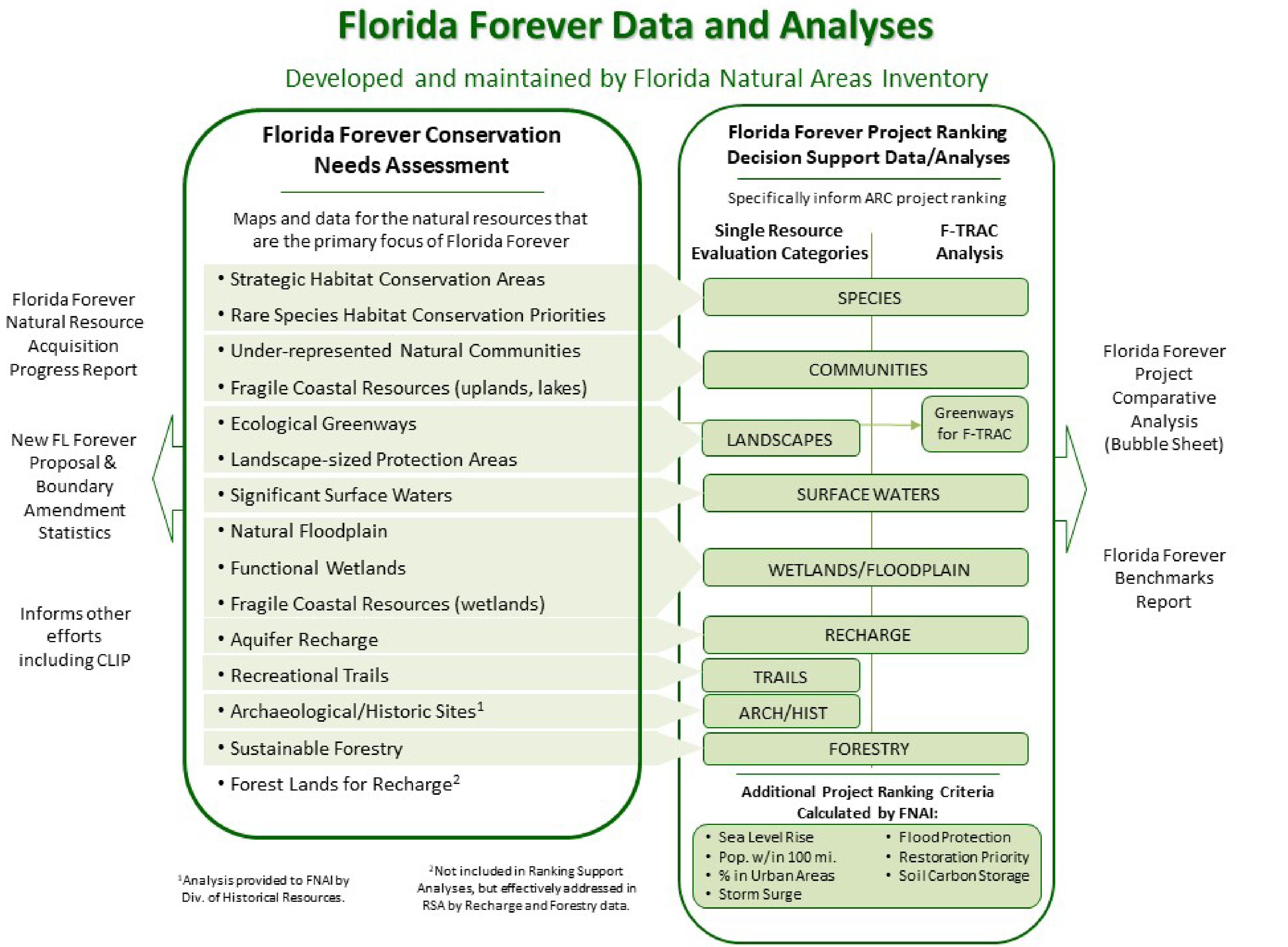


Figure 2. Relationships between Florida Forever data and analyses developed and maintained by Florida Natural Areas Inventory.

Documentation. The FFCNA data are organized around specific performance measures listed in the Florida Forever Act (see below), which leads to some redundancy in resource type or function across data layers. We therefore re-combined certain data into Decision Support data layers for use in the Ranking Support Analyses, as detailed in the RSA Documentation.

Data Layers Included in the Florida Forever Conservation Needs Assessment

The data layers included in the FFCNA correspond to 14 performance measures or criteria approved by the Legislature for the Florida Forever program. These fourteen measures were selected for the FFCNA because they are resource-based criteria that can be used to set acquisition priorities. Several other measures fit this description but could not be mapped because the current data are inadequate (e.g. natural resource-based recreation), or the data were not complete statewide. The remaining measures were either non-resource based, such as the use of alternatives to fee-simple acquisition, or were post-acquisition measures, such as reforestation or removal of non-native invasive plants. A complete list of Florida Forever goals and measures is found in s. 259.105, F.S. and 18-24, F.A.C. (see Appendix A).

Use of the Florida Forever Conservation Needs Assessment

The information contained in this report was developed or compiled specifically to address specific performance measures of the Florida Forever Act and to inform actions relating to the Florida Forever program. As such, the data do not necessarily represent a definition of the resource that is appropriate for general use outside the Florida Forever program. Although the information contained in the FFCNA may be relevant to other conservation planning activities, it should not be used for purposes other than the Florida Forever program without coordination with the Florida Natural Areas Inventory, or the original, primary sources of data.

The data layers compiled in this report represent a statewide perspective of natural resource distributions. We recognize that more detailed local information may be available for some resource types, and we encourage collaboration with the Florida Natural Areas Inventory in providing a local perspective to future versions of the FFCNA. The data layers are currently available online, subject to a use agreement, at http://www.fnai.org/.

Data Specifications

Data layer development was done in ArcGIS 10.2 – 10.6, a Geographic Information System (GIS) software package produced by Environmental Systems Research Institute, Inc. (ESRI). All data layers are in Florida Albers projection with the NAD 1983 HARN datum, and the distance units are in meters. The projection parameters are as follows:

24 00 00	First Standard Parallel
31 30 00	Second Standard Parallel
-84 00 00	Central Meridian
24 00 00	Latitude of Origin
400000	False Easting (meters)
0	False Northing (meters)

For modeling and statistical purposes, all data layers were converted to 15 meter grids using the Spatial Analyst extension.

Organization of this Report

Following the introduction, the report is organized into three parts: (1) descriptions of how each measure was defined and the method for creating the representative data layer. This part comprises most of the document and includes separate sections for each measure; (2) references; and (3) appendices. Three appendices will be noted here: Appendix B summarizes changes to the FFCNA for each version update going back to the original version completed in 2000. That summary is helpful for determining when or if an earlier version of a particular data layer or analysis was changed. Appendix C summarizes several "basemap" data layers that are essential building blocks of many of the FFCNA data and analyses, including land cover, species occurrence data, and landscape quality/integrity analyses. Appendix J is a brief chronology of expert workshops FNAI has held from 2000 to present to inform various FFCNA data and modeling decisions.

DATA LAYER DEVELOPMENT

This section is divided into 14 subsections corresponding to the Florida Forever measures included in the *Conservation Needs Assessment.* We discuss how we interpreted each measure as defined by 18-24, F.A.C. (implementation of s. 259.105, F.S.), how we defined each measure based on geographic data, and the methods we used to develop each data layer. The following is a list of Florida Forever measures and criteria and their corresponding numbers from 18-24, F.A.C. (see Appendix A).

Section	**Measure**
1- Strategic Habitat Conservation Areas	B1
2- FNAI Rare Species Habitat Conservation Priorities	B2
3- Ecological Greenways	B3
4- Under-represented Natural Communities	B4
5- Landscape-sized Protection Areas	B5
6- Natural Floodplain	C3
7- Surface Water Protection	C4
8- Fragile Coastal Resources	C6
9- Functional Wetlands	C7
10- Aquifer Recharge	D3
11- Recreational Trails	E2
12- Significant Archaeological Sites	F2
13- Sustainable Forest Management	G1
14- Forestland to Maintain Recharge Function	G3

Section 1
Strategic Habitat Conservation Areas

Measure B1: The number of acres acquired of significant strategic habitat conservation areas.
Source: Florida Fish and Wildlife Conservation Commission

Measure definition

The Florida Fish and Wildlife Conservation Commission originally identified strategic habitat conservation areas (SHCA) in the Commission report, "Closing the Gaps in Florida's Wildlife Habitat Conservation System" (Cox et al. 1994). The goal of the SHCAs is to identify the minimum amount of land needed in Florida to ensure long-term survival of key components to Florida's biological diversity. In 2006, the SHCAs underwent a significant revision based on a new suite of species, updated datasets, new datasets that did not exist when the original analysis was conducted, and improved analytical techniques including spatially explicit population viability analyses. The SHCAs identify important remaining habitat conservation needs on private lands for 33 terrestrial vertebrates, totaling more than 8 million acres (Endries et al. 2009).

In order to help focus Florida Forever acquisition efforts, we asked Beth Stys and Mark Endries at FWC to prioritize the SHCAs. We also worked with FWC to revise the SHCAs to reflect habitat needs within existing conservation lands. Methods for prioritizing SHCAs and including habitat within conservation lands are described below. Detailed methods for development of the SHCAs are documented in a report by FWC (Endries et al. 2009).

Identification of SHCAs on Conservation Lands

The SHCAs identify privately-owned areas for only those species that do not have adequate protection on conservation lands, thereby ignoring species whose critical habitat is protected on conservation lands. Red-cockaded woodpecker, for example, is not included as an SHCA because no additional private lands are needed for its long term persistence; however it could be argued that red-cockaded woodpecker habitat on conservation lands should be included as an SHCA because it would be required for the species to persist. Sixty-two wildlife species were selected for analysis. A population risk assessment was conducted for each of 62 focal vertebrate species although only 33 were selected as sufficiently at risk to warrant inclusion as an SHCA. This means that 29 species have sufficient protection on conservation lands such that their habitat on these lands could be thought of as an SHCA. In order to reflect habitat needs within existing conservation lands we worked with FWC to augment the SHCAs to include potential habitat within conservation lands for all 62 focal species.

Prioritization of SHCAs

The approach for prioritizing SHCAs was based on global and state natural heritage ranks. The SHCAs were not prioritized based on species richness. If two or more species overlap, the area is classed according to the species with highest priority. In 2016 the SHCAs prioritization was updated to reflect changes in ranks to several species. The species were grouped into six priority classes as shown in Table 1-1.

Developed areas based on the Cooperative Land Cover v3.1 were removed from the final dataset.

Table 1-1. Prioritization of SHCAs and of potential habitat for additional species.

Species		State Rank	Global Rank
Priority 1: SHCAs and potential habitat for species with ranks of S1 and G1-G3.			
Species with SHCA:			
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	S1	G5T1
Odocoileus virginianus clavium	Florida Key Deer	S1	G5T1
Peromyscus polionotus allophrys	Choctawhatchee 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
Nerodia clarkii taeniata	Atlantic Salt Marsh Snake	S1	G4T1
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	S1	G5T1
Myotis grisescens	Gray Bat	S1	G3
Oryzomys palustris pop. 2	Sanibel Island Rice Rat	S1	G5T1
Microtus pennsylvanicus dukecampbelli	Florida saltmarsh vole	S1	G5T1
Species with Potential Habitat on Conservation Lands:			
Eumeces egregius insularis	Cedar Key mole skink	S1	G5T1
Tantilla oolitica	rim rock crowned snake	S1	G1
Priority 2: SHCAs and potential habitat for species with ranks of S1, G4-G5 or S2, G2-G3.			
Species with SHCA:			
Oryzomys palustris pop. 3	Silver Rice Rat	S2	G5T2
Crocodylus acutus	American Crocodile	S2	G2
Rostrhamus sociabilis plumbeus	Snail Kite	S2	G4T3
Aphelocoma coerulescens	Florida Scrub Jay	S2	G2
Neoseps reynoldsi	Sand Skink	S2	G2
Sciurus niger avicennia	Big Cypress Fox Squirrel	S2	G5T2
Charadrius alexandrinus	Cuban Snowy Plover	S1	G4
Ammodramus maritimus macgillivraii	Mac Gillivray's (Smyrna) Seaside Sparrow	S2	G4T2
Notophthalmus perstriatus	Striped Newt	S2	G2
Ammodramus maritimus fisheri	Louisiana Seaside Sparrow	S1	G4T4
Buteo brachyurus	Short-tailed Hawk	S1	G4
Ursus americanus floridanus	Florida black bear	S2	G5T2
Species with SHCAs only:			
Desmognathus monticola	Seal Salamander	S1	G5
Species with Potential Habitat on Conservation Lands:			
Ambystoma cingulatum	flatwoods salamander	S2	G2
Eumeces egregius egregius	Florida keys mole skink	S2	G5T2
Grus canadensis pratensis	Florida sandhill crane	S2	G5T2
Kinosternon baurii pop 1	keys mud turtle	S2	G5T2
Picoides borealis	red-cockaded woodpecker	S2	G3
Rana okaloosae	Florida bog frog	S2	G2
Priority 3: SHCAs for species with ranks of S2, G4-G5 or S3, G3.			
Species with SHCA:			
Patagioenas leucocephala	White-crowned Pigeon	S3	G3
Ammodramus maritimus peninsulae	Scott's Seaside Sparrow	S3	G4T3
Athene cunicularia floridana	Burrowing Owl	S3	G4T3
Podomys floridanus	Florida Mouse	S3	G3
Elanoides forficatus forficatus	American swallow tailed kite	S2	G5

Species with Potential Habitat on Conservation Lands:			
Caracara cheriway	crested caracara	S2	G5
Gopherus polyphemus	gopher tortoise	S3	G3
Myotis austroriparius	southeastern bat	S3	G3
n/a	wading birds	S2	G4
Sciurus niger shermani	Sherman's fox squirrel	S3	G5T3
Seiurus motacilla	Louisiana waterthrush	S2	G5
Priority 4: SHCAs for species with ranks of S3 and G4.			
Species with SHCA:			
Hyla andersonii	Pine Barrens Tree Frog	S3	G4
Nerodia clarkii clarkii	Gulf Salt Marsh Snake	S3	G4T4
Species with Potential Habitat on Conservation Lands:			
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.			
Species with SHCA:			
Accipiter cooperii	Cooper's Hawk	S3	G5
Coccyzus minor	mangrove cuckoo	S3	G5
Species with Potential Habitat on Conservation Lands:			
Rynchops niger	black skimmer	S3	G5
Vireo altiloquus	black whiskered vireo	S3	G5
Aramus guarauna	limpkin	S3	G5
Passerina ciris	painted bunting	S3	G5
Haliaeetus leucocephalus	bald eagle	S3	G5
Priority 6: SHCAs for species with ranks of S4-S5 and G5.			
None of the species analyzed for the SHCAs analysis fit these criteria.			

A map and acreage table for this data layer are provided in Appendix J.

Section 2
FNAI Rare Species Habitat Conservation Priorities

Measure B2: The number of acres acquired of highest priority conservation areas for Florida's rarest species.
Source: Florida Natural Areas Inventory

Measure definition

The FNAI Habitat Conservation Priorities data layer (FNAIHAB) prioritizes places on the landscape that would protect both the greatest number of rare species and those species with the greatest conservation need. We developed the data layer by first selecting species with the greatest conservation need in Florida and developing habitat maps around known occurrences of those species. The Inventory currently has more than 30,000 occurrence records for Florida's rare and endangered species in the form of point locations. For this data layer we wanted to identify habitat areas, based on these point locations that represent the geographic extent of the species occurrence on the landscape. We created habitat polygons only around known occurrences, rather than creating polygons of potential habitat where no occurrence records exist. In using this method, we are able to definitively say that acquisition of a habitat area serves to protect a particular species because we have documentation of the species at that site. The habitats were then ranked based on quality/suitability for the species and the species were weighted based on conservation need. The weighted habitat maps for 281 species were then overlaid to determine overall conservation priorities for Florida's rarest species. The process of selecting species, creating habitat maps, weighting species by conservation need, and building the overlay model is discussed below.

Selection of Species

In the current update (version 4.0) we wanted to broaden the number of species included, particularly for the rarest species, so we modified the criteria as follows:

- All G1 or T1 species (T1 refers to subspecies; e.g., a G5T1 would be included)
- All G2 or T2 species, UNLESS 10 or more EOs were on conservation lands at Baseline (the beginning of the Florida Forever program in 2001)
- All G3S1 or T3S1 species, UNLESS 10 or more EOs were on conservation lands at Baseline
- All Federally Listed species
- No G4 or G5 species, unless Federally Listed

An important exception to the criteria involves invertebrate species. FNAI has added a large number of invertebrate species to our database over the past ten years, and many still lack thorough information on locations, range, and life history. Therefore we elected to only include invertebrate species that have been included in previous versions of FNAIHAB, if they met the new criteria above. No additional invertebrate species have been added at this time, even if they meet the criteria. We plan to add more invertebrate species in future updates to the model.

FNAI scientists reviewed the entire target list and recommended deletions if habitat acquisition in Florida was not a conservation need for the species. Several species were removed from the target list based on this review.

The current target list contains 281 species, comprised of 151 plants, 64 vertebrates, and 66 invertebrates. All target species included in the analysis are listed in Appendix F.

Habitat Mapping Method

The current mapping method has been somewhat standardized in an attempt to be more objective, transparent, and consistent across species, but still involves selecting suitable land cover types surrounding a known occurrence location. Habitat mapping efforts for this update spanned 2009-2013, and land cover sources varied over that time, but the majority of mapping used the Cooperative Land Cover data set.

Standard Method

The default method of habitat mapping is described here. Even for species where the standard method was used there may have been minor exceptions which are noted in appendices or internal FNAI documentation.

EO Selection: Certain element occurrences were not included in habitat mapping. Extirpated EOs were not mapped. Introduced populations (in places where historical populations were not known) were not mapped. A subset of extremely low-precision EOs known as "general precision" in earlier versions of the EO database were also not mapped (these are represented in the EO database as circles with an area of 49,431 acres).

Buffers: Two buffers are used to select and limit land cover polygons associated with an EO. The Primary buffer determines which land cover polygons in the vicinity will be selected, while the Maximum buffer limits the outer extent of land cover polygons at a specified distance from the EO. Each species was assigned a buffering radius based on the species' biology (see Appendix G). For most plant species for example, the radius was 400 meters, while the radius was generally larger for vertebrates. Both Primary and Maximum buffers varied by species radius criteria and EO size.

FNAIHAB Species Buffer Criteria

EO polygon size:	**<10 acres**	**10-99 acres**	**100-999 acres**	**>=1,000 acres AND**	
				Rep Acc = High or Very High	**Rep Acc < High**
Primary Buffer	full radius	½ radius	¼ radius	¼ radius	1 meter
Maximum Buffer	4X radius	2X radius	2X radius	2X radius	2X radius

In the table above, "Rep Acc" refers to Representation Accuracy, a measure of spatial precision in the FNAI database. High or Very High Representation Accuracy indicates that much or all of the EO polygon is known to be occupied by the species, and therefore warrants a larger buffer beyond the EO to account for additional habitat likely to be used by the species.

For example, consider an EO polygon of size 50 acres for a plant species with a default radius of 400 meters. In this case the EO polygon would be buffered by 200 meters for the Primary Buffer, and the EO polygon would be buffered by 800 meters for the Maximum Buffer. If the same plant species had an EO polygon 2,000 acres in size with High Representation Accuracy, the EO polygon would be buffered by 100 meters for the Primary Buffer and 800 meters for the Maximum Buffer (note that the Maximum buffer distances are based off the original EO polygon, not buffering the Primary Buffer).

The rationale for these buffers is based on the nature of FNAI Element Occurrence polygons. Because EOs are already buffered to account for potential spatial error, low-precision EOs tend to be larger than high-precision EOs. The attenuation of buffer sizes based on EO size is an attempt to avoid biasing habitat area mapped by original EO spatial precision.

Selecting Land Cover: For each species we determined suitable land cover classes in consultation with FNAI staff biologists (and for some species, outside experts) and individual EO habitat descriptions in the database. All suitable land cover polygons intersecting the Primary Buffer of a given EO were selected as habitat. Any polygons extending beyond the Maximum Buffer were cut off (clipped) at that buffer. (Technically, all suitable polygons intersecting the Maximum Buffer were dissolved into contiguous polygons before the Primary Buffer selection, then clipped at the Maximum Buffer.) In some cases polygons might be cutoff before the Maximum Buffer if obvious obstacles not accounted for in the land cover data were present (as observed on aerial photography).

<u>Alternate Methods</u>

Aquatic Species: Most of Florida's water bodies are state-owned sovereign lands and thus not candidates for a land acquisition program. Conservation needs for many aquatic species, however, extend to the terrestrial habitats buffering these waters; therefore, for fish, freshwater mussels, and other aquatic invertebrates, we identified upland areas that, if acquired, would serve to protect the aquatic habitats in which these species occur. For stream-dwelling species, the linear extent of the stream or river in which each species occurs was delineated. If the extent was unknown, we cut off the extent 1 mile downstream of the most downstream occurrence. The same method applied to upstream occurrences when the upstream extent was unknown. For species inhabiting lakes or ponds the habitat extent included the entire water body.

All contiguous wetlands within 1 mile of the water body were selected because of the important role of wetlands in improving or maintaining water quality in adjacent natural waterways (Department of Environmental Protection 1997). All natural uplands within 1000 feet were also included.

Spring and cave species: For aquatic cave and spring species, all habitat within 250 meters of the element occurrence, excluding intensive urban land use (CLC categories not categorized as "natural" or "semi-natural"), was included in the model. A buffer of 250 meters was deemed a reasonable terrestrial protection zone for aquatic caves and springs. For spring-dwelling species, the spring, or spring run was buffered by 250 m. For gray bat, *Myotis grisescens*, the only terrestrial cave species on the target list, natural landcover within 400 meters of known maternity caves was included as habitat in the model because this buffer helps ensure a forested corridor to the water bodies over which these bats forage.

Keys Species: For some species, the known extent of the population, rather than a distance radius, was used to delineate habitat. For example, for most island or keys species all appropriate habitat on the island where the species occurs was selected.

Eastern Indigo Snake:

<u>*Species Occurrence Data*</u>

We selected FNAI Element Occurrences for indigo snake that met the following criteria: Last Observation date of 1992 or later (less than 20 years old), EO Rank <> X or H (extirpated or historic), and Representation Accuracy (spatial precision) > Very Low. To this dataset we added additional occurrence data provided by Kevin Enge of FWC. We used a subset of FWC data that met the following criteria: source <> FNAI (to eliminate redundant data), Year >= 1992, and Accuracy of Low, Medium, or High (did not include '?', 'Y', 'N'). Occurrence polygons were buffered using the standard Primary and Maximum buffering system, with a primary radius of 5,000 meters (so maximum buffers were 20,000 meters for occurrences < 10 acres or 10,000 meters for occurrences >= 10 acres).

<u>*Base Map*</u>

We assigned land cover types into primary and secondary suitability for indigo snake. Primary land cover types represent the core preferred habitat for indigo snake (most natural uplands), while secondary types represent additional areas that indigo snakes will use if in the vicinity of core habitat (most natural wetlands; low-intensity agriculture). For simplicity we chose not to distinguish habitat preferences between north and south Florida for this species.

Generally speaking, primary habitat was selected within max buffers, and secondary habitat within a 100 meter buffer of the selected primary habitat was also added. After the selections, contiguous patches of habitat less than 1,000 acres in area were eliminated.

The final draft model was reviewed by Kevin Enge at FWC, who raised questions about the mapping results in south Florida, particularly the Everglades. The method for using occurrence data and starting patches to identify final base habitat was revised for south Florida populations to add additional habitat.

<u>*Suitability Scoring*</u>

In this case, we used the CLIP Landscape Integrity Index as an overlay on the indigo snake base map. The Landscape Integrity Index (LSI) is a measure of land uses and "intactness" of any given area and is also measured on a 10 point scale. An LSI score of 10 represents a very large expanse of natural land cover that is relatively remote from development, while a score of 1 represents a large area of intensive development (generally medium to large cities).

After review we did choose to distinguish between the majority of indigo snake habitat and several smaller isolated patches between 1,000 and 5,000 acres. So the final suitability scoring was assigned as shown in the following table:

	Landscape Integrity			
Patch Size	**9-10**	**7-8**	**5-6**	**1-4**
5,000 acres+	10	8	5	2
1,000 – 4,999 acres	8	5	2	2

Black Bear:

<u>*Core Populations*</u>

The standard method of mapping land cover around EOs is less effective for wide-ranging species like black bear. Given available knowledge of black bear range and core populations, we chose to begin with the FWC black bear Primary and Secondary range polygons as a starting point for habitat mapping. This is analogous to the FNAI model for panther, which is based in the USFWS panther sub-team conservation zones for panthers in south Florida.

<u>*Base Map*</u>

We followed Tom Hoctor's 2006 assignment of land cover types into Primary, Secondary, and Matrix habitat for black bear, and crosswalked those to the current CLC v2.3 land cover. We then selected all CLC land cover polygons matching one of the Hoctor primary or secondary habitat categories that intersected FWC primary and secondary range polygons. Because the range polygons were not drawn with high spatial precision, we did not cutoff habitat at range edges, but buffered range by 5,000 meters, and used that as a cutoff for any polygons that extended far beyond the FWC range polys. Next we added matrix-type land cover polygons within a 1km buffer of selected primary/secondary habitat. Finally, isolated patches less than 100 hectares in size were eliminated. (Note: the FWC range includes barrier islands in the Florida panhandle; we elected not to include those in this bear habitat model.)

<u>*Suitability Scoring*</u>

The standard method of scoring suitability assigns a single score to each contiguous patch, but that approach was not practical for a wide-ranging species black bear where spatially distinct "patches" can extend for hundreds of miles.

In this case, we scored suitability of black bear habitat based on two criteria: the original FWC zone designation (primary vs. secondary), and the CLIP Landscape Integrity Index. The Landscape Integrity Index (LSI) is a measure of land uses and "intactness" of any given area and is also measured on a 10 point scale. An LSI score of 10 represents a very large expanse of natural land cover that is relatively remote from development, while a score of 1 represents a large area of intensive development (generally medium to large cities). The LSI was also used to score suitability for indigo snake, another wide-ranging habitat generalist species. Final suitability scoring criteria:

In FWC Primary Zone:

LSI	Primary Habitat	Secondary Habitat	Matrix Habitat
9-10	10	8	6
7-8	8	6	4
5-6	6	4	2
1-4	4	2	1

In FWC Secondary Zone or beyond Zones (5 km buffer):

LSI	Primary Habitat	Secondary Habitat	Matrix Habitat
9-10	8	6	4
7-8	6	4	2
5-6	4	2	1
1-4	2	-	-

Panther:

Previous Method – 2006

We included all natural and seminatural land cover classes within the Primary, Secondary, and Dispersal zones of the USFWS Panther Zones (Florida Panther Subteam of the Multi-Species/Ecosystem Recovery Implementation Team for South Florida 2002). We also included intensive agriculture (citrus, row crops) polygons within these zones if they contained a panther telemetry point. The model was prioritized and assigned values by zones: Primary = 10; Dispersal = 8; Secondary = 4. No areas north of the Caloosahatchee River were included.

Draft Method – 2012

USFWS Panther Zones: We followed the 2006 methodology but used the CLC v2.2 land cover, and excluded intensive agriculture regardless of telemetry points (per Dan Hipes).

North of Caloosahatchee: We first selected areas used by 3 or more individual cats based on June 2008 telemetry. We then created a separate primary buffer of 5,000 meters for each cat north of the Caloosahatchee. We converted these buffers to raster grids (value 1), added them together, and retained areas with three or more cats overlapping. We converted those areas back to polygons and selected intersecting buffers which became the primary buffers used north of the Caloosahatchee. We then created maximum buffers of 20,000 meters (primary buffers plus 15,000). We used the standard mapping method and clipped CLC v2.2 polygons by maximum buffers, selected all natural and seminatural land cover classes, dissolved to get contiguous patches, and retained those patches that intersected primary buffers.

<u>Final Method – November 2012</u>
After meeting with Tom Hoctor on November 15, 2012, we decided to use USFWS Panther Zones, including the 2007 "North Area" Zone (Thatcher et al. 2006) not included with the original zones. We selected CLC v2.2 Natural, Seminatural, and Improved Pasture/Field Crop classes and clipped by Panther Focal Areas 2007.

Florida scrub-jay:

FNAI staff compiled best-available occurrence data for scrub-jay, including Jaywatch data from 2002-2009, a statewide survey from the mid-1990s (Fitzpatrick et al. 1994) and FNAI element occurrences. The model started with the standard Primary Buffer method, using a buffer of 800 meters around occurrences. Land cover polygons were classed into two tiers of suitability for scrub-jay. Tier 1 land cover includes scrub, scrubby flatwoods, coastal scrub, oak scrub, and sand pine scrub. Tier 2 includes coastal strand, dry prairie, mesic flatwoods, shrub & brushland, and unimproved/woodland pasture (improved pasture in Seminole State Forest was also included based on known use by scrub-jays).

Using the Primary Buffers and land cover tiers, land cover was selected and grouped into four categories:

1. Primary Core Habitat: Tier 1 land cover polygons intersecting Primary Buffers.
2. Secondary Core Habitat: Tier 2 land cover polygons within 50 meters of Primary Core Habitat.
3. Primary Nearby Habitat: Tier 1 land cover polygons within 50 meters of Primary Core and Secondary Core combined.
4. Primary Outlying Habitat: Tier 1 land cover polygons within 1000 meters of Primary Core Habitat.

Suitability scores were assigned by expert judgment based on patch condition and population data, with Primary Core assigned 10, 6, or 3; Secondary Core assigned 1; Primary Nearby assigned 10, 6, or 3; and Primary Outlying assigned 9, 5, or 2.

American crocodile:

FNAI element occurrences were considered insufficient as a starting point for the extent of crocodile occurrence, so we relied on the Priority Amphibian and Reptile Conservation Areas (PARCA) polygon identified for crocodile by JJ Apodaca and The Orianne Society (Sutherland and deMaynadier 2012) as our reference range extent. Within that polygon we selected suitable land cover polygons (coastal wetlands, open waters, and coastal hammock, grassland, beach, and berm). Several selected land cover polygons extended far beyond the PARCA boundary so were cut off by reviewing aerial photography for reasonable break points in the vicinity of the PARCA boundary. Some additional areas near the boundary were added based on known suitability and/or use by crocodiles. All mapped habitat was scored as High Suitability (10 points).

Mangrove fox squirrel:

We supplemented FNAI occurrence data for mangrove fox squirrel with data from Michelle Eisenberg at University of Central Florida, and Courtney Tye from FWC/IFAS. Not all observation points were included, but were reviewed and selected based on likelihood of occurrence.

We started with the standard buffering method using a Primary Buffer of 5,000 meters. Land cover polygons were classed into two tiers of suitability for mangrove fox squirrel. Tier 1 or Primary Habitat includes mesic, wet, and scrubby flatwoods, unimproved or woodland pasture, and golf courses (although obviously not natural, golf courses in southwest Florida are frequently inhabited by mangrove fox squirrels). Tier 2 habitat includes most other forested upland and wetland communities, as well as dry prairie and rural open areas. Tier 2 habitat is used only intermittently by fox squirrels for foraging, nesting, and movement between Tier 1 patches. Tier 1 habitat was selected by Primary and Maximum buffers using the standard method. Tier 1 habitat was then buffered by 100 meters, and any Tier 2 habitat adjacent to Tier 1 and within the 100 meter buffer was selected and added. Suitability was scored using the standard method.

Red-cockaded woodpecker:

We used comprehensive colony and cavity location data compiled by FNAI staff from multiple sources. Expert judgment was used to select land cover types associated with colony locations that were suitable for nesting and foraging. Suitability was scored using the standard method.

Florida Grasshopper Sparrow:

Following the standard buffering method we applied a buffering radius of 2000 meters to establish Primary and Maximum Buffers around element occurrences for Florida grasshopper sparrow. We initially selected all dry prairie within the Maximum Buffer then modified the habitat to include only those areas identified by Delany et al. 2007 as occupied. Suitability was scored using the standard method.

MacGillivray's Seaside Sparrow:

We used location data from a comprehensive field survey by NeSmith and Jue (2003). Instead of the standard buffering method, the scientist who conducted the 2003 survey used expert judgment to select known and likely occupied salt marsh polygons from the SJRWMD Florida Land Use Land Cover 2009 data. Suitability was scored using the standard method.

Wood Stork:

For wood storks we supplemented FNAI occurrence data for rookeries with additional rookery data compiled by Tsai et al. (2011). Because foraging habitat is a primary limiting factor (Ogden 1990) we selected appropriate foraging wetlands within a 25 kilometer radius of rookery sites. The buffer distance was chosen following Tsai et al. (2011) based on foraging distances from the nesting colony. Wood storks will feed in almost any shallow wetland depression where fish tend to be concentrated (Ogden 1990). Ogden (1990) also emphasizes the importance of protecting many different wetlands, with both long and short annual hydroperiods, in order to maintain the wide range of feeding site options required by wood storks.

Nesting colonies (and associated feeding habitat) were prioritized based on 3 factors recommended by Tsai et al. (2011): colony size, colony longevity, and isolation from mainland. Colonies were assigned points for each factor as follows:

Points	Size	Longevity	Mainland Isolation*
3	>=300 nests	>10 years	Islands best
2	50-299 nests	2-10 years	↓
1	1-49 nests	1 year	Mainland worst

*Index assigned by Tsai et al. (2011)

Suitability was determined by summing the points across criteria for each colony and factoring in the year of last observation. Final suitability scores were assigned as follows:

Criteria Points Sum	Suitability Score
7 - 9	10
4 - 6	6
<4 OR if Last Year observed was pre-1990	3

Beach Mice:

Occupied habitat for all 6 sub-species of beach mice was mapped in 2012 for the Florida Beaches Habitat Conservation Plan (FBHCP) and these maps were incorporated directly into FNAIHAB v.4. Mapping methods, described in the draft HCP (http://www.flbeacheshcp.com/drafthcp.php), relied on input from beach mouse experts through a series of workshops. The final maps are based on current best available survey information. Suitability was scored using the standard method.

Sea Turtles:

Occupied habitat for 3 species of sea turtles (loggerhead, green, and hawksbill) was mapped in 2012 for the Florida Beaches Habitat Conservation Plan (FBHCP) and these maps were incorporated directly into FNAIHAB v.4. Mapping methods, described in the draft HCP (http://www.flbeacheshcp.com/drafthcp.php), relied on input from sea turtle experts through a series of workshops. The final maps are based on current best available survey information from Florida Wildlife Research Institute (FWRI). Because land cover type (sandy beach) and patch size are not sufficiently discriminating to inform suitability, and EO Rank was not available, we relied on nest density to determine suitability. The suitability scores of 10, 6, or 3 correspond to nest density classes of high, medium, or low, respectively, developed by FWRI for surveyed beaches and summarized for 2006-2011. Note that FWRI developed these classes within genetic subunits for loggerhead to help account for natural nest density variation.

Piping Plover:

We supplemented FNAI occurrence data with additional data from the following sources: International Piping Plover Census (IPPC 2001, 2006); USFWS Critical Habitat; and location data from Patrick Leary for northeast Florida. Habitat in the vicinity of all sources was delineated from aerial photography based on expert judgment. Suitability was scored using the standard method.

Suitability Scoring

We assign Suitability scores to distinct habitat patches for each species' habitat model. The intent of this score is to recognize that not all portions of a species habitat model are equal; some areas are more suitable in terms of land cover type, size, shape, fragmentation, landscape context, etc. than others. Suitability is typically scored as High, Medium, or Low, and the scores factor into each species' model weighting in the overall FNAIHAB model. The method described here was the default used to score most species habitat models, but certain species were scored in alternate ways as described above.

Distinguishing Patches

We have attempted to develop a set of objective criteria for designating patches, although in practice we have found it challenging to apply the criteria consistently to the wide range of circumstances found across species' models. The primary consideration for distinguishing patches is the configuration of primary buffers around Element Occurrences:

- In general, all habitat polygons intersecting the same primary buffer were assigned to the same patch.
- If two or more primary buffers were connected by the same habitat polygon, all polygons within both/all primary buffers were generally assigned to the same patch.
- In rare cases, a major obstacle running through a primary buffer could justify splitting polygons within the same primary buffer into separate patches. Examples include major rivers or major highways (interstate/turnpike). Urban development in general did not count as a barrier, as it can be an indication that a single patch has been fragmented.
- In general, polygons that did not intersect the same primary buffer were assigned to separate patches.
- In some cases for "large-scale matrix" type habitat (e.g. flatwoods), patches could be grouped by max buffers rather than primary buffers.

Suitability Criteria

The Suitability score is made up of four criteria:

EO Rank – Many element occurrences, including most that have been documented within the last 15-20 years, have been assigned an EO Rank based on the perceived viability of the observed population. This rank is a good assessment of the general condition of the population and its surrounding habitat. It also takes into account whether the population is being actively managed or is threatened by impacts such as development or invasive species.

Habfit – This is a simple measure of how well the land cover types included in a patch fit the preferred habitat for a species. FNAI staff assigned a Habfit of High, Medium, or Low during the mapping process. In general, most Natural land cover types that are compatible with the species' habitat preferences were assigned High, most Seminatural land cover types (eg. plantation, pasture) were assigned Medium, and intensively developed lands were assigned Low. In some cases Natural cover types might be assigned Medium if they are not the preferred habitat for the species (e.g. uplands for a wetland-preferring species) but were nevertheless mapped due to occurrence of the species. A Habfit of Low was rarely assigned as intensive land cover types were rarely included in species' habitat models. If a patch included a mix of Natural and Seminatural cover types, the majority type was assigned. Note that Habfit reflects ONLY land cover type. It does not consider patch size, shape, context, or any other factor.

Size – Individual patches mapped for a species can vary considerably in area, with some being small enough to be considered sub-optimal for a species. We considered the concept of identifying a "minimum viable patch" for each species (or species group), but the effort required to research each species' spatial requirements would have been prohibitive. Instead we summarized actual mapped patch sizes by species group and general habitat requirement categories to identify patterns in the data. Ultimately we classified species into four general habitat types – rockland, small-patch, intermediate, and matrix – and three biotic groups – plants, amphibians/reptiles/invertebrates, and birds/mammals. For each of the ten resulting combinations we identified a benchmark patch size that corresponded roughly to the midpoint between the lowest quartile patch size and median patch size for that class combination. The benchmarks are as follows:

Benchmark Patch Sizes (acres)

Habitat Type	Plants	Amphibians Reptiles Invertebrates	Birds Mammals
Rockland plants	20	n/a	n/a
Small-patch	50	50	50
Intermediate	100	100	500
Matrix	500	1,000	2,000

Rockland includes plant species found in pine rocklands only or both pine rocklands and rockland hammocks. Small-Patch includes scrub, rockland hammock (but not pine rockland), beach, cave, and spring species. Intermediate includes slope, marsh, hammock, etc. Matrix includes flatwoods, sandhill, saltmarsh, mangrove, prairies, floodplain forests, etc.
Note that these benchmarks did not apply to wide-ranging species (primarily bear, panther, and some birds) as they were assigned customized Suitability prioritizations as noted above.

Configuration – This criterion measures the shape and fragmentation of the patch, as well as the intensity of land cover types along the immediate edge of the patch (landscape context). This measure is a modified edge-to-area ratio. Each habitat patch was buffered by 100 meters. Using CLC land cover data, the areas of Natural, Seminatural, Water, and Non-natural land cover types were tabulated within the buffer (buffer only, does not include the patch itself). The acreages were then weighted as follows:

- Natural acres *x* 0.1
- Water acres *x* 0.25
- Seminatural acres *x* 1
- Non-natural acres *x* 3

The weighted acres were then totaled, and divided by the total patch area taken to the power of 0.68 (we determined that this particular fractional power of area normalized the ratio for patch size – large and small patches with the same shape and landscape context score identically). We found this weighted ratio to be an effective measure for assessing patch shape, fragmentation, and edge context.

Configuration scores were then classed into five classes, based on comparison with modelers' subjective assessments of patch configuration and context for a sample of nine representative species models, as follows:

HIGH	<1.5
MED HIGH	1.5 – 2.799
MEDIUM	2.8 – 6.249
MED LOW	6.25 – 13.999
LOW	14.0+

A group of coastal species was found to be unfairly penalized by the above classification. These species naturally occur in linear patches (often along barrier islands) with relatively high edge-to-area ratios, and often in proximity to coastal highways that count as intensive land uses. For those species we used an alternate classification from the same starting configuration score:

HIGH	<4.0
MED HIGH	4.0 – 6.499
MEDIUM	6.5 – 17.999
MED LOW	18.0 – 24.999
LOW	25.0+

The following species were classified according to the coastal/linear classes (for each species, all patches were classed using the same class system):

- *Charadrius alexandrinus*
- *Charadrius melodus*
- *Helianthus debilis ssp. vestitus*
- *Hojeda inaguensis*
- *Jacquemontia reclinata*
- *Neotoma floridana smalli*
- *Oryzomys palustris* pop. 2
- *Peromyscus polionotus allophrys*
- *Peromyscus polionotus leucocephalus*
- *Peromyscus polionotus niveiventris*
- *Peromyscus polionotus peninsularis*
- *Peromyscus polionotus phasma*
- *Peromyscus polionotus trissyllepsis*
- *Plestiodon egregius insularis*
- *Procyon lotor auspicatus*
- *Sigmodon hispidus insulicola*
- *Tephrosia angustissima* var. *curtissii*

Suitability Score Calculation
Each of the four criteria was scored on a 10-point scale, as shown below:

EORANK	points
A	10
AB	9
B	8
BC	7
C	5
CD	4
D	3
X?	1
other	not factored

HABFIT	points
High	10
Medium	6
Low	1

SIZE	points
3.5x benchmark	10
2x	9
1x	8
0.75x	7
0.5x	6
0.33x	5
0.2x	4
0.15x	3
0.1x	2
<0.1x	1

Configuration	points
High	10
Medium-High	8
Medium	6
Medium-Low	4
Low	1

When no EO Rank was assigned for a patch, only the three other factors were considered. Points for all factors were added together and averaged back to a 10 point scale. The final Suitability score was assigned as follows:

Overall Suitability	
High	7.5 – 10
Medium	4.5 – 7.49
Low	<4.5

Finally, each patch scored as High Suitability received a numeric value of 10, Medium Suitability received value 6, and Low Suitability received value 3 for overlay purposes described below.

<u>Species Conservation Need Weighting</u>

Each species receives a Conservation Needs Weight based on the following criteria: Grank, total habitat area mapped, and percent habitat protected on conservation lands. This weighting is specifically designed to prioritize species that would benefit most from additional land acquisition for conservation, and differs from the FNAIHAB version used in the Critical Lands and Waters Identification Project (CLIP) database. However, the Grank scoring portion of this version is based on the CLIP version, which is derived from a survey of FNAI biologists' relative priorities for various combinations of Global and State rarity ranks.

FNAIHAB-Florida Forever Version 4.0 Species Conservation Needs Weighting Points

Grank	CLIP Points	FF Points (CLIP/3)
G1	1200	400
G2T1	1080	360
G3T1	936	312
G4T1	720	240
G2	400	133
G5T1	372	124
G3T2	360	120
G4T2	312	104
G5T2	240	80
G3	120	40
G4T3	108	36
G5T3	94	31
G4	38	13
G5T4	34	11
G5	12	4

Hab Acres	Points
0 – 100	100
101 – 1,000	85
1,001 – 10,000	70
10,101 – 100,000	55
100,001 – 1M	40
1 Million – 10M	25
>10 Million	10

Percent Protected	Points
0 – 4.9%	100
5 – 9.9%	95
10 – 14.9%	90
15 – 19.9%	85
20 – 24.9%	80
25 – 29.9%	75
30 – 34.9%	70
35 – 39.9%	65
40 – 44.9%	60
45 – 49.9%	55
50 – 54.9%	50
55 – 59.9%	45
60 – 64.9%	40
65 – 69.9%	35
70 – 74.9%	30
75 – 79.9%	25
80 – 84.9%	20
85 – 89.9%	15
90 – 94.9%	10
95 – 99.9%	5
100%	0

The rationale for Hab Acres scoring is that species with the least total area are "closest to the brink" in terms of vulnerability, and have likely seen the most loss of historic extent. However, it results in a bias against species who occupy large areas but also require more area for survival. Therefore, as in previous versions, certain species also receive bonus points for having large habitat area requirements. The following species received an additional 15 points for large area requirements: American crocodile, Florida grasshopper sparrow, Florida panther, snail kite, mangrove fox squirrel, Florida black bear, eastern indigo snake, wood stork, and crested caracara.

To demonstrate the scoring system, here are two species examples. Appendix F contains full conservation needs weighting data and scoring for all 281 species.

- Godfrey's butterwort (*Pinguicula ionantha*): G2 (133points); 38,115 acres (55points); 88% protected (15points) = 203 total points
- Eastern indigo snake (*Drymarchon couperi*): G3 (40points); 10+million acres (10points); 38% protected (65points); large area requirements (15points) = 130 total points

<u>Model Overlay and Class Breaks</u>

Each species habitat model was converted to a 15-meter raster grid with cell values corresponding to patch Suitability scores. Each grid was weighted (multiplied) by the species' conservation needs weight score, and all 281 weighted grids were added together. The resulting overlay model had values ranging from 72 to 115,792. In keeping with previous versions of FNAIHAB, the raw overlay was divided into six priority classes.

Final FNAIHAB Version 4 Priority Class Breaks

		Acres			
Class	**Overlay Cell Value**	**Private Land**	**Conservation Land**	**Total**	**Notes**
Priority 1	5750+	319,327	656,756	976,083	Only G1s with small area and low protection
Priority 2	3700 – 5749	474,540	1,768,299	2,242,839	No single G2 makes P2; G3+G4 very unlikely
Priority 3	2500 – 3699	939,773	1,492,071	2,431,843	No single G3 makes P3; G4+G5 very unlikely
Priority 4	1350 – 2499	2,177,873	2,419,807	4,597,680	Single G4 only if low protection; G5 very unlikely
Priority 5	850 – 1349	4,739,051	2,008,151	6,747,201	Single G5 only if high suitability
Priority 6	1 - 849	2,479,953	725,496	3,205,449	

The Notes in the table above indicate the basic rationale for each class break. The breaks are designed so that a single species with high conservation need can get into the top priorities, as well as various combinations of more than one species with moderate need (rarity-weighted richness). A map of the final model is shown in Appendix J.

Section 3
Significant Landscapes, Linkages and Conservation Corridors

Measure B3: The number of acres acquired of significant landscapes, landscape linkages, and conservation corridors, giving priority to completing linkages.
Source: University of Florida and Department of Environmental Protection/Office of Greenways and Trails.

Measure definition

The Florida Ecological Greenways Network (FEGN) of the Statewide Greenways System Planning Project is a statewide system of landscape hubs, linkages, and conservation corridors that was developed by the University of Florida using a GIS decision support model. The FEGN delineation process combined a systematic landscape analysis of ecological significance and the identification of critical landscape linkages in a way that can be replicated, enhanced with new data, and applied at different scales. The Ecological Network connects and integrates existing conservation areas with unprotected areas of high ecological significance. Such an integrated conservation land network will protect important ecological functions, community and landscape juxtapositions, and the need for biotic movement more thoroughly than the present collection of isolated conservation areas. The highest priority landscape linkages within Ecological Greenways Network are critical for conserving viable populations of our flagship species such as the Florida black bear and Florida panther that require large connected areas to support viable populations. These and other high priority ecological greenways also represent the best opportunities to maintain large, connected landscapes that will best conserve biological diversity over the long term and maintain essential ecological processes and services including water quality and quantity protection, protection from storms, clean air, nature recreation, etc.

Methods

The original delineation process was collaborative and overseen by three separate state-appointed greenways councils. During the development of the model, technical input was obtained from the Florida Greenways Commission, Florida Greenways Coordinating Council, state, regional, and federal agencies, scientists, university personnel, conservation groups, planners and the general public in over 20 sessions. When the modeling was completed, the results were thoroughly reviewed in public meetings statewide as part of the development of the Greenways Implementation Plan completed in 1999. A detailed description of the original model is in the Final Report of the Statewide Greenways System Planning Project (Carr et al. 1999; Hoctor et al. 2000; http://www.geoplan.ufl.edu). In 2013 the FEGN underwent a significant update with input from a Technical Advisory Group (Hoctor 2013).

Prioritization

The original Ecological Greenways encompasses nearly 23,000,000 acres including open water, and existing conservation lands. If open water and conservation lands are excluded, there are approximately 11,000,000 acres remaining. In order for the Ecological Greenways network to be a more effective planning tool, the University of Florida identified priorities using a two-step prioritization process. In 1998 two meetings with staff from the Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Florida Natural Areas Inventory, the Water Management Districts, and other agencies and groups were conducted to discuss criteria and data for selecting priorities. Based on these meetings, the University of Florida developed a GIS model that refined and modified the original ecological greenways model process to identify features within the ecological greenways model results that were high, moderate, or lower priorities for protecting statewide connectivity.

The next step involved separating areas identified as high and moderate priorities into even more refined classes of priority using a general set of criteria. Though the original prioritization was used to support this effort, more refined priorities were needed to serve as a better planning tool. The following criteria were used to place potential landscape linkage and corridor projects into more refined priority classes:

1) Potential importance for maintaining or restoring populations of wide-ranging species (e.g., Florida black bear and Florida panther)

2) Importance for maintaining a 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) Importance as a riparian corridor to protect water resources, provide functional habitat gradients, and to possibly provide connectivity to areas within other states.

The results of the second phase of prioritization were reviewed and approved by the Florida Greenways and Trails Council in November 2001.

The Florida Greenways Program implementation report (1998) included the identification of critical linkages as the next step following prioritization in the process of protecting an ecological greenways network across the state. Critical linkages serve as more defined project areas that are most important for protecting the Florida Ecological Greenways Network. Such critical linkages are to be approved by the Florida Greenways and Trails Council on an iterative basis as linkages are protected or priorities change over time. Two primary data sets were used to delineate the first iteration of critical linkages. To define linkages that are most critical to the protection of the Florida Ecological Greenways Network, prioritization based on both ecological criteria and level of threat by conversion to development (development pressure) is needed. For ecological-based prioritization, the prioritization process described above that categorized the Florida Ecological Greenways Network into six priority levels was used. Development pressure was modeled by Jason Teisinger (2002). These analyses were then combined to identify candidate areas for selection as Critical Linkages. Areas were selected that had either very high ecological significance or high ecological significance while also having critical areas threatened by development. Ten areas were selected for Critical Linkage status and these areas will now serve as the highest priorities for protecting landscape connectivity through the Florida Forever Program, Save Our Rivers program, and for other conservation initiatives where state, regional, and local government can work with willing landowners to protect our best remaining large, connected landscapes statewide.

In 2008, for the Critical Lands and Waters Identification Project (CLIP), two additional priority levels were added to the existing Florida Ecological Greenways Network priority classes as a strategic subset of the original Priority 1 and Priority 2 areas. These two new highest priority classes, Critical Linkages 1 and Critical Linkages 2, were delineated by identifying the areas within Priority 1 and Priority 2 linkages that were considered most important for completing a statewide ecological network of public and private conservation lands. These Critical Linkages were reviewed and accepted by the CLIP Technical Advisory Group as part of the development of the CLIP database and identification of CLIP statewide conservation priorities. These new priorities were also accepted by the Florida Greenways and Trails Council in December 2008.

In 2013 the FEGN underwent revision as part of the Critical Lands and Waters Identification Project (CLIP; Hoctor et al 2013). In 2016, as part of the CLIP 4.0 updates there were further revisions to the priorities in the FEGN, following recommendations to continue work discussed in the 2013 report. The updates focused on three primary goals: addressing impacts from sea level rise, addressing functional connectivity to other states; and better reflect areas that should be considered high priorities for corridor protection statewide. Full details of the revisions may be found in the CLIP v.4 Technical Report (Oetting et al 2016).

FNAI modified the Ecological Greenways to exclude open water. A map and acreage table for this data layer are shown in Appendix J.

Section 4
Under-represented Natural Communities

Measure B4: The number of acres acquired of under-represented native ecosystems.
Source: Florida Natural Areas Inventory

Measure Definition
According to the Guide to Natural Communities of Florida (FNAI 2010b), Florida features as 81 different natural community types. Many of these community types, particularly wetland communities, are relatively well-represented on existing conservation lands, and therefore are less of a priority for land acquisition than some of Florida's rarest communities that are currently not well-protected.

Methods
The 1997 *Florida Preservation 2000 Program Remaining Needs and Priorities Report* (Brock 1997) identified natural community types that were inadequately represented on conservation lands in Florida (based on Kautz 1993). Since that time, the Office of Environmental Services (OES), Florida Department of Environmental Protection, has regularly reported progress toward protecting additional acres of natural communities through land acquisition. Based on the OES criteria, a natural community is considered to be inadequately represented on conservation lands if less than 15% of the original extent of that community is currently found on existing conservation lands.

Table 4-1 lists those communities that are included in the data layer for measure B4, using the OES criteria as a starting point. The original acreages were calculated from a map of historic vegetation produced by Davis (1967). Remaining acreages were calculated based on the individual natural community data layers developed for this measure, as described below. Seepage slopes and upland glades were not identified as distinct communities on the original Davis map, so we are unable to report the percent of original acreage remaining. However, seepage slopes are known to be a rare community type that supports a large number of rare endemic plant species. Some estimates suggest that less than 1% of the original extent of seepage slope communities remain (FNAI 1990). Upland glade is also a critically imperiled community (ranked G1/S1 by FNAI) that supports endemic plant species.

Similarly, although we do not have a historical map of sandhill upland lake, we can assume that this community is under-represented because the associated sandhill community is under-represented. Previous statewide land cover overestimated the amount of remaining dry prairie so that it exceeded the 15% threshold; recent improvements in mapping dry prairie, however, confirm that this imperiled community is under-represented on conservation lands. Dry prairie is critical habitat for the endemic Florida grasshopper sparrow. Upland pine was also added as an under-represented type based on recommendations from resource experts.

Taken as a whole, the scrub community type appears to be fairly well protected based on Table 4-1. However, much of the scrub on conservation lands is located in the Ocala National Forest. If scrub other than that in the Ocala region is considered, 84% of the original scrub extent is unprotected. Scrub is also a community that supports a large number of endemic species, particularly in the Lake Wales Ridge region.

Table 4-1. Natural community types considered to be under-represented.

Natural Community	Original Acres	Remaining Acres	Acres Protected at Baseline (July 2001)	Percent of Original Protected (July 2001)
Upland Glade (G1)	n/a	40	0	n/a
Pine Rockland (G1)	224,000	820	15,500	7
Scrub (G2)	979,000	146,310	359,820	36
Rockland Hammock (G2)	296,000	2,800	15,230	5
Dry Prairie (G2)	1,205,000[a]	59,070	90,460	8
Seepage Slope (G2)	n/a	30	6,370	n/a
Sandhill (G3)	6,943,000	314,820	485,300	7
Sandhill Upland Lake (G3)	n/a	57,270	12,790	n/a
Pine Flatwoods (G4)	12,558,000	14,850	148,810	8
Upland Hardwood (G5)	1,635,000	1,144,230	1,030,290	2
Upland Pine (G4)	n/a	383,970	28,870	n/a

[a]Historical extent of dry prairie based on Bridges (2006)

With the exception of sandhill upland lake, under-represented natural communities were derived primarily from the Cooperative Land Cover Map (FNAI 2010a [CLC]), version 2.3 or 3.1. Adjustments were also made based on FNAI element occurrences and aerial photo review. In September 2015, FWC published CLC v3.1 with some significant updates over previous versions. We reviewed each under-represented natural community type as mapped in CLC 3.1 and compared it with previous versions. Mapping decisions for each type are described below.

Upland Glade

The primary data source for this community is CLC v2.3, which contains all known upland glade sites as mapped and ground-truthed by FNAI.

Pine Rockland

We used CLC v3.1 for pine rockland with a few exclusions based on aerial photo review and comparison with comprehensive survey data for pine rockland in Miami-Dade County provided by the Institute for Regional Conservation.

Scrub

We used CLC v3.1 for scrub and scrubby flatwoods with a number of specific corrections based on aerial photo review and comparison with CLC v2.3 within Florida Forever project boundaries.

Rockland Hammock

We used CLC v3.1 for rockland hammock with 3 additions based on FNAI element occurrences for rockland hammock.

Dry Prairie

We used CLC v3.1 as the sole source for dry prairie.

Seepage Slope

We used CLC v2.3 for seepage slope because it includes ground-truthed data that is not reflected in CLC v3.1. A small subset of polygons was then excluded based on FNAI element occurrences that identified them as wet prairie.

Sandhill Upland Lake

Distinguishing sandhill upland lakes from other lake types is challenging. No comprehensive differentiation of lake types exists in available land cover data. We attempted to identify relatively pristine sandhill upland lakes by applying criteria to the lakes category of WMD land cover. First, we selected lakes with >= 75% overlap with historic sandhill or scrub based on the Davis (1967) map or within 60 meters of sandhill, scrub or scrubby flatwoods based on the current under-represented natural community maps. Because sandhill lakes are typically lentic water bodies without significant surface inflows and outflows, we eliminated lakes that were associated with 1st or 2nd order streams based on the National Hydrography Dataset. Next we established a size range of 1 – 1000 acres that should fit the majority of sandhill lakes. The lower limit attempts to separate permanent lakes from more temporary depression ponds. The upper limit approaches the maximum size of sandill lakes on current protected areas but also attempts to limit the sandhill lakes to those that can be acquired by the state and that are not sovereign submerged lands. We also included any sandhill upland lakes identified in the FNAI element occurrence database or in FNAI natural community mapping projects. Finally, we eliminated lakes for which >33% of the perimeter was not a ‘natural’ land cover type. Where sandhill upland lakes overlapped other natural communities, we retained the sandhill lake classification. Although we believe this data layer captures the majority of sandhill upland lakes, we acknowledge that it likely contains other lake types and excludes some high quality sandhill lakes.

Sandhill

We used CLC v3.1 as the sole source for sandhill.

Upland Pine

We used CLC v2.3 as the sole source for upland pine.

Pine Flatwoods

This community includes both mesic and wet flatwoods. We used CLC v3.1 as the sole source and included the following classes:

CLC v3.1 SITECODE	LAND COVER TYPE
1300	Pine Flatwoods and Dry Prairie
1310	Dry Flatwoods
1311	Mesic Flatwoods
1340	Palmetto Prairie
2220	Other Coniferous Wetlands
2221	Wet Flatwoods
22211	Hydric Pine Flatwoods
222111	Cutthroat Grass Flatwoods
222112	Cabbage Palm Flatwoods
22212	Hydric Pine Savanna
2222	Pond Pine

Upland Hardwood Forest

Upland Hardwood Forest is difficult to accurately map with remotely-sensed data because its signature often cannot be distinguished from other hardwood forest types, including disturbed, semi-natural types and successional hardwood forest. Prior to FFCNA v4.1 this community was based primarily on 2003 FWC Landsat Vegetation. In the current version we used a combination of CLC v3.1, FNAI element occurrences, physiographic provinces, and spatial analysis to improve the representation of upland hardwood forest.

First we included polygons from CLC v3.1 where detailed land cover type was ‘Upland Hardwood Forest’. Next we selected FNAI element occurrence source polygons for the following upland hardwood-associated species: Hexastylis arifolia , Monotropsis reynoldsiae , Calycanthus floridus , Erythronium umbilicatum , Matelea alabamensis , Matelea floridana , Matelea flavidula , Epigaea repens , Aquilegia canadensis var. australis , Hemidactylium scutatum , Agkistrodon contortrix , Tamias striatus , Helmitheros vermivorum. We also selected all Upland Hardwood Forest element occurrences. All polygons were reviewed with 2013 or later ortho-aerial imagery. In general, any CLC v.3.1 Mixed-Hardwood Coniferous polygons that overlapped these element occurrences were selected for inclusion. Other CLC 3.1 polygons or newly digitized polygons were added where upland hardwood forest appeared to be extant based on the imagery review.

Next, in consultation with FNAI’s community ecologist, polygons were limited to physiographic provinces (White et al 1970) that corresponded to the range of upland hardwood forest as defined in the Guide to the natural communities of Florida: 2010 edition (FNAI 2010b). These include the following:

Alachua Lake Cross Valley
Beacon Slope
Bell Ridge
Brooksville Ridge
Central Valley
Cotton Plant Ridge
Crescent City Ridge
Deland Ridge
Dunellon Gap
Duval Upland
Fairfield Hills
Florahome Valley
Fountain Slope
Grand Ridge
Greenhead Slope
Gulf Coastal Lowlands
High Springs Gap
Intraridge Valley
Kenwood Gap
Lake Harris Cross Valley
Lake Henry Ridge
Lake Munson Hills
Lake Upland
Lake Wales Ridge
Lakeland Ridge
Marianna Lowlands
Marion Upland
Martel Hill
Mount Dora Ridge
New Hope Ridge
Northern Highlands
Ocala Hill
Orlando Ridge
Polk Upland
Relict Bar
Rock Ridge Hills
St. Johns River Offset
Sumter Upland
Tallahassee Hills
Trail Ridge
Tsala Apopka Plain
Wakulla Sand Hills
Welaka Hill
Western Highlands
Western Valley
Winter Haven Ridge
Zephyrhills Gap

Finally, we conducted a spatial analysis to exclude hardwood forests in our dataset that occurred as ‘hedge rows’, i.e. thin strips bordering agricultural land uses.

Final Natural Communities Dataset

In areas of overlap between communities, a hierarchy was developed to assign the overlap areas to the community with higher assumed accuracy. Overlap rules were assigned in the following order, with the communities listed first taking precedence: Upland Glade, Pine Rockland, Rockland Hammock, Seepage Slope, Upland Pine, Dry Prairie, Scrub & Scrubby Flatwoods, Sandhill, Pine Flatwoods, Upland Hardwood Forest, and Sandhill Upland Lake. Maps of each natural community are also revised following the field assessments for new Florida Forever proposals each year. An acreage table and map of this data layer are shown in Appendix J.

Section 5
Landscape-sized Protection Areas

Measure B5: The number of landscape-sized protection areas that exhibit a mosaic of predominantly intact or restorable natural communities (>50,000 acres) established through new acquisition projects, or augmentations to previous projects.

Source: Florida Natural Areas Inventory

Measure definition

For the purpose of the Florida Forever Conservation Needs Assessment, this measure is interpreted narrowly to mean a count of the number of contiguous areas managed for conservation that are greater than 50,000 acres in size. For project evaluation purposes we have developed a separate analysis measuring the relative contribution of each Florida Forever project to existing or potential Landscape-sized Protection Areas. That project-based analysis is detailed in the Ranking Support Analyses Documentation.

Methods

For this measure, managed areas were grouped into Managed Area Complexes (MACs). The FNAI Florida Managed Areas (FLMA) coverage was converted to raster and "water out" was removed. The raster underwent a 3-cell Expand and Shrink process to close small gaps, and the resulting raster was Region-Grouped. Each contiguous region is a separate Managed Area Complex (a MAC can contain multiple different managed areas, as long as they are contiguous after the expand/shrink process). MACs greater than 50,000 acres are counted toward this measure for the Florida Forever Natural Resource Acquisition Progress (NRAP) report.

Section 6
Natural Floodplain

Measure C3: The number of acres acquired that protect natural floodplain functions.
Source: FEMA, FNAI

Measure Definition

Floodplains are often described in terms of statistical frequency of flooding, i.e. 10-year floodplain or 100-year floodplain. The boundary of the 100-year flood is commonly used in floodplain mitigation programs to identify areas where the risk of flooding is significant, e.g. FEMA data. We worked closely with members of the Florida Forever Technical Advisory Group who recommended that the natural floodplain should be represented by natural or semi-natural areas within the 100-year floodplain as identified by FEMA.

Methods

The source data layers for 100-year floodplain include the following:

1. FEMA Digital Flood Insurance Rate Map (DFIRM) Database, 2001 – 2017, for 63 counties.
2. FEMA Digital Q3 Flood Data, 1996 (FEMA96), for 4 counties without DFIRM (Palm Beach, Citrus, Hendry, Sarasota).
3. Floodplain estimated using the overlap of wetlands and hydric soils data fill gaps in DFIRM or FEMA 96 data, especially for South Florida counties. The wetlands/hydric soils floodplain surrogate was used in DFIRM counties where DFIRM data listed FLD_ZONE as D, AREA NOT INCLUDED, and in FEMA 96 counties where FEMA 96 data listed ZONE as ANI, D, X500, or NULL. The wetlands/soils floodplain surrogate was recommended by a subgroup of the Florida Forever Technical Advisory Group after several alternate methods, including use of digital elevation data, were explored.

The precision of FEMA data is variable from county to county, and from urban to rural areas.
In areas where FEMA data existed, we used the 100-year floodplain or Special Flood Hazard Area (SFHA) as Natural Floodplain. Sovereign submerged lands and developed lands were excluded from this layer.

Prioritization

Data were prioritized into 6 categories using the Functional Wetlands prioritization method (see Section 9 of this report). Floodplain priorities were assigned based on natural quality without regard to upland/wetland status using a Land Use Intensity index (LUI) developed by Tom Hoctor at the University of Florida (updated by FNAI in 2018 based on Cooperative Land Cover Map v3.3) and the FNAI Potential Natural Areas (PNA). An acreage table and map of this data layer are shown in Appendix J.

Section 7
Surface Water Protection

Measure C4: The number of acres acquired that protect surface waters of the state
Source: Florida Natural Areas Inventory and Florida Department of Environmental Protection/ Office of Coastal and Aquatic Managed Areas

Measure Definition

In consultation with water resource experts from the water management districts, the Florida Department of Environmental Protection (DEP) Division of Water Resource Management, and DEP Office of Coastal and Aquatic Managed Areas (CAMA), we determined that this measure concerns the protection of surface waters that currently remain in good condition, as opposed to those in need of restoration. Restoration efforts are covered under other Florida Forever goals and measures.

The next step was to determine which types of surface water resources should be included as significant surface waters. Initially, CAMA staff agreed to compile data layers to be used in this measure. They provided GIS data for shellfish harvesting areas, seagrass beds, and Outstanding Florida Waters (OFWs). OFWs include Special OFWs, which are those not located in existing managed areas, Other OFWs (those within managed areas), and Aquatic Preserves.

On August 18, 2000, we conducted a water resources review meeting with experts from the water management districts, DEP, and the Florida Geological Survey (see Appendix H for a description of the Water Resources Workshop). As a result of that meeting, we agreed to include National Wild and Scenic Rivers, springs, and estuaries included in the National Estuary Program. Subsequently we also included water bodies important for imperiled fish as a base layer (Hoehn 1998).

Methods

Significant surface waters were grouped into eight distinct categories, and a separate sub-model was developed for each. The eight sub-models and the final combination are described below:

Sub-model 1: Special OFW Rivers

The features included in this sub-model are only the rivers designated Special OFWs, and the Loxahatchee River (Florida's only National Wild & Scenic River). Some lake systems in central Florida and some coastal areas are also designated Special OFWs, but those were included in other sub-models. The following features were selected for buffering:

- all streams within the major basin of the OFW river. These were selected from the National Hydrography "nhd_reach" line data layer.
- The special OFW boundary for each river, from the special OFW data layer developed by DEP.
- Stream polygons associated with the OFW river, from the water management FLUCCS landcover data layers.

Each of these data sets was buffered by 1000 feet and by 1 mile. The 1 mile buffer was overlaid on the "drainage basins 1997 areas" data layer from DEP. The buffers were manually edited to remove portions that did not lie within the basins flowing into the streams of interest.

All sub-basins included in the major river basins were also scored based on three factors: stream order, downstream length, and basin class. Stream order was based on nhd_reach level, modified so that each Special OFW river started as stream order 1. To calculate downstream length, each Special

OFW River was divided into four equal stream lengths. All tributaries flowing into each of the four segments were scored as contributing to 1, 2, 3, or all 4 stream lengths. The sub-basin containing the OFW river (which was usually a single sub-basin running the length of the river) was divided at these four segments, with the division line following elevation patterns from a 30-meter Digital Elevation Model. Basin class was defined by size of the overall basin of each Special OFW river (Table 7-1). Sub-basins were scored based on the three factors as shown in Table 7-2

Table 7-1. Basin classification based on total area of the basin.

Basin Class	Basin Area (sq. mi.)
1	10,000+
2	6,000 – 9,999
3	4,000 – 5,999
4	1,000 – 3,999
5	100 –999
6	0 – 99

Table 7-2. Scoring system for the Special OFW Rivers sub-basins.

Stream Order	Stream Order Points	Basin Class	Basin Class Points	Downstream Length	Length Points	**Total Points**	**Model Class**
1	100	1	90	4	70	**250-260**	**1**
2	70	2	80	3	55	**230-249**	**2**
3	50	3	70	2	40	**200-229**	**3**
4	35	4	60	1	25	**170-199**	**4**
5	25	5	50			**130-169**	**5**
6	20	6	50			**100-129**	**6**
7	15					**1-99**	**7**
8	10						

Finally, the two buffers were overlaid on the sub-basins model (with the 1000 foot buffer overriding the 1 mile buffer where the two overlapped) and the final Special OFW sub-model was scored as shown in Table 7-3. A map of the Special OFW Rivers sub-model is shown in Fig. 7-1.

Table 7-3. Prioritization system for the Special OFW Rivers sub-model.

Buffer	Basin Model Class	**OFW Rivers sub-model Priority Class**
1,000 feet	1	**1**
1,000 feet	2	**2**
1,000 feet	3	**3**
1 mile	1	**4**
1,000 feet	4	**4**
1 mile	2	**5**
1,000 feet	5	**5**
1 mile	3	**6**
1,000 feet	6	**6**
1 mile	4	**7**
1 mile	5	**8**
none	1	**8**
1 mile	6	**9**
none	2	**9**
none	3-6	**10**

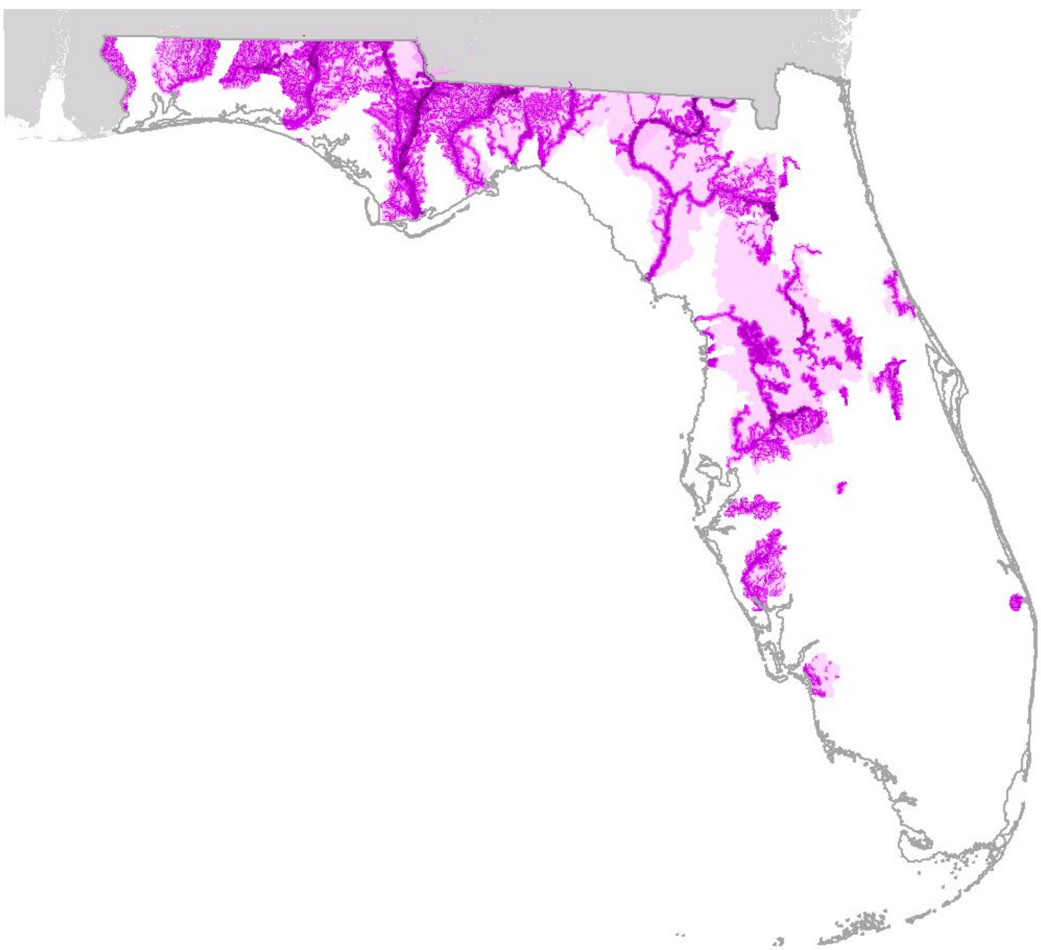


Figure 7-1. Special OFW rivers sub-model with darker colors showing higher priorities.

Sub-model 2: Coastal Surface Waters

This sub-model included the following coastal resources: shellfish harvesting areas, seagrass beds, coastal aquatic preserves, and national estuaries. Each of these data sets and their tributary streams was buffered by 1000 feet and by 1 mile. The 1 mile buffers were manually edited to remove portions that did not lie within the basins flowing into the resources of interest.

In 2015, this model was updated to address areas with intensive canal networks. Methods described as occurring "within the Update Zone" apply to the area shown in Fig. 7-2.

Figure 7-2. "Update Zone" for Surface Water revisions.

The 1-mile buffer was overlaid on watershed sub-basins: "drainage basins 1997 areas" data layer from DEP for most of the state. NRDC HUC 12 basins were default in the Update Zone; SFWMD Arc Hydro Enhanced sub-watersheds were more detailed and used where available through most of the SFWMD.

Streams data used statewide was obtained from FWC in 2007. These streams were a modification of NHD streams based on an updated digital elevation model. Within the Update Zone, a 2014 update of NHD flowlines maintained by DEP was used.

Within the Update Zone, canals and other artificial waterways were eliminated from consideration. 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. Wetland polygons were not given a 1,000 ft buffer, but were given a 1 mile buffer.

All sub-basins statewide were then scored based on proximity to the coastal resources. Sub-basins contiguous to the resource were given a proximity score of 1, sub-basins adjacent to proximity 1 were scored proximity 2, and so on (within the Update Zone, the "least proximal" sub-basin scored 18). Some larger basins were subdivided at arbitrary intervals to make them more comparable to other sub-basins in size. Those divisions were made following elevation patterns from a 10-meter Digital Elevation Model obtained from FWC.

Finally, the two buffers were overlaid on the coastal proximity model (with the 1000 foot buffer overriding the 1 mile buffer where the two overlapped) and the final Coastal sub-model was scored as shown in Table 7-4. A map of the Coastal sub-model is shown in Fig. 7-3.

Table 7-4. Prioritization system for the coastal sub-model.

Buffer	Coastal Proximity	**Coastal sub-model Priority Class**
1,000 feet	1	**1**
1,000 feet	2-3	**3**
1 mile	1	**4**
1,000 feet	4+	**5**
1 mile	2-3	**5**
1 mile	4+	**6**
none	1	**6**
none	2-3	**7**
none	4+	**8**

Figure 7-3. The coastal sub-model with darker colors showing higher priorities.

Sub-model 3: Other OFWs (Managed Areas)
This sub-model includes the category of "other Outstanding Florida Waters" which essentially includes all state conservation lands and federal lands managed by the National Park Service or U.S. Fish & Wildlife Service. All waterbodies on these lands are included in the other OFW designation (see DEP website: http://www.dep.state.fl.us/water/wqssp/ofw.htm). Because these OFWs typically cover only segments of rivers, or lakes within the managed area boundaries, they were treated differently from the more complete OFW river systems modeled in the Special OFW sub-model. Also included in this category is the everglades hydrological system. The OFW designation for the everglades includes all wetlands within the system, so wetlands in the managed areas spanning the everglades (Everglades NP, Big Cypress NP, Everglades WMA, and Loxahatchee NWR) were included as resources to be buffered in this sub-model.

Stream and basin data and model methods followed the approach outlined in the Coastal Sub-model above, including the 2015 updates in the Update Zone. The same scoring system was used as listed in Table 7-5.

A map of the Other OFW sub-model is shown in Fig. 7-4.

Table 7-5. Prioritization system for the Other OFW sub-model.

Buffer	OFW Proximity	**Other OFW sub-model Priority Class**
1,000 feet	1	**1**
1,000 feet	2-3	**3**
1 mile	1	**4**
1,000 feet	4+	**5**
1 mile	2-3	**5**
1 mile	4+	**6**
none	1	**6**
none	2-3	**7**
none	4+	**8**

Figure 7-4. Other OFWs sub-model with darker colors showing higher priorities.

Sub-model 4: Keys

The entire Florida Keys are included in the list of Outstanding Florida Waters by DEP. The keys were treated identically to the other coastal resources and could have been included in the Coastal sub-model, but were modeled separately in the event that they might have been prioritized differently.

The keys coastline was selected from a detailed shoreline data layer available from DEP. Those line segments were then buffered by 1000 feet and 1 mile as with the other water resources. All land areas on the keys were treated as proximity of 1 (equivalent to coastal proximity; Fig. 7-4).

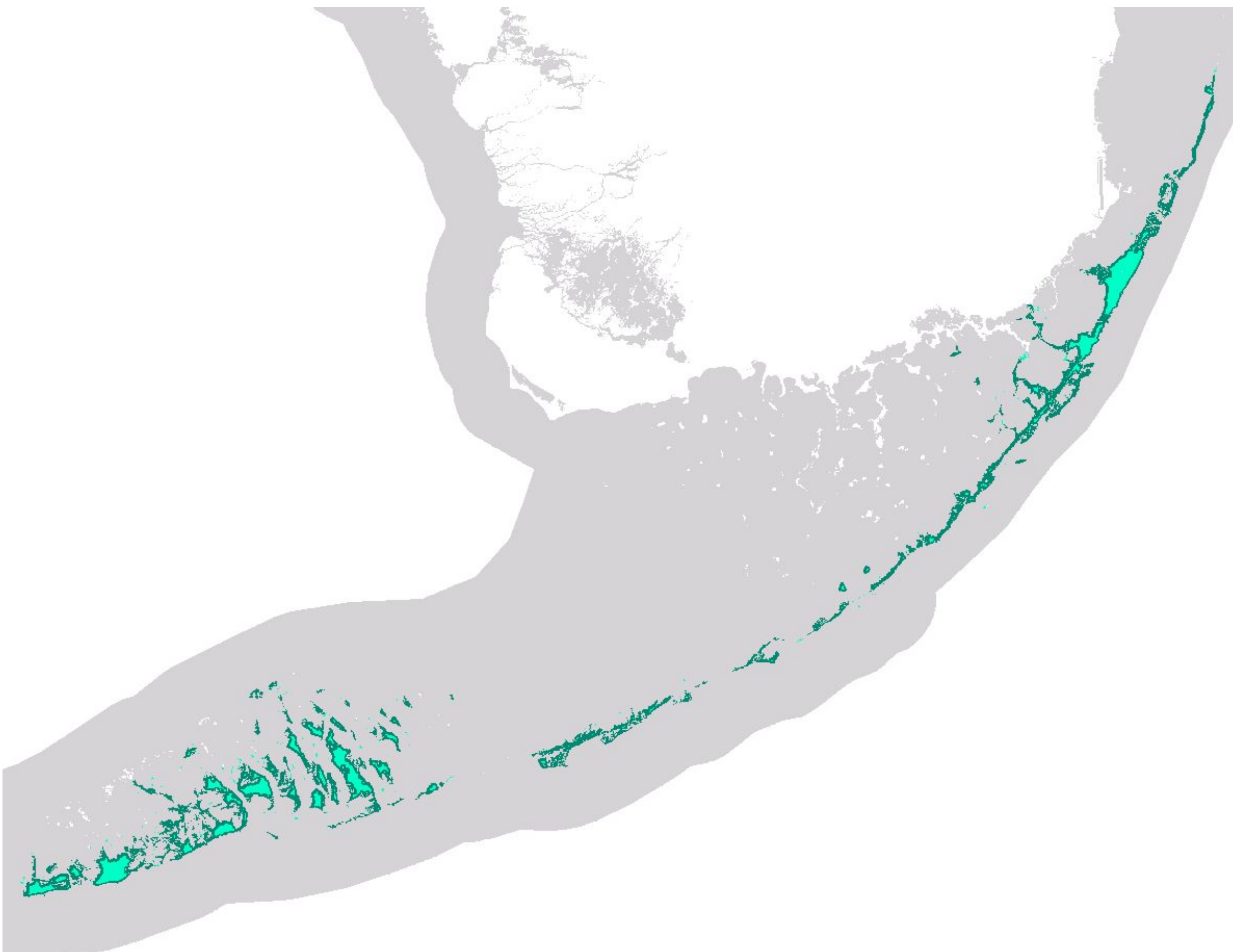


Figure 7-5. Keys sub-model with darker colors showing higher priorities.

Sub-model 5: Springs

Springs are represented in this model by a point data layer of magnitude 1-4 springs developed by the Florida Geological Survey. These points were buffered by the standard 1000 foot and 1 mile buffers (edited by basin boundaries as described above). The buffers were classified into 8 priorities: the top four priorities are the 1000 foot buffers of magnitude 1-4 springs respectively, and the remaining four priorities are the 1 mile buffers of magnitude 1-4 springs respectively.

A map of the Springs sub-model is shown in Fig. 7-5.

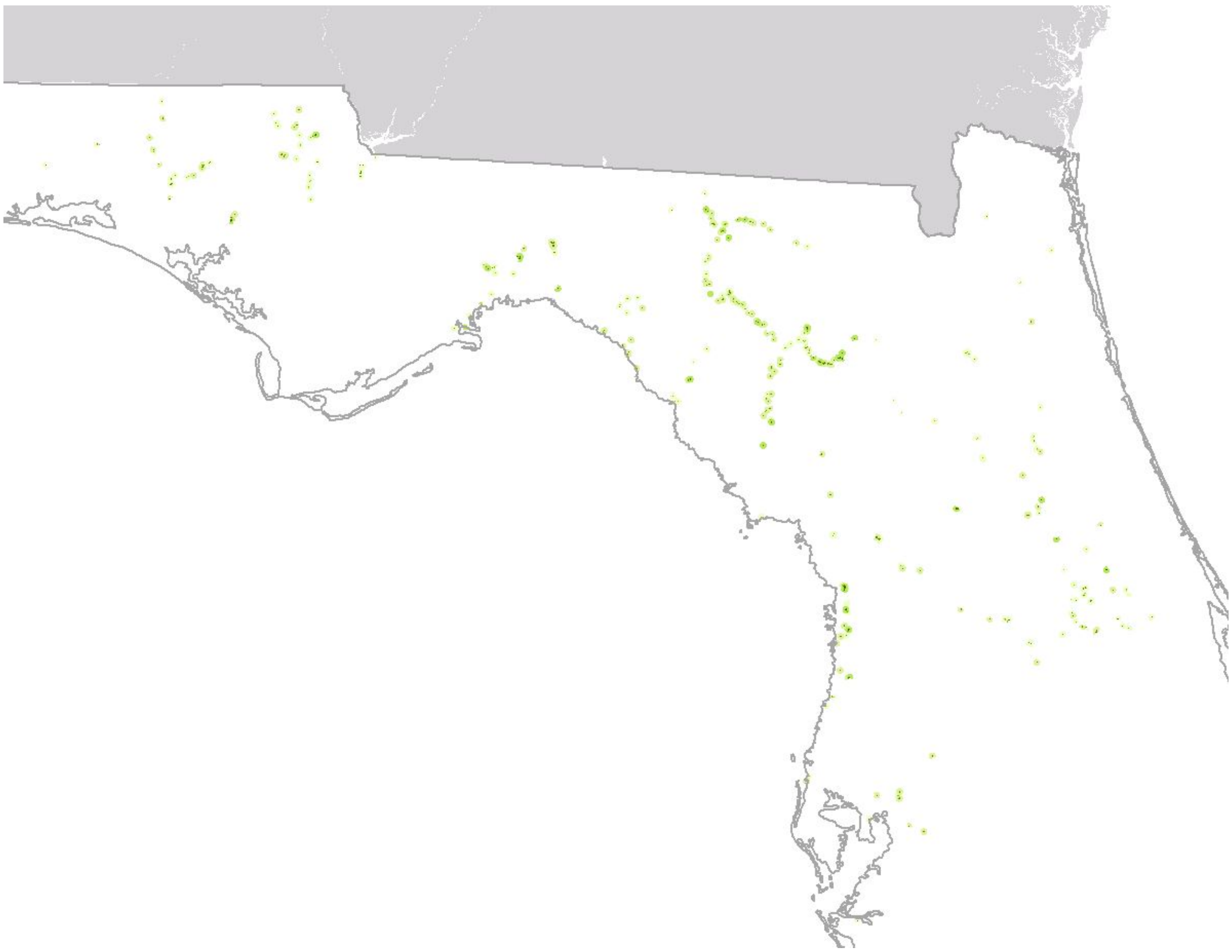


Figure 7-6. Springs sub-model with darker colors showing higher priorities.

Sub-model 6: Rare Fish Basins

A study by Ted Hoehn at the Florida Fish and Wildlife Conservation Commission identified basins that are important for rare and imperiled fish species (Hoehn 1998). Hoehn distributed a model of those fish basins weighted by species rarity and diversity. The model was divided into 5 priority classes. This modeling has since been updated by Mark Barrett at FWC (Barrett 2013), resulting in occurrence data and potential habitat modeling for 26 species.

This sub-model consists of HUC 12 basins and streams identified by Barrett, overlaid with the 1000 foot and 1 mile buffers. Species were weighted according to Hoehn's original method, and basins were scored based on all species included. A documented occurrence of a species in a basin was scored double a modeled potential for the species in the basin. Basins were assigned to priority classes as follows:

P1 (High) = 520+
P2 (Med High) = 300-519
P3 (Med) = 140-299
P4 (Med Low) = 60-139
P5 (Low) = 10-59

These breaks were modified from Hoehn's original method due to the larger number of species and basins modeled, and the particular scoring system used in the current update, but they are intended to follow the general intent of Hoehn's method.

The sub-model priorities were defined as shown in Table 7-6 and a map is shown in Fig. 7-6.

Table 7-6. Prioritization system for the rare fish basins sub-model.

Buffer	Basin Priority Class	**Rare Fish Sub-model Priority Class**
1,000 feet	1	**1**
1,000 feet	2	**2**
1,000 feet	3	**3**
1,000 feet	4	**4**
1 mile	1	**4**
1,000 feet	5	**5**
1 mile	2	**5**
1 mile	3	**6**
1 mile	4	**7**
1 mile	5	**8**
none	1	**9**
none	2-3	**10**
none	4-5	**11**

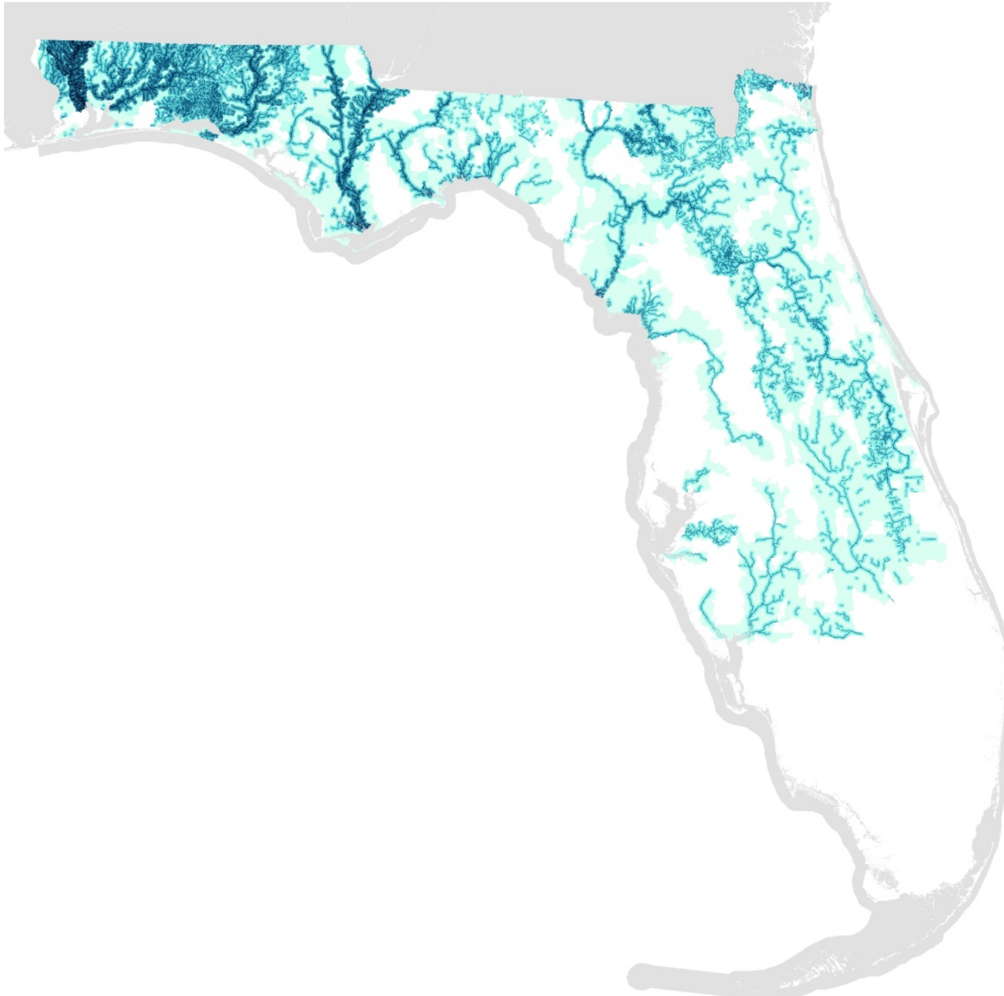


Figure 7-7. Rare fish sub-model with darker colors showing higher priorities.

Sub-model 7: OFW Lakes and Inland Aquatic Preserves

This sub-model represents a small subset of resources that were modeled separately to reflect their high priority. The modeling method is identical to Sub-model 3 (other OFWs). These resources were separated from Sub-model 3 in order to give them a higher priority in the final integrated Surface Water model (see below).

The 1000 foot buffers of these resources are identified in Figure 7-8. Inland aquatic preserves are shown in purple, OFW lakes are shown in pink. All of these buffers are treated as Sub-model 7 Priority 1 for the final overlay. All other buffers and basins related to these resources remain the same as in Sub-model 3.

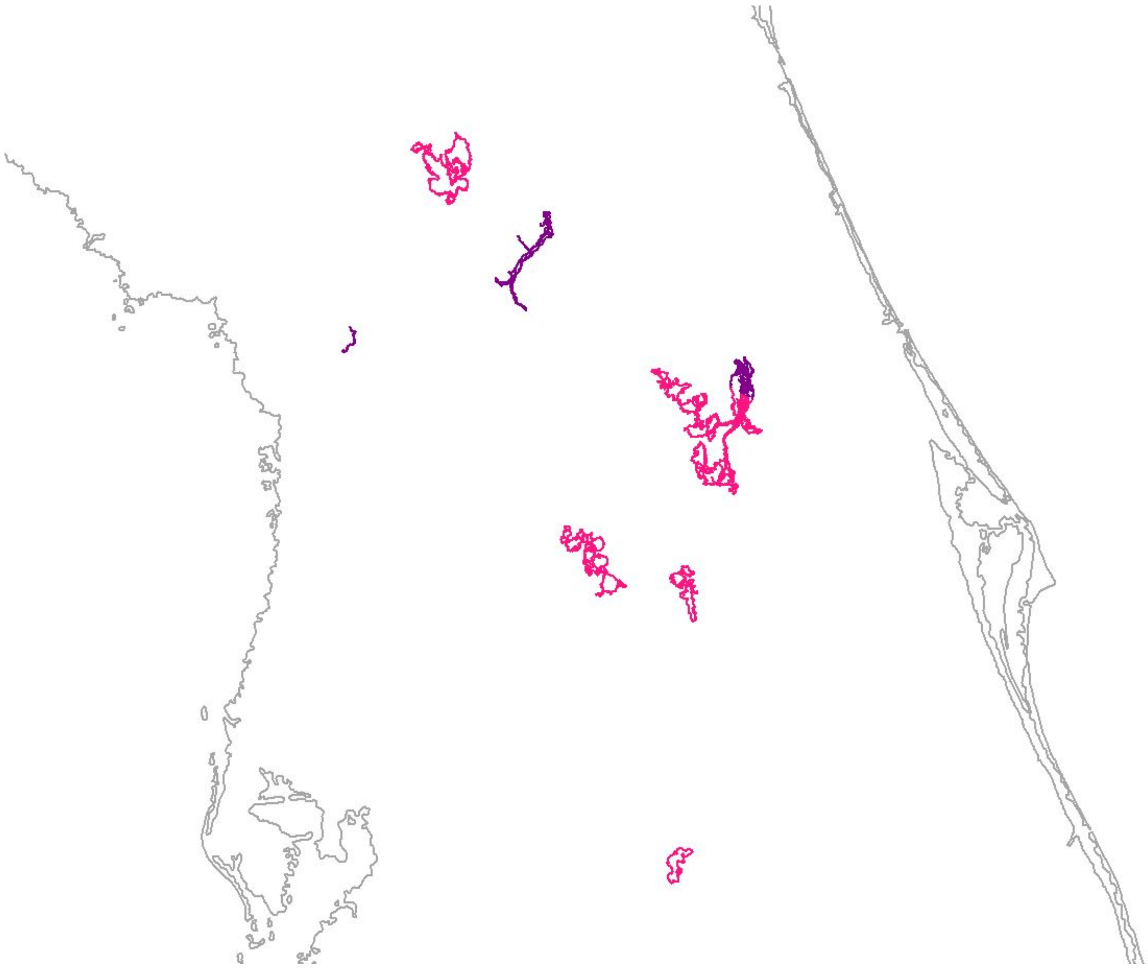


Figure 7-8. OFW lakes and inland Aquatic Preserves sub-model with darker colors showing higher priorities.

Sub-model 8: Water Supply Sources

Water supply sources are those water bodies in the state that are designated Class 1 (potable water supply) by DEP (source: 2014 update of "Surface Water Class Boundaries (areas)" data layer). Those sources and their tributaries were buffered by 1,000 feet and 1 mile, and basin proximity was assigned using the same method as described for the Coastal sub-model, including the 2015 Update Zone revisions. The final sub-model priority classes also follow the same system as outlined for the Coastal sub-model.

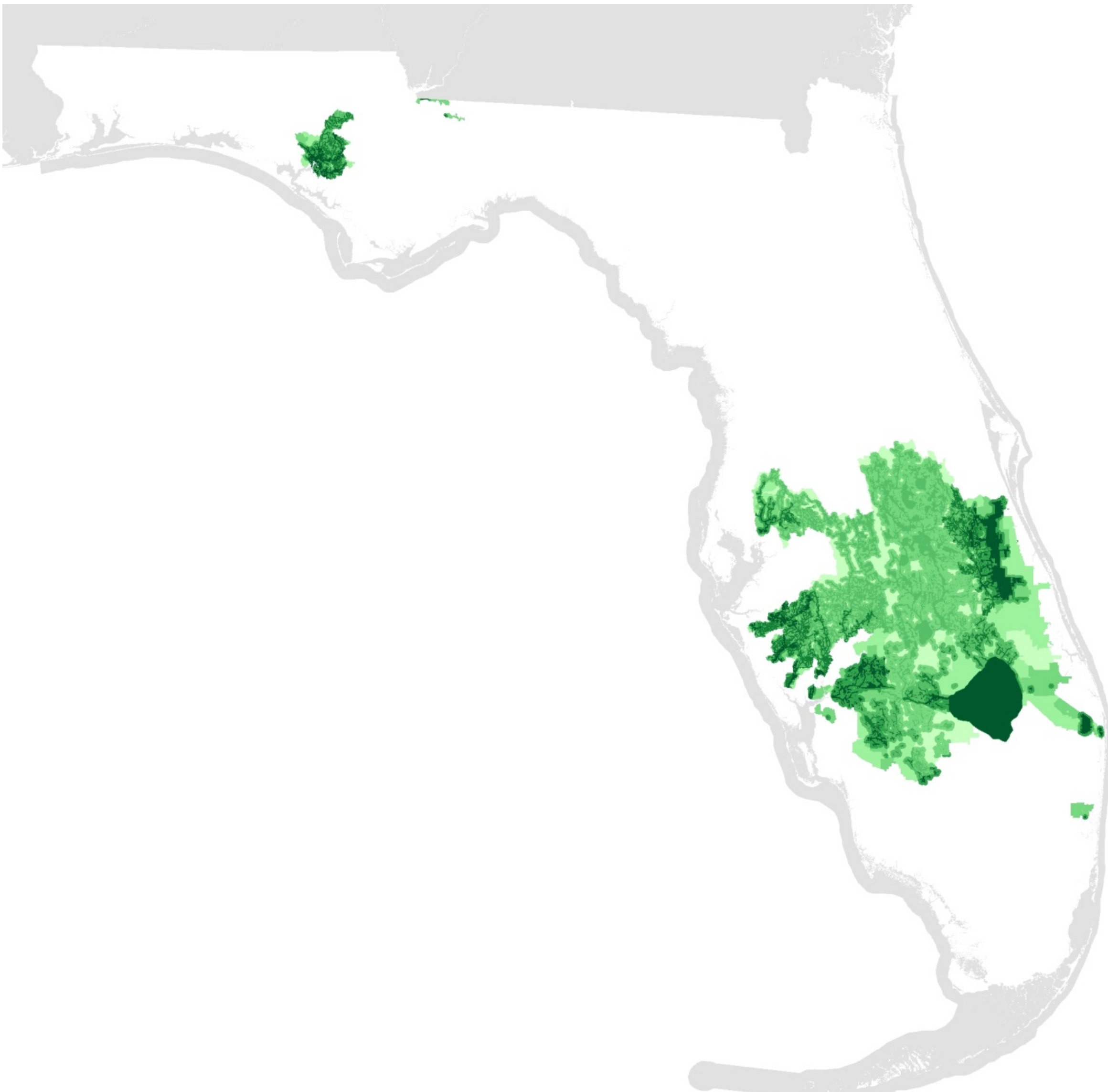


Figure 7-9. Water Supply sub-model with darker colors showing higher priorities.

Final Surface Water Model Integration

The final model is a straightforward overlay of the eight sub-models and is classed into seven priorities using the rules shown in Table 7-7.

Table 7-7. Prioritization system for the integrated surface water model.

2015 Model Scoring									
SURFACE WATER PRIORITY	**Special OFW Rivers**	**Coastal**	**MA OFWs**	**Keys**	**Springs**	**Rare Fish**	**Lakes OFWs**	**Water Supply**	**Notes**
1	1	1		1	1	1	1	1	1,000 ft buffers only
2	2		1		2-4	2			1,000 ft buffers only
3	3	3		2	5	3		3	1,000 ft + 1 mile (keys, springs)
4	4-5	4	3-4		6-8	4-5		4	1,000 ft + 1 mile
5	6-7	5	5			6-7		5	1,000 ft + 1 mile
6	8	6	6			8-9		6	basins + 1mile
7	9-10	7-8	7-8			10-11		7-8	basins + 1mile (Sp. OFW only)

Finally, FNAI's standard "water out" data layer was used to remove water bodies from the model. Developed lands were also removed.

An acreage table and map of this data layer are shown in Appendix J.

Section 8
Fragile Coastal Resources

Measure C6: The number of acres acquired that protect fragile coastal resources
Source: Florida Natural Areas Inventory

Measure Definition

We defined fragile coastal resources as those natural communities most vulnerable to disturbance or development. Upland coastal communities face a variety of threats, especially invasion by non-native species and real estate development (Johnson and Barbour 1990). The high percentage of Florida's upland barrier coast already developed (>50%) and the continued rapid rate of development prompted an assessment of remaining coastal uplands in Florida (Johnson and Muller 1993; Johnson and Gulledge 2005). The major upland communities surveyed by Johnson and Muller were included in the fragile coastal resources data layer: beach dune, coastal grassland, coastal strand, coastal scrub, and maritime hammock. Coastal wetland communities are also threatened by development and other human activities. Florida Marine Research Institute has documented significant losses to salt marsh and mangrove communities (Florida Fish and Wildlife Conservation Commission 2000), which were also included in this data layer. Finally, we also included imperiled coastal lakes - Coastal Dune Lakes and Coastal Rockland Lakes - because they are recognized as globally imperiled (G2) communities.

We restricted coastal natural communities to those that occur within one kilometer of the shoreline of marine or estuarine waters, or those that were identified and mapped for the assessment of Florida's remaining coastal upland communities (Johnson and Gulledge 2005).

We recognize that some important coastal resources, such as seagrass beds and shellfish harvesting areas are not explicitly represented in this data layer. These resources, however, were identified by DEP/Coastal and Aquatic Managed Areas as important surface waters and, therefore, are captured in the surface water protection data layer. In future revisions, we may reconsider the most appropriate representation of data that overlaps different resource categories.

Methods

Coastal classes were extracted from the Florida Cooperative Land Cover Map v2.3 (Table 8-1). An acreage table and map of this data layer are shown in Appendix J.

Table 8-1. Community types included in the fragile coastal resources data layer.

Coastal Uplands	**Coastal Wetlands**	**Coastal Lakes**
Scrub (G2) Scrubby Flatwoods (G2) Beach Dune (G3) Coastal Berm (G3) Coastal Grassland (G3) Coastal Strand (G3) Maritime Hammock (G3) Shell Mound (G2)	Salt marsh (G5) Mangrove (G5) Keys Tidal Rock Barren (G3)	Coastal Dune Lake (G2) Coastal Rockland Lake (G2)

Section 9
Functional Wetlands

Measure C7: The number of acres of functional wetland systems protected
Source: FNAI; WMD; FDEP

<u>Measure Definition</u>
We consulted with resource experts on how best to define and represent functional wetlands. First, we considered which, of the statewide digital datasets that represent wetlands, to use: U. S. Fish and Wildlife Service's 1:24,000 National Wetlands Inventory (NWI), wetlands from the FWC Landsat land cover data, or wetland polygons from the Land Use Land Cover (LULC) data. Previous versions of the Functional Wetlands were based on NWI data; these data, however, are not regularly updated. Based on our experience as well as the recommendation of experts we decided, instead of NWI, to use wetlands identified in the LULC data. Recent updates to the wetlands classification and spatial delineation appear to have improved the accuracy of these data over NWI. In August 2010, the Cooperative Land Cover Map (CLC; FNAI 2010a) was published which incorporates the latest LULC data for most of the state but also incorporates more recent high quality ground-truthed data on many state conservation lands. We therefore assumed the wetlands classes of the CLC to be the most up-to-date and accurate and used these as our base dataset.

The functionality of wetlands is more difficult to define. Although some research on a local level has attempted to assess the functional status or significance of wetlands (Sutter et. al. 1999; South Florida Water Management District, 2001), there is no such effort on a statewide scale. Even on the local level, it may be difficult to find agreement on a scientific methodology for assessing functionality (Swanson, SLER, pers. comm.). One suggestion was to use size as an indicator of functionality. This, however, was rejected because it would lead to de-emphasis or elimination of small depressional wetlands, which have a critical function in the systems where they occur. We finally reached a consensus that with the available data the closest approximation to "functional wetlands" that we could achieve was "wetlands existing in a natural state". We used a Land Use Intensity index (LUI) and Potential Natural Areas to estimate the natural functionality of lands adjacent to wetlands.

<u>Methods</u>
We created a functional wetlands data layer by first selecting all wetland land cover classes within the Cooperative Land Cover Map v3.3 (CLC), with a few corrections based on comparison with the previous version of wetlands.

Prioritization
Wetlands were assigned priorities based on natural quality using a Land Use Intensity index (LUI) developed by Tom Hoctor at the University of Florida (updated by FNAI in 2018 based on CLC v3.3) and the FNAI Potential Natural Areas (PNA).

The LUI characterizes the intensity of land use across the state on a scale of 1 – 10 with 10 being the least intense (most natural). Intensity is based on a multi-scale neighborhood analysis of five general categories of land use: natural, semi-natural (such as rangelands and pine plantation), improved pasture/rural residential, 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. FNAI revised the LUI in October 2018 based on CLC v3.3, provided to FNAI by FWC in August 2018.

The PNAs are ranked from P1 to P4 based on size, perceived quality, and type of natural community present. PNAs with these ranks were grouped into "high quality" natural areas. PNAs ranked P5 are areas that do not meet the criteria for P1 – P4 but are nonetheless believed to be ecologically viable tracts of land representative of Florida's natural ecosystems.

Table 9-1 shows how both the LUI and PNAs were applied to help refine the prioritization of functional wetlands. An acreage table and map of this data layer are shown in Appendix J.

Table 9-1. Prioritization method for wetlands based on Land Use Intensity index and FNAI Potential Natural Areas.

Land Use Intensity Index	PNA 1 – 4	PNA 5	Non-PNA
10 *(lowest intensity)*	Priority 1	Priority 2	Priority 2
9	Priority 2	Priority 3	Priority 3
8	Priority 3	Priority 3	Priority 4
7	Priority 3	Priority 4	Priority 4
6	Priority 4	Priority 4	Priority 5
5	Priority 4	Priority 5	Priority 6
4	Priority 5	Priority 6	Priority 6
1 - 3	Priority 6	Priority 6	Priority 6

Section 10
Aquifer Recharge

Measure D3: The number of acres acquired of ground water recharge areas critical to springs, sinks, aquifers, other natural systems, or water supply.
Source: Advanced Geospatial, Inc.; Florida Natural Areas Inventory

Measure Definition

This measure is broad in scope, underscoring specific resources such as springs and sinks, but also covering recharge areas for aquifers, natural systems and water supply. Areas of potential recharge to the Floridan and surficial aquifers were determined from source data inputs for soil hydraulic conductivity, proximity to karst features, depth to water, and overburden. In order to further prioritize areas important to recharge protection, we incorporated additional data related to springs and public water supply.

Methods

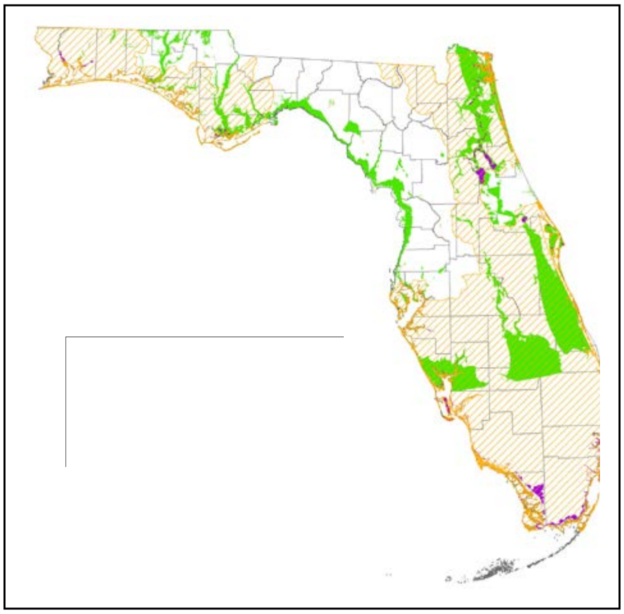
Florida Natural Areas Inventory subcontracted with Advanced Geospatial, Inc. (AGI) to develop a statewide Recharge Potential model. Input data layers for the model were consistent with those used in the Florida Aquifer Vulnerability Assessment (FAVA) developed by the Florida Geological Survey and consisted of soil hydraulic conductivity, proximity to karst features, depth to water, and overburden. Using a spatial analysis called Fuzzy Logic, AGI combined the layers in a logical fashion based on observations derived from the FAVA model. Detailed documentation for the base model may be found in AGI's final report, "FNAI- Recharge Component, 2009" which is included as Appendix I in this report.

The AGI model is a statewide grid of 300 x 300 meter cells, with cell values ranging from 0 – 1 on a continuous scale. The continuous values allow for flexibility in how the model is applied. For Florida Forever reporting and evaluation it was necessary to group the values into several priority classes, ranging from high to low, to help focus on the most important places statewide to protect significant recharge areas. The prioritization also addresses the intent of Florida Forever to acquire recharge areas important for springs and water supply. FNAI consulted with AGI, Florida Geological Survey (FGS) and DEP to accomplish this prioritization.

Prioritization

Discharge Removal

As suggested by reviewers of the AGI model, we removed areas where recharge is not happening. AGI identified areas of discharge for the Floridan (FAS) and Surficial Aquifer Systems (SAS). We worked with AGI to create a layer of discharge areas to be removed from the recharge model. Within the extent of the SAS we only used SAS discharge areas. Outside the extent of the SAS we used FAS discharge areas (Fig. 10-1).



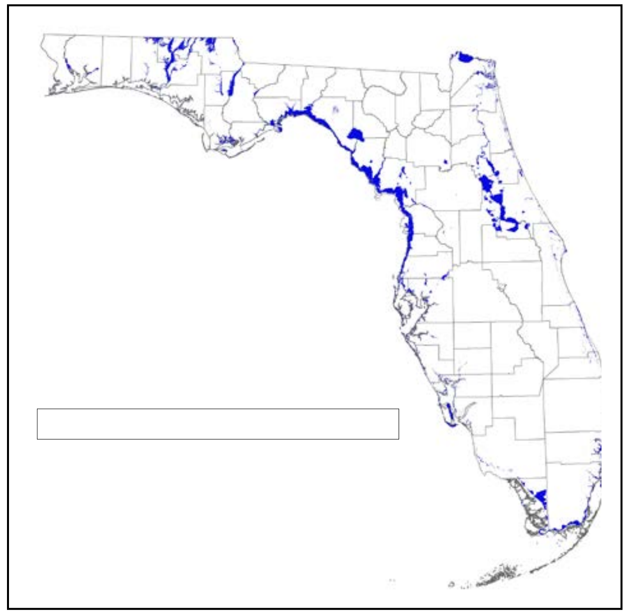


Figure 10-1. Discharge areas removed from the Recharge Potential model based on SAS discharging within the SAS extent and FAS discharging outside the SAS extent. Areas of FAS discharging within the SAS extent were not removed.

Classification of Continuous Values

We classified the Recharge Potential model into five priority classes as a starting point. Table 10-1 shows the value ranges and resulting acreage in each priority class. The "five-class" model is shown in Fig. 10-2. The choice of break values for the classes (0.9, 0.8, 0.6, 0.4) is based on the pattern used with other Florida Forever resource datasets, where the high priority classes define the most limited resource and typically contain the fewest acres.

Table 10-1. Prioritization scheme of "five-class" recharge model.

Priority Class	**Value Range**	**Acres**	**Percentage of AGI model**
Priority 1 (Highest)	0.9 - 1	1,452,534	4%
Priority 2	0.8 – 0.89	4,902,351	14%
Priority 3	0.6 – 0.79	9,717,013	28%
Priority 4	0.4 – 0.59	6,941,868	20%
Priority 5	0.001 – 0.39	11,772,698	34%
TOTAL		34,786,464	100%

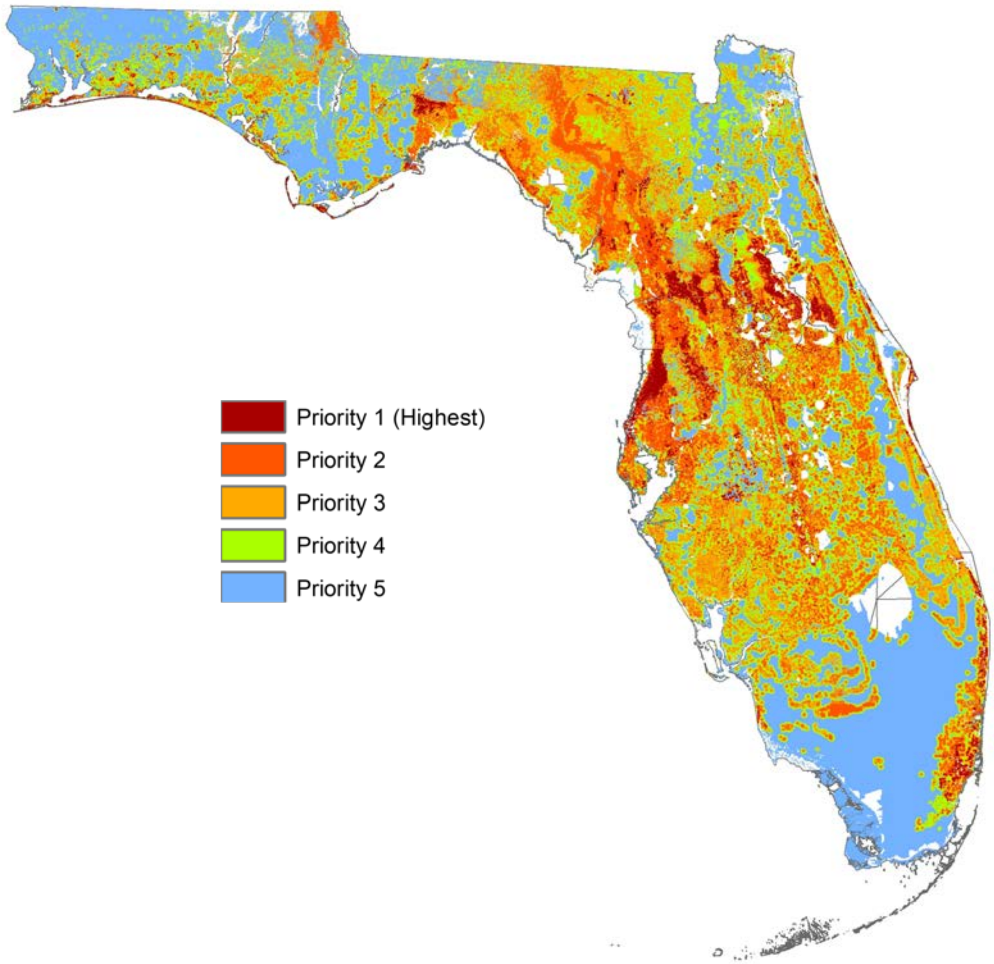


Figure 10-2. Five-class potential recharge model with discharge removed.

Final Prioritization with Springs, Public Water Supply Data, and Swallets
In order to elevate the importance of recharge for springs and water supply we decided that areas meeting criteria for those resources would receive a boost of one priority level. The criteria are discussed below.

Springs.- Specific language in the Florida Forever Act, as well as input from DEP and others indicates that recharge for springs should be given special consideration. We initially assumed that springshed delineations would be an appropriate data source for this. Florida Geological Survey (FGS) advised us, however, that the current springshed data was not suitable for this analysis for several reasons: 1) springsheds have not been delineated for all springs; 2) the existing springsheds are inconsistently delineated and derived from different sources using different methods in different time periods; and 3) springshed boundaries are dynamic and change based on factors such as climate and pumpage; therefore they should not be used for an 'in or out' measurement.

FGS recommended using the "Springs Protection Areas" dataset developed by FGS for the Department of Community Affairs in 2005 (Fig. 10-3). This data layer incorporates springsheds and other information to provide a resource for land-use decision makers. The Springs Protection Areas are described in an online document:
ftp://ftp.dep.state.fl.us/pub/geo/FGS_Publications/OFMS/springshed_dca_poster_OFMS95_12-17-04.pdf

We applied the Springs Protection Area as an overlay to the five-class model, discussed further below.

Water Supply.- Data that identify specific recharge areas important for public water supply may exist on a regional or local level but do not exist statewide. Ideally 'wellsheds', similar to springsheds, would be delineated to identify areas critical to recharging public supply wells. We consulted with staff of the water management districts and DEP's Source Water Assessment and Protection Program (SWAPP) to identify the best available data for this measure. The recommended alternative was to buffer public supply wells based on well type following the method of SWAPP: Community wells are given 1000 foot radius buffers; non-community and non-transient non-community wells are given 500 foot radius buffers (Fig. 10-3). Although this method applies a consistent set of buffers to public water supply wells statewide, it actually identifies setbacks to prevent direct well contamination rather than identifying important recharge areas for those wells. Nonetheless, the wellhead protection zones should be considered a high priority because of the critical importance of these wells to public water supply. We applied the Public Water Supply (PWS) Well Buffers as an overlay to the five-class model, discussed further below.

Swallets.- In April 2015 we consulted with FGS about potential updates to the Aquifer Recharge priorities. Staff at FGS recommended that swallets be considered in the prioritization. Swallets are stream-to-sink features where surface waters enter karst features and interact with Florida aquifers.

We first obtained a point dataset of FGS Swallets, 2007 edition from DEP (http://www.dep.state.fl.us/gis/datadir.htm accessed 6 May 2015). The current dataset is incomplete in that it represents primarily major swallets that reside within first magnitude springsheds. It is important to include these but with the intent to update the recharge layer as the swallet data are expanded. In order to identify priority drainage areas associated with swallets we created a dataset of flowlines into swallets where the reach extent was limited to 1 mi upstream of the swallet feature (most were much shorter than 1 mi). We then buffered the flowlines and swallet point features by a primary buffer of 1000 feet, following surface protection buffer, and a secondary 1 mile buffer as recommended by FGS. Finally, we retained only portions of buffers that were within the DEP watershed (WBID) associated with each swallet feature.

Overlay.- Any areas of the five-class model that overlapped either the Springs Protection Areas or buffered PWS Wells retained their original priority class. Areas outside of the Springs Protection Areas or buffered PWS Wells were assigned the next lower priority class, resulting in a final prioritized model with 6 classes.

Swallet priorities were incorporated into the final prioritized recharge dataset in 2015 based on overlap of prioritized recharge with swallet buffers as follows: If recharge area is within a swallet 1000-foot buffer, it is assigned Priority1; if recharge area is within a swallet 1-mile buffer, then the original priority class is boosted by 1 to the next highest priority class unless it was already Priority 1; any remaining non-recharge areas (i.e. discharge) within the swallet 1-mile buffer were assigned as Priority 6.

The final Recharge Prioritization map and acreage table are shown in Appendix J.

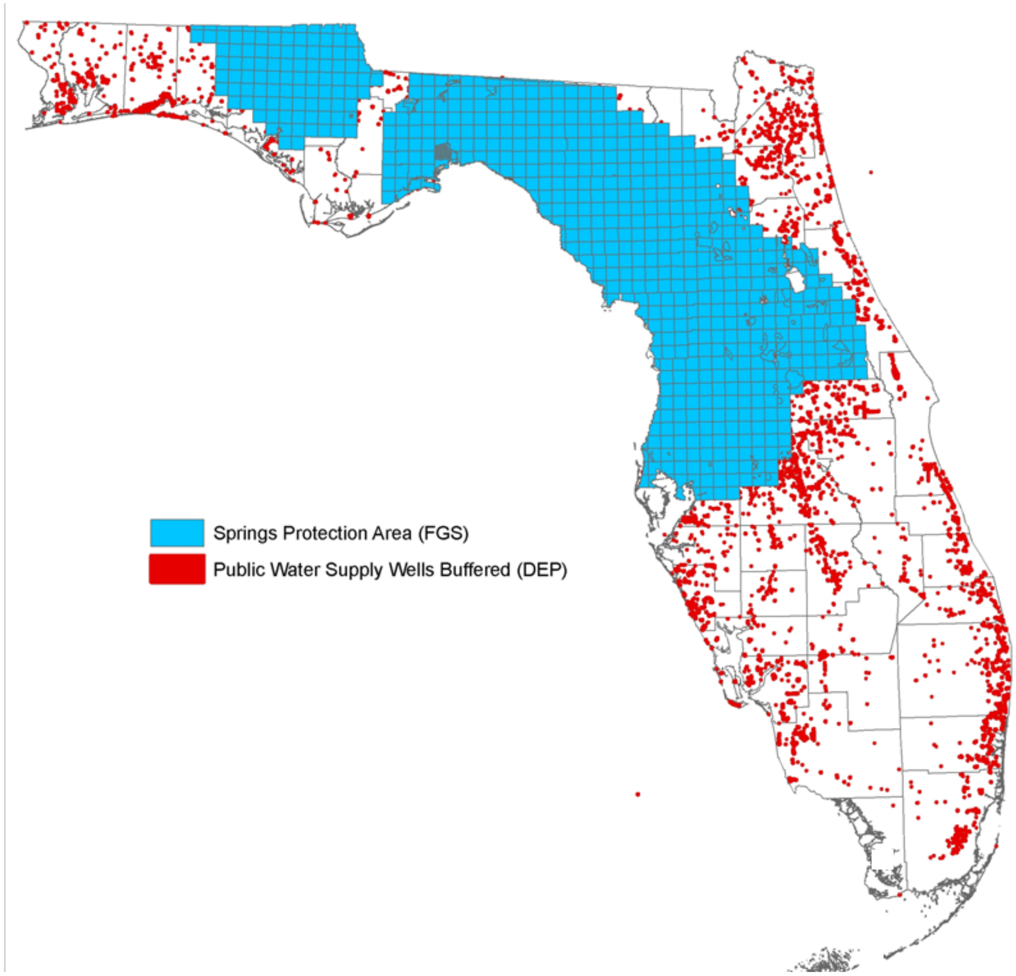


Figure 10-3. Springs Protection Areas and buffered PWS wells used in final prioritization of the Recharge Potential Model.

Section 11
Recreational Trails

Measure E2: The miles of trails that are available for public recreation, giving priority to those that provide significant connections including those that will assist in completing the Florida National Scenic Trail.
Source: University of Florida and Department of Environmental Protection/Office of Greenways and Trails.

Measure Definition

A Trail Opportunities Network was developed as part of the Florida Greenways and Trails System to identify a set of potential trail corridors that provide a connected set of linear recreational opportunities statewide (Florida Department of Environmental Protection and Florida Greenways Coordinating Council 1998, 2004, 2013, 2015, 2018). The Trails Network is designed to provide opportunities to move along trails systems from major city to major city and from those urban areas to sites of historic, cultural and ecological significance. Version 4.4 is based on the 2018 Update of Florida's Trail Network (Florida Department of Environmental Protection 2018).

Methods

The trail opportunities are composed of sub-network corridors for hiking and multi-use. We met with the staff of DEP/Office of Greenways and Trails to develop a version of land trail priorities and opportunities suitable for project evaluation purposes. We combined the 2018 Land Trail Priorities and Opportunities polylines and assigned Priority 1 to all trail 'Priorities', and Priority 2 to trail 'Opportunities'. If trail types overlapped, the segment retained the priority of the highest ranked segment. We buffered trail lines by 0.25 miles to create half mile corridors. Both linear distance and corridor acreage were used to evaluate projects for recreational trails. A mileage table and a map of this data layer are shown in Appendix J.

Section 12
Significant Archaeological Sites

Measure F1: The increase in the number of and percentage of historic and archaeological properties, which are listed in the Florida Master Site File or National Register of Historic Places that are protected or preserved for public use.
Source: Department of State/Division of Historical Resources

Measure Definition

Florida Department of State/Division of Historical Resources (DHR) maintains the Florida Master Site File and administers the National Register of Historic Places in Florida. Because the Florida Forever program will focus primarily on acquiring lands rather than buildings, DHR recommended that only archaeological sites and not historic structures be considered acquisition criteria in this assessment. DHR provided geographic data for the Florida Master Site File, which contains more than 30,000 archaeological sites. Standing structures are still important variables in considering acquisitions through the Florida Forever program and any historic properties purchased would still count toward meeting the measure.

Methods

DHR provided digital boundaries of archaeological sites from the Florida Master Site File. These data were included in the *Assessment*. As of November 2018 there were 35,420 sites of which 15,044 were protected in July 2001 at the onset of the Florida Forever program.

Section 13
Sustainable Forest Management

Measure G1: The number of acres acquired that are available for sustainable forest management
Source: Water Management District land cover; historic vegetation map of Davis (1967)

Measure Definition

We consulted with forestry experts from the Florida Forestry Service (FFS) and the Florida Forestry Association on how best to define and represent measure G1 with existing geographic data. The statutory definition of sustainable forest management includes the ". . . reforestation, managing, growing, nurturing, and harvesting of trees for useful products . . ." (see S253.036, F.S.). According to forestry experts, this definition refers primarily to pine trees. These experts also consider lands to be available for forest management if they were former pinelands that could be reforested (i.e. pastures). Thus, for measure G1, we developed a statewide data layer of existing and potential pinelands. Whether or not these forests are available upon acquisition for sustainable forest management will depend on the policies of the managing agency. For example, although FFS considers all its pinelands and potential pinelands to be available for forest management, other agencies may manage these areas primarily for uses other than timber harvest.

Methods

We selected all upland coniferous forest and coniferous plantation polygons from the Cooperative Land Cover v.3.1, and confirmed Longleaf Pine Ecosystem polygons from the Longleaf Pine Ecosystem Geodatabase v.3 to represent existing pinelands. This category was then subdivided into natural pinelands and plantation. For Ocala National Forest, which is dominated by planted sand pine but managed as scrub, we overrode the majority land cover classification of sand pine scrub so that these areas would be scored as pine plantation. For potential pinelands, we used the historic vegetation map of Davis to first identify areas that were historically pine: Forests of Longleaf Pine and Xerophytic Oaks; Forests of Mixed Hardwoods and Pines; North Florida Pine Flatwoods, Sand Pine Scrub Forests; South Florida Pine Flatwoods; and South Slash Pine Forests. Within these areas, we selected primarily agricultural lands as potential pineland (Table 13-1). Open water and developed lands were removed from all categories.

We originally met with Steve Bohl (FFS), Leon Irvin (FFS) and Randy Kautz (FWC) to discuss ways to further prioritize the forestry data layer. Four criteria were used to prioritize existing pinelands: Natural vs. Planted, Size, Distance to Market, and Hydrology. Hydrology was determined from NRCS soils data as shown in Table 13-2. Table 13-3 lists the prioritization method agreed to by the forestry experts. Potential pinelands were assigned the lowest priority class.

Table 13-1. Cooperative Land Cover and Land Use Land Cover categories selected for existing and potential pinelands.

Natural Pine		**Planted or Disturbed Pine**	
CLC Code	Description	CLC Code	Description
1200	High Pine and Scrub	1213	Sand Pine Scrub (Ocala NF only)
1230	Upland Coniferous	182112	Urban Open Pine
1231	Upland Pine	18312	Rural Open Pine
1240	Sandhill	18333	Tree Plantations
1300	Pine Flatwoods and Dry Prairie (excl dry prairie)	183332	Coniferous Plantation
1310	Dry Flatwoods	18312	Rural Open Pine
1311	Mesic Flatwoods	2450	Wet Coniferous Plantation
1312	Scrubby Flatwoods		
2220	Other Coniferous Wetlands		
2221	Wet Flatwoods		
22211	Hydric Pine Flatwoods		
22212	Hydric Pine Savanna		
2222	Pond Pine		

Potential Pineland (must overlap with Davis pinelands)	
1500	Shrub and Brushland
1831	Rural Open
18321	Cropland/Pasture
183211	Row Crops
183212	Field Crops
183213	Improved Pasture
183214	Unimproved/Woodland Pasture
1832151	Fallow Cropland

Table 13-2. Criteria used to assign hydrology classes to existing pinelands based on NRCS soils.

Soils Hydric Rating	**Logic**	**Soils Drainage Class**	**Final Hydrology Class in Model**
All Hydric	OR	Very Poorly Drained	Wet
Partially Hydric		-	Mesic
Not Hydric		-	Dry
Unknown Hydric	AND	Excessively Drained	Dry
Unknown Hydric	AND NOT	Very Poorly Drained or Excessively Drained	Mesic

Table 13-3. Criteria used to prioritize the forestry data layer.

CRITERIA (% influence on score)	**DATA LAYER SOURCE**	**SCORE**
NATURAL VS. PLANTED PINE (24%)	Cooperative Land Cover; Land Use Land Cover	
Natural		10
Plantation/disturbed		8
Potential (ag lands that could be restored to pine)		0
SIZE (33%)		
≥ 7,500 acres		10
2,500 – 7,500 acres		5
<2,500 acres		1
MILES TO MARKET (33%)	Primary Mills in Florida, Florida Forest Service	

< 50 mi		10
50 - 100 mi		5
≥ 100 mi		1
HYDROLOGY (10%)	NRCS SSURGO Soils	
Mesic		10
Dry		5
Wet		1

The forestry data were scored based on the 4 criteria above, resulting in a grid with grid cell scores ranging from 367 to 1000. The highest potential score was 1000 ((natural = 240 points = 10 points X 24% influence) + (>7,500 acres = 330 points = 10 points X 33% influence) + (< 50 miles to market = 330 points = 10 points X 33% influence) + (mesic site = 100 points = 10 points X 10% influence)). We divided the resulting data layer into 4 priority classes and added a fifth class for "potential" pineland (agricultural lands that could be restored to pineland). The breaks for the 4 priority classes were determined based on the type of information represented by the four criteria. Table 13-4 describes the justification for each priority class. An acreage table and map for this data layer are shown in Appendix J.

Table 13-4. Descriptions, scores, and acreages for the priority classes of the forestry data layer.

G1: Sustainable Forestry	Scores	Description
Priority 1	950-990	Contains at least the top scores for all criteria except Hydrology and at least the middle score for Hydrology.
Priority 2	737-894	Contains at least the middle scores for three of the criteria and top score for Size or Distance to Market
Priority 3	522-693	Contains at least the middle scores for all criteria except Hydrology.
Priority 4	<522	Contains remainder of pinelands not captured above.
Priority 5	N/A	Potential pinelands
Total		

Section 14
Forestland to Maintain Recharge Function

Measure G2: The number of acres of forestland acquired that will serve to maintain natural groundwater recharge functions.
Source: Cooperative Land Cover; Florida Geological Survey; Water Management Districts; other water resource experts

<u>Measure Definition</u>
In consultation with forestry experts from the Division of Agriculture and Consumer Services/Florida Forest Service and the Florida Forestry Association, we defined this measure as the acres of existing forestland that are also areas of high recharge.

<u>Methods</u>
We selected existing pineland data developed for Measure G1 that overlapped with Priorities 1 – 3 of the Aquifer Recharge data layer developed for Measure D3.

REFERENCES

Advanced GeoSpatial Inc. 2009. FNAI – Recharge Component. A report prepared for Florida Natural Areas Inventory, Tallahassee, Florida.

Arthur, J. D., A. E. Baker, J. R. Cichon, A. R. Wood, A. Rubin. 2005. Florida Aquifer Vulnerability Assessment (FAVA): Contamination potential of Florida's principal aquifer systems. Florida Geological Survey, Florida Department of Environmental Protection, Tallahassee, Florida.

Aucott, W. 1988. Water Resources Investigation Report 88-4057. USGS.

Barrett, M.A. 2013. Fish species distribution modeling in Florida freshwater streams: A focus on rare and imperiled species. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, FL. 64 pp.

Bridges, E. L. 2006. Landscape ecology of Florida dry prairie in the Kissimmee River region. Pages 14-44 in R. F. Noss, editor. Land of fire and water. Proceedings of the Florida Dry Prairie Conference. Painter, DeLeon Springs, Florida.

Brock, O. G. 1997. Florida Preservation 2000 Program Remaining Needs and Priorities: Addendum Report. Land Acquisition and Management Advisory Council.

Carr, M. H., P. D. Zwick, T. S. Hoctor and M. A. Benedict. 1999. Final Report, Phase II, Florida Statewide Greenways Planning Project. Department of Landscape Architecture, University of Florida, Gainesville, Florida.

Cox, J., R. Kautz, M. MacLaughlin, and T. Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Florida Game and Fresh Water Fish Commission, Office of Environmental Services, Tallahassee, Florida.

Davis, J. H., Jr. 1967. General map of the natural vegetation of Florida. Circ. S-178. Institute of Food and Agricultural Science, Agricultural Experiment Station, University of Florida, Gainesville, Florida.

Delany, M. F., M. B. Shumar, M. E. McDermott, P. S. Kubilis, J. L. Hatchitt and R. G. Rivero. 2007. Florida grasshopper sparrow distribution, abundance, and habitat availability. Southeastern Naturalist 6:15-26.

Eaton, M. J., P. T. Hughes, J. D. Nichols, A. Morkill, and C. Anderson. 2011. Spatial patch occupancy patterns of Lower Keys marsh rabbit. Journal of Wildlife Management 75:1186-1193.

Endries, M., B. Stys, G. Mohr, G. Kratimenos, S. Langley, K. Root, and R. Kautz. 2009. Wildlife Habitat Conservation Needs in Florida: Updated Recommendations for Strategic Habitat Conservation Areas. Florida Fish and Wildlife Conservation Commission. Tallahassee, Florida.

Faulhaber, C. A., N. D. Perry, N. J. Silvy, R. R. Lopez, P. A. Frank, P. T. Hughes, and M. J. Peterson. 2007. Updated distribution of the Lower Keys marsh rabbit. Journal of Wildlife Management 71:208–212.

Fitzpatrick, J. W., B. Pranty, and B. Stith. 1994. Florida scrub-jay statewide map, 1992 – 1993. U. S. Fish and Wildlife Service Report, Cooperative Agreement no. 14-16-0004-91-950. Florida Department of Environmental Protection. 1997. Final report: ecological integrity grant. Florida Department of Environmental Protection, Tallahassee, Florida.

Florida Department of Environmental Protection and Florida Greenways Coordinating Council. 1998. Connecting Florida's Communities with Greenways and Trails: The Five-Year Implementation Plan for the Florida Greenways and Trails System. Florida Department of Environmental Protection, Office of Greenways and Trails. Tallahassee, Florida.

Florida Department of Environmental Protection and Florida Greenways Coordinating Council. 2004. 2004 Update and Prioritization of Florida's Trail Network. Florida Department of Environmental Protection, Office of Greenways and Trails. Tallahassee, Florida.

Florida Department of Environmental Protection. 2013. Florida Greenways & Trails System Plan 2013 - 2017. Florida Department of Environmental Protection. Tallahassee, Florida.

Florida Department of Environmental Protection. 2018. Florida Greenways & Trails System 2018-2022 Plan and Maps Update. Florida Department of Environmental Protection. Tallahassee, Florida. Online: https://floridadep.gov/parks/ogt/content/florida-greenways-and-trails-system-plan-and-maps. Last accessed 11/29/18.

Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute. 2000. Atlas of Marine Resources, version 1.3b.

Florida Geoplan Center. 1998. Phase II final report for the Florida Statewide Greenways System Planning Project. University of Florida, Gainesville, Florida.

Florida Natural Areas Inventory. 1990. Guide to the natural communities of Florida. Florida Natural Areas Inventory. Tallahassee, Florida.

Florida Natural Areas Inventory. 2000. Florida Forever Conservation Needs Assessment: Summary report to the Florida Forever Advisory Council. Florida Natural Areas Inventory and Florida Department of Environmental Protection, Tallahassee, Florida.

Florida Natural Areas Inventory. 2010a. Development of a Cooperative Land Cover Map: Final Report. Florida Natural Areas Inventory. Tallahassee, Florida.

Florida Natural Areas Inventory. 2010b. Guide to the natural communities of Florida – 2010 Edition. Florida Natural Areas Inventory. Tallahassee, Florida.

Florida Natural Areas Inventory and Florida Forest Service. 2014. Longleaf Pine Ecosystem Geodatabase v.1 Final Report. Online: http://fnai.org/LongleafGDB.cfm. Last accessed 6/11/2015.

Florida Panther Subteam of the Multi-Species/Ecosystem Recovery Implementation Team for South Florida. 2002. Landscape Conservation Strategy for the Florida Panther in South Florida. U.S. Fish and Wildlife Service. Vero Beach, Florida.

Franz, R., and L. Franz. 1979. Distribution, habitat preference, and status of populations of the Black Creek crayfish, *Procambarus (Ortmannicus) pictus* (Decapoda: Cambaridae). Florida Scientist 42(1):13-17.

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

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

Hoehn, T. S. 1998. Rare and imperiled fish species of Florida: a watershed perspective. Office of Environmental Services, Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Johnson, A. F., and M. G. Barbour. 1990. Dunes and maritime forests. Pp. 429-480 *in* R. L. Myers and J. J. Ewel (eds.), Ecosytems of Florida. The University of Central Florida Press, Gainesville, Florida.

Johnson, A. F. and J. W. Muller. 1993. An assessment of Florida's remaining coastal upland natural communities: final summary report. Florida Natural Areas Inventory.

Kautz, R. S. 2000. Ranking of Strategic Habitat Conservation Areas and lands needed for Florida black bear and Florida panther. Unpublished report of Florida Fish and Wildlife Conservation Commission, Office of Environmental Services, Tallahassee, Florida.

Kautz, R. S. 1993. Trends in Florida wildlife habitat 1936- 1987. Florida Scient. 56(1): 7-24.

Kautz, R. S., D. T. Gilbert, and G. M. Mauldin. 1993. Vegetative cover in Florida based on 1985-1989 Landsat Thematic Mapper imagery. Florida Scientist 56:135-154.

Moler, P. E. 1992. Eastern indigo snake, *Drymarchon corais couperi* (Holbrook). Pp. 181-186 *in* P. E. Moler (ed.), Rare and Endangered Biota of Florida, vol. 3: Amphibians and Reptiles. Univ. Press of Florida, Gainesville, Florida.

Morrison, J. L. 1996. Crested caracara (*Caracara plancus*). Pp. 1-28 *in* A. Poole and F. Gill (eds.), Birds of North America, No. 249. National Academy of Sciences, Philadelphia PA and The American Ornithologists' Union, Washington, D.C.

NeSmith, C. C. and S. S. Jue. 2003. Resurvey of the distribution and status of MacGillivray's Seaside Sparrow and Worthington's Marsh Wren in Florida. Final Report to the Florida Fish and Wildlife Conservation Commission. Tallahassee, Florida.

Oetting, J., T. Hoctor, and M. Volk. 2016. Critical Lands and Waters Identification Project (CLIP): Version 4.0, Technical Report - September 2016. Tallahassee, Florida.

Ogden, J. C. 1990. Habitat management guidelines for the wood stork in the southeast region. U. S. Fish and Wildlife Service, Southeast Region, Atlanta, Georgia.

Pimm, S. L., J. L. Lockwood, C. N. Jenkins, J. L. Curnutt, M. P. Nott, R. D. Powell, and O. L. Bass Jr. 2002. Sparrow in the Grass: A report on the first ten years of research on the Cape Sable Seaside Sparrow (Ammodramus maritimus mirabilis).

Platt, W. J., and M. W. Schwartz. 1990. Temperate hardwood forests. Pp. 194-229 *in* R. L. Myers and J. J. Ewel (eds.), Ecosytems of Florida. The University of Central Florida Press, Gainesville, Florida.

Stith. B. 1999. Metapopulation viability analysis of the Florida scrub-jay (*Aphelocoma coerulescens*): a statewide assessment. U. S. Fish and Wildlife Service Report, Contract # 1448-40181-98-M234.

Stys, B., R. Kautz, D. Reed, M. Kertis, R. Kawula, C. Keller and A. Davis. 2003. Florida Vegetation and Land Cover Data Derived from 2003 Landsat ETM+ Imagery. Florida Fish and Wildlife Commission, Tallahassee, FL.

Sutter, L. A., J. B. Stanfill, D. M. Haupt, C. J. Bruce, and J.E. Wuenscher. 1999. NC-CREWS: North Carolina coastal regional evaluation of wetland significance. North Carolina Division of Coastal Management, Department of Environment and Natural Resources, Raleigh, North Carolina.

Thatcher, C., F. van Manen and J. Clark. 2006. An assessment of habitat north of the Caloosahatchee River for Florida panthers. Final Report to U. S. Fish and Wildlife Service.

Tsai, J., P. Frederick and K. Meyer. 2011. Finding wood stork habitat and conserving the right features. Final Report for: Felburn Foundation, Georgia Department of Natural Resources, National Fish and Wildlife Foundation/Southern Company, South Florida Water Mangement District. University of Florida, Gainesville.

U. S. Fish and Wildlife Service. 1981. Florida Everglades Kite critical habitat *in* Region 4 Endangered Species Notebook. U. S. Fish and Wildlife Service, Atlanta, Georgia.

APPENDIX A

Florida Forever Program Goals and Measures

Sections of Florida Administrative Code Chapter 18-24, Florida Forever Land Acquisition and Mangement, that contains measures or criteria addressed by the Florida Forever Conservation Needs Assessment**:**

18-24.0022 Florida Forever Goals and Numeric Performance Measures.

(1) The Florida Forever goals and measures described in this rule apply to all programs that receive Florida Forever Trust Funds pursuant to Section 259.105(3), F.S. Some goals and measures are specific to acquiring land, while others are primarily measures for capital improvement expenditures. Some measures are not directly related to Florida Forever program activities per se, but are general ecosystem function measures that may have an indirect connection or a post-acquisition land management or land use component. Some measures are specific to one or more of the programs funded under Florida Forever pursuant to Section 259.105(3), F.S, while the majority of the goals and measures overlaps with several programs.

(2) The council shall employ the following Florida Forever goals and measures when evaluating, selecting and ranking acquisition projects. Numeric values for these measures shall be supplied to the Council pursuant to paragraph 18-24.006(3)(c), F.A.C.:

(a) Enhance the coordination and completion of land acquisition projects, as measured by:

1. The number of acres proposed to be acquired that contribute to the enhancement of essential natural resources (such as retention of biodiversity and water quantity and quality), ecosystem service parcels (such as those that assist in carbon sequestration, flood control and storm surge protection), and connecting linkage corridors, as identified and developed by the best available scientific analysis, and measured under goals paragraphs (2)(b), (c), (d), and (g) of this rule.

2. The number of acres proposed to be protected through the use of alternatives to fee-simple acquisition.

3. The number of Florida Forever acquisition funding partners and partners with other funding sources, including the percent of funding to be derived from partnerships, and the estimated amount of funds to be made available by the funding partners.

4. For ranking purposes only, the remaining acres and percent completion of each project on the Florida Forever list.

(b) Increase the protection of Florida's biodiversity at the species, natural community, and landscape levels, as measured by:

1. The number of acres proposed to be acquired of significant strategic habitat conservation areas, as identified in the Florida Forever Conservation Needs Assessment.

2. The number of acres proposed to be acquired of highest priority conservation areas for Florida's rarest species, as identified in the Florida Forever Conservation Needs Assessment.

3. The number of acres proposed to be acquired of significant landscapes, landscape linkages, and conservation corridors, giving priority to completing linkages, as identified in the Florida Forever Conservation Needs Assessment.

4. The number of acres proposed to be acquired of underrepresented native ecosystems, as identified in the Florida Forever Conservation Needs Assessment.

5. The number of acres proposed to be acquired that would establish or enhance a landscape-sized protection area of at least 50,000 acres that exhibits a mosaic of predominantly intact or restorable natural communities, as identified in the Florida Forever Conservation Needs Assessment.

6. The number of imperiled species known or reported to occur on the acquisition project.

(c) Protect, restore, and maintain the quality and natural functions of land, water, and wetland systems of the state, as measured by:

1. The number of acres proposed to be acquired that enhance the management feasibility of existing conservation lands, as documented by the affected agency(ies) that manage or own the existing conservation lands.

2. The number of acres proposed to be acquired for restoration, enhancement, and management as identified in plans prepared pursuant to Section 373.199, F.S., the management prospectus for an acquisition project prepared pursuant to Section 259.032(9)(d), F.S., or the Florida Ecological Restoration Inventory, which is maintained by the Department of Environmental Protection's Division of Water Resource Management and available at www.dep.state.fl.us/water/wetlands/feri or by writing Florida Wetland Restoration Information Center, 2600 Blair Stone Road, M.S. 3500, Tallahassee, Florida 32399, or by calling (850) 245-8336.

3. The number of acres proposed to be acquired that protect natural floodplain functions, as identified in the Florida Forever Conservation Needs Assessment.

4. The number of acres proposed to be acquired that protect surface waters of the state in designated watersheds, as identified in the Florida Forever Conservation Needs Assessment.

5. The number of acres proposed to be acquired to minimize damage from flooding, as identified by the Department of Environmental Protection in coordination with the water management districts.

6. The number of acres proposed to be acquired that protect fragile coastal resources, as identified in the Florida Forever Conservation Needs Assessment. These include those acres that help species and natural communities adapt to climate change.

7. The number of acres of functional wetland systems proposed to be protected, as identified in the Florida Forever Conservation Needs Assessment.

(d) Ensure that sufficient quantities of water are available to meet the current and future needs of natural systems and the citizens of the state, as measured by:

1. The number of acres proposed to be acquired which provide retention and storage of surface water in naturally occurring storage areas, such as lakes and wetlands, consistent with the maintenance of water resources or water supplies and consistent with district water supply plans, as identified by the water management districts in plans prepared pursuant to Section 373.199, F.S.

2. The number of acres proposed to be acquired for a water resource development project, as identified in plans prepared pursuant to Section 373.199, F.S.

3. The number of acres proposed to be acquired of groundwater recharge areas critical to springs, sinks, aquifers, other natural systems, or water supply, as identified in the Florida Forever Conservation Needs Assessment.

(e) Increase natural resource-based public recreational and educational opportunities, as measured by:

1. The number of acres proposed to be acquired that are proposed to be available for potential natural resource-based public recreation or education, as identified by the Department of Environmental Protection in coordination with other agencies.

2. The miles of trails that are proposed to be made available for public recreation, giving priority to those that provide significant connections including those that will assist in completing the Florida National Scenic Trail, as identified in the Florida Forever Conservation Needs Assessment.

3. For ranking purposes only, the population served within 100 miles of the acquisition project.

(f) Preserve significant archaeological or historic sites, as measured by:

1. The number and relative significance of archaeological sites identified on the acquisition proposal, as reported by the Department of State's Division of Historical Resources in the Florida Master Site File.

2. The number and relative significance of historic sites identified on the acquisition proposal, as reported by the Department of State's Division of Historical Resources in the Florida Master Site File.

(g) Increase the amount of agricultural and forest land available for sustainable management of natural and agricultural resources, as measured by:

1. The number of acres proposed to be acquired that are potentially available for sustainable forest management and could provide economic return utilizing multiple-use management, as identified in the Florida Forever Conservation Needs Assessment.

2. The number of acres of forestland proposed to be acquired that will serve to maintain natural groundwater recharge functions, as identified by overlaying data from measures subparagraphs (2)(d)3. and (g)1. above.

3. For ranking purposes only, the number of acres of improved agricultural lands proposed to be protected, as verified by the Department of Agriculture and Consumer Services in coordination with the landowner.

4. For ranking purposes only, the number of acres of unimproved agricultural lands proposed to be protected, as verified by the Department of Agriculture and Consumer Services in coordination with the landowner.

5. The number of development units proposed to be acquired, as verified by the landowner through the approved local government comprehensive plan.

(h) Increase the amount of open space available in urban areas, as measured by:

1. The number of acres proposed to be purchased of open space within urban service areas.

2. The number of linear feet proposed to be acquired to protect working waterfronts, as defined in Sections 380.503(18)(a) and (b), F.S.

18-24.006 Council Evaluation and Ranking.

(1) Following full review, the Council shall develop a list of projects for consideration by the Board in accordance with the provisions of Sections 259.105(3)(b) and 259.105(4), (8), (9), (10), (13), (14), (15), and (16), F.S.

(2) Following the full review of projects pursuant to Rule 18-24.005, F.A.C., the Council shall select projects for inclusion on the list. An affirmative vote of at least five council members shall be required to place a project on the list to be presented to the Board. The Council may provide recommendations to the Division of State Lands on which category or categories to place each land acquisition project, or portions thereof.

(3) The Division of State Lands shall categorize the list pursuant to Section 259.105(17), F.S., in preparation for work plan development. The Council shall evaluate the entire list of approved projects and rank them individually in numerical priority order within each category for consideration by the Board as follows:

(a) When assigning priority rankings to projects the Council shall give increased priority to those projects that meet the provisions of the Florida Forever criteria described in Sections 259.105(9)(j) and (l), F.S., as further described in subsections 18-24.0021(10) and (12), F.A.C., and in Section 259.105(10), F.S., as described in paragraph (3)(b) of this rule.

(b) The council shall also give increased priority to those projects where the state's land conservation plans overlap with the military's need to protect lands, water, and habitat to ensure the sustainability of military missions including:

1. Protecting habitat on nonmilitary land for any species found on military land that is designated as threatened or endangered, or is a candidate for such designation under the Endangered Species Act or any Florida statute, as determined by Florida Natural Areas Inventory in coordination with Florida Fish and Wildlife Conservation Commission or Department of Agriculture and Consumer Services;

2. Protecting areas underlying low-level military air corridors or operating areas, as described in official military documents presented by the affected military installations; and

3. Protecting areas identified as clear zones, accident potential zones, and air installation compatible use buffer zones delineated by our military partners, and for which federal or other funding is available to assist with the project pursuant to subsection 18-24.021(11), F.A.C.

(c) Priority Rankings for each project shall be determined by the Council based on the results of the full review detailed in Rule 18-24.005, F.A.C., a comparative analysis of each project's ability to meet the Florida Forever goals and measures and the Florida Forever criteria as identified in Rules 18-24.0021 and 18-24.0022, F.A.C., and additional information as identified in paragraphs (a), (b), and (d). As an initial information source for conducting this comparative analysis, the Department of Environmental Protection shall provide the council a comparative analysis and evaluation of each Florida Forever Project, which shall include rankings for each geographic-based resource type outlined in the subsection 18-24.0022(2), F.A.C., as well as rankings based on an efficient resource analysis using a computer modeling approach to conservation reserve design that involves iterative site selection, which describes those projects offering the greatest return in resource protection given the estimated acreage likely to be acquired by the Florida Forever Program. The Department also shall provide the council with a matrix of the criteria met by each project including the criteria described in paragraph (b), as well as information on the current status of negotiations to acquire property on the Division of State Lands work plan as described in subsection (6). The Council shall also consider any other contributing technical analysis of Florida Forever projects submitted by Council members, other organizations or persons in conducting its review of projects for priority ranking.

(d) The Council shall also consider the following when developing its priority list:

1. Projects that are considered priority resources, as described in subsection 18-24.0022(6), F.A.C., for multiple Florida Forever goals shall be given greater consideration than those that are considered priority resources for fewer or only one Florida Forever goal. Projects that meet multiple Florida Forever criteria, as described in Rule 18-24.0021, F.A.C., shall be given greater consideration than those that meet fewer or only one Florida Forever criterion.

2. Projects with the greatest percentage of acreage acquired, as measured by subparagraph 18-24.0022(2)(a)4., F.A.C., shall be given greater consideration than those with a lesser percentage of acreage acquired if the remaining lands to be acquired contribute significantly to the Florida Forever goals and measures.

3. Projects that close a critical gap in a recreational or ecological greenway, or landscape linkage, shall be given greater consideration than those that do not.

4. Projects that provide the greatest opportunities for resource-based recreation as identified in the State Comprehensive Outdoor Recreation Plan, which is prepared by the Department of Environmental Protection's Division of Recreation and Parks for the State of Florida pursuant to Section 375.021, F.S., shall be given greater consideration than those that provide fewer opportunities for resource-based recreation.

5. Lands that help to address the challenges of global climate change by providing opportunities to sequester carbon, provide habitat, protect coastal lands or barrier islands, and otherwise mitigate and help adapt to the effects of sea-level rise, shall be given greater consideration than those that do not.

6. Many factors, other than technical resource data, are important in the project evaluation, selection, and ranking process. For example threat of development or loss of resource values are difficult factors with no clear methodology for comparing projects numerically at this time. Similarly, public support, owner's willingness to sell at a reasonable price, management needs and other important factors takes on many forms that are not readily quantifiable. Additionally, other important information that may not be explicitly captured by the current Florida Forever goals and measures may be presented to the Council in the Project Evaluation Report, prepared pursuant to Rule 18-24.005, F.A.C., or during public hearings held pursuant to paragraphs 18-24.004(1)(c) and 18-24.005(3)(c), F.A.C. The Council shall consider these and other factors identified during the project evaluation and public hearings of the council as additional information when deciding where to rank a project on the priority list.

APPENDIX B

Chronology of Data and Analysis Revisions

The Florida Natural Areas Inventory has actively maintained and updated the Florida Forever Conservation Needs Assessment (FFCNA) since the beginning of the Florida Forever program in 2000. In many cases data layers have been updated as new and improved models and analyses have been completed. Data are also updated based on updated and improved land cover data that provide more accurate classifications as well as updates to land use changes. In order to keep the main body of the Technical Report concise and focused on the current version of FFCNA, we are using this appendix to maintain an archive of updates and revisions from previous versions. Changes are listed in chronological order organized by FFCNA version numbers. Increasingly we are attempting to provide a rationale for the changes to help the reader understand why revisions were considered necessary or beneficial.

<u>Revisions from Version 1.3 to Version 2.0 (2005)</u>
The Conservation Needs Assessment data layers are regularly revised as better information becomes available. For example, since Version 1.3 new FWC Landsat Land Cover data (2003) has been developed; also, new data are continually being added to the FNAI rare species database. Version 2.0 constitutes a major revision to several data layers: 1) FNAI Rare Species Habitat Conservation Priorities was updated based on substantial new species location information, updates to the Conservation Lands database, and a revised methodology for determining a species conservation need; 2) Under-represented Natural Communities were updated based on the 2003 FWC Landsat Land Cover, and new survey information for upland glades, pine rocklands and scrub; 3) Natural Floodplain data were revised based on 2003 FWC Landsat Land Cover and new methodology as recommended by water resource experts; 4) Surface Water Protection was revised based on input from water resource experts and using a new methodology that better reflects the protection priorities for different types of surface waters; and 5) Recreational Trails was updated by the Office of Greenways and Trails and University of Florida in 2004.

<u>Revisions from Version 2.0 to Version 2.1 (2006)</u>
The Fragile Coastal Resources data layer was updated with new information from a status survey of coastal uplands by Johnson and Gulledge (2005). The Aquifer Recharge data was revised based on the Florida Aquifer and Vulnerability Analysis and other data from Florida Geological Survey. We anticipate further revision of this data in 2006. We also anticipate correcting all data layers for lands that have been developed since the creation of the underlying land cover data.

Revisions from Version 2.1 to Version 2.2 (2007)

The FNAI Rare Species Habitat Conservation Priorities were revised to reflect updates to the FNAI element occurrence database, including new species location information for G1 species and species rank changes; habitat maps for all species were revised to remove lands that had been developed as of 2004.

The Under-represented Natural Community layer was updated based on revisions to several natural communities (pine rocklands, sandhill, and pine flatwoods) and the inclusion of two new communities (dry prairie and sandhill upland lakes). We added sandhill upland lake and dry prairie as under-represented types based on recommendations from resource experts. Although we do not have a historical map of sandhill upland lake, we can assume that this community is under-represented because the associated sandhill community is under-represented. Previous statewide land cover overestimated the amount of remaining dry prairie so that it exceeded the 15% threshold; recent improvements in mapping dry prairie, however, confirm that this imperiled community is under-represented on conservation lands. Dry prairie is critical habitat for the endemic Florida grasshopper sparrow.

The Sustainable Forestry and Forestland to Maintain Recharge Function layers were updated based on recent WMD land cover data. We also corrected all data layers for lands that have been developed as of 2004.

Revisions from Version 2.2 to Version 3 (2008)

A new version of Strategic Habitat Conservation Areas was published by FWC in 2007 with significant changes in species models and population viability analysis methods over the previous version published in 1994 and later supplement in 2000. The prioritization method for SHCAs is different as well. The Under-represented Natural Community layer was updated based on revisions to several natural communities (scrub, sandhill, and pine flatwoods).

Surface Water Protection: There are three major changes from the previous surface water model (version 2.2). First, we revised the coastal submodel to include updated basin data for the South Florida Water Management District, and an updated streams coverage developed by FWC. Second, we added a new submodel, Water Supply, which prioritizes areas important for potable water sources. Third we revised the "Other OFW" submodel priorities to be consistent with the system used for the coastal and water supply submodels. Based on those changes, the final model integration has also changed, and the final model now has seven priority classes rather than the previous six.

Revisions from Version 3.0 to Version 3.1 (2009)

The Under-represented Natural Community layer was updated based on ongoing revisions to several natural communities (scrub, sandhill, dry prairie and pine flatwoods). The Ecological Greenways layer was updated by Tom Hoctor at the University of Florida to include two additional priority classes—Critical Linkages 1 and Critical Linkages 2. New versions of the Strategic Habitat Conservation Area and Recharge layers are expected in summer 2009.

Revisions from Version 3.1 to Version 3.2 (2009)
The Strategic Habitat Conservation Areas dataset was revised and finalized in June 2009 by FWC. The revision includes additional species and revisions to the prioritization since 2007. A Prioritized Recharge dataset, developed by Advanced Geospatial, Inc. and Florida Natural Areas Inventory, was completed in June 2009.

Revisions from Version 3.2 to Version 3.3 (2010)
The Strategic Habitat Conservation Areas (SHCA) dataset was modified for the Needs Assessment to include 'strategic' habitat on conservation lands; the SHCA were originally identified only on private lands. The Functional Wetlands data were revised to include all wetlands identified by the Land Use Land Cover data developed by DEP and the water management districts; previous versions of wetlands were based on the National Wetlands Inventory. The prioritization of wetlands was also revised. Minor revisions were made to the Under-represented Natural Communities and Rare Species Habitat Conservation Priorities.

Revisions from Version 3.3 to Version 3.33 (2011)
The Under-represented Natural Communities, Functional Wetlands, and Sustainable Forestry datasets were modified for the FFCNA based on the Cooperative Land Cover Map v1.1 (FNAI 2010a). The Large Landscapes data layer was replaced by a new method for evaluating projects based on their contribution to large landscapes. New data were developed to evaluate lands that help address the challenges of global Climate Change, a new Florida Forever ranking criterion added by amendment of Administrative Rule 18-24 in 2010.

Revisions from Version 3.33 to Version 4.0 (2013)
Version 4 contains significant changes to several data layers including Rare Species Habitat Conservation Priorities, Natural Communities, Ecological Greenways, Natural Floodplain, and Recreational Trails. These updates include real ecological condition changes as determined from surveys and recent aerial photography, changes in imperilment status of species and communities, new availability of high quality data such as digital elevation and 100-year floodplain, and reassessment of statewide priorities for recreational trails and greenways. Changes also reflect recommendations of the Florida Forever Expert Advisory Group and Critical Lands and Waters Identification Project Technical Advisory Group.

Upland Pine was added to the Natural Community layer based on recommendations from the Expert Advisory Group.

Rare Species Habitat Conservation Priorities (FNAIHAB): We changed species' selection criteria to broaden the number of species included and place more emphasis on the rarest (G1-G2) species. Total number of species included increased from 247 to 281. The new criteria have shifted the focus more toward the rarest species as shown in the following table:

FNAIHAB Version 4.0 Species Composition Compared to Version 3.3

	Version 3.3		Version 4.0	
	Number	Percent	Number	Percent
Total Species	247	100%	281	100%
Plants	142	57%	151	54%
Invertebrates	41	17%	66	23%
Vertebrates	64	26%	64	23%
G1	114	46%	155	55%
G2	89	36%	92	33%
G3	39	16%	32	11%
G4	3	1.2%	1	0.4%
G5	2	0.8%	1	0.4%

The standard species habitat method was revised in an attempt to be more objective, transparent, and consistent across species. A maximum buffer system was added in order to standardize the maximum extent of a habitat polygon from the original occurrence location.

The method used to map aquatic species also changed significantly from FNAIHAB Version 3.3. The buffer for natural uplands changed from 100 meters to 1,000 feet, and a new buffer of 1 mile was used to limit the extent of wetlands adjacent to the water body or buffered uplands.

We significantly revised the methods used to map certain wide-ranging generalist species, including indigo snake and black bear.

We changed the method for assigning Suitability scores to habitat patches. Previously Suitability has been scored subjectively by expert judgment. FNAI scientists (and occasionally outside experts) reviewed each habitat patch and assigned a score based on factors including land cover type, size, shape, fragmentation, landscape context, etc. This method worked well, but was time-consuming and lacked transparency and consistency. Our goal for the current FNAIHAB revision was to develop an objective, quantitative, transparent method that could be scored efficiently using automated GIS tools.

The conservation needs weighting method has also been revised for FNAIHAB version 4.0. While we are still weighting species on similar criteria (Grank, percent protected, etc.), we have eliminated the Conservation Needs Weight groupings used in previous versions. Each species now receives an individual score that is used in weighting each species' habitat model for the overlay model. The previous groupings were intended to "round" species' conservation needs weights into five groups of species with similar conservation need. In practice they complicated the scoring and model-building process and added a layer of obfuscation to the modeling framework, and we ultimately decided they were not necessary.

Revisions from Version 4.0 to Version 4.01 (2014)

Version 4.01 includes revisions to Natural Communities, Sustainable Forestry, and Recreational Trails. Natural Communities were updated within the boundaries of new Florida Forever proposals considered by ARC in 2014 based on field visits by FNAI staff. Sustainable Forestry was updated based on the latest land cover (CLC v2.3) and information on longleaf pine sites from the Longleaf Pine Ecosystem Geodatabase v.2. The Recreational Trails data layer now includes the Florida Greenways and Trails System "Priority Paddling Trails", in addition to Land Trail Priorities and Opportunities.

Revisions from Version 4.01 to Version 4.1 (2015)

Version 4.1 includes revisions to Natural Communities, Fragile Coastal Resources, Significant Surface Waters, Functional Wetlands, Natural Floodplain, Sustainable Forestry, and Aquifer Recharge. Natural Communities, Coastal Resources, Wetlands, and Forestry were updated based on substantial updates to statewide land cover with the September 2015 publication of the Cooperative Land Cover Map v3.1. The latest land cover was also used to revise supporting data such as the Land Use Intensity Index which is used in the prioritization of Functional Wetlands and Natural Floodplain.

Surface Waters underwent significant revision based on recommendations from the Critical Lands and Waters Identification Project (CLIP) Technical Advisory Group to eliminate intensive canal networks in south Florida from consideration. The new method eliminated canals and other artificial waterways from consideration within an update zone in south Florida. 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. Wetland polygons were not given a 1,000ft buffer, but were given a 1 mile buffer. Basin proximity to resource scores were also collapsed into three categories: 1 (proximal), 2-3, and 4+. These changes affected the Coastal, Other OFW, and Water Supply submodels. The Rare Fish basins submodel was also revised to incorporate new modeling data from FWC.

Aquifer Recharge was updated to include priorities associated with swallet features as recommended by the Florida Geological Survey.

Revisions from Version 4.1 to Version 4.2 (2016)

Version 4.2 includes revisions to Strategic Habitat Conservation Areas (SHCA), Natural Communities, Ecological Greenways, and Recreational Trails. The prioritization of SHCAs was revised to reflect changes in the imperilment ranks of species. Natural Communities were updated based on field assessments of 2015-2016 Florida Forever proposals. Ecological

Greenways underwent significant revision as part of updates to CLIP v4.0, with the number of priority classes being reduced from 6 to 5 but with an overall increase in acreage for the total area identified. Recreational Trails was updated with the 2015 version of land trail priorities and opportunities published by the FDEP/Office of Greenways and Trails.

<u>Revisions from Version 4.2 to Version 4.3 (2017)</u>
Version 4.3 includes revisions to Natural Communities, Functional Wetlands, and Natural Floodplain. Natural Communities were updated based on field assessments of 2016-2017 Florida Forever proposals. Wetlands were revised based on a significant update to the Cooperative Land Cover Map (v3.2.5), which resulted in improvements to the baseline wetlands dataset as well as to the Land Use Intensity Index (LUI) used in the prioritization scheme. The Natural Floodplain layer was updated based on new digital FEMA/DFIRM data for several counties and, as for wetlands, the prioritization was updated based on a new LUI developed from improvements to the Cooperative Land Cover Map.

<u>Revisions from Version 4.3 to Version 4.4 (2018)</u>
Version 4.4 includes revisions to Natural Communities, Functional Wetlands, and Natural Floodplain. Natural Communities were updated based on field assessments of 2017-2018 Florida Forever proposals. Wetlands were revised based on some localized updates to the Cooperative Land Cover Map (v3.3), which resulted in improvements to the baseline wetlands dataset as well as to the Land Use Intensity Index (LUI) used in the prioritization scheme. The Natural Floodplain layer was updated to add the surrogate floodplain to areas in Sarasota, Charlotte, Lee, St. Lucie and Martin counties and, as for wetlands, the prioritization was updated based on a new LUI developed from improvements to the Cooperative Land Cover Map.

APPENDIX C

Basemap Data Layers

The following data were integral to the development of final data layers for many of the Florida Forever measures, and are referenced throughout this document. For ease of organization and reference, these data are described in this section. We also identify advantages and disadvantages of each data type with regard to their use in the Florida Forever Conservation Needs Assessment.

FNAI Element Occurrences

The Florida Natural Areas Inventory (FNAI or the Inventory) maintains a database of occurrences of more than 1,200 rare plant and animal species and about 80 natural community types known to occur in Florida. Currently this FNAI database includes more than 33,000 occurrences of plants, animals, and communities. These records are compiled from a variety of sources, including FNAI science staff surveys, scientific literature, museum collections, federal, state, and local government agencies, and academic experts. The data are managed in a relational database and in GIS coverages in the form of point and/or polygon locations for individual Element Occurrences (EOs).

For each element occurrence data are maintained on observation dates, habitat description and quality, number and status of individuals, management considerations, locational certainty and best sources for the occurrence information. For animals and plants, EOs generally refer to more than a casual sighting; they usually indicate a viable population of the species. Natural community EOs represent high quality examples of natural communities, and thus are not a comprehensive coverage of all occurrences of a given community type.

For each element (species or community) FNAI maintains both a Global Rank (G-RANK) and a State Rank (S-RANK) to indicate the overall rarity of the species or community on a global and statewide basis. A complete listing and explanation of global and state ranks is available in Appendix D, along with an explanation of state and federal listing status for listed species.

For some EOs, FNAI has developed polygon boundaries representing the true geographic extent of the occurrence. However, these boundaries are still in development and are not available in a comprehensive format for all elements.

A list of the plants, animals, and communities tracked by the FNAI, along with their global and state ranks and federal and state listing status, is published annually and is available from the Inventory.

The FNAI element occurrence database is the single most comprehensive source for locations of rare species and natural communities throughout the state. The data are compiled in a consistent fashion based on uniform standards and are quality-checked by FNAI scientists. The occurrences are to some extent an abstraction of the location of species and communities on the landscape. In order to identify geographic areas for conservation, a map of polygons showing the geographic extent of species occurrences would be useful. To address this issue, we developed habitat models based on FNAI EO locations and land cover maps, which are explained in more detail under Measure B2 in this document.

FNAI Managed Areas/Conservation Lands

The Florida Natural Areas Inventory maintains a database of lands managed for conservation by federal, state, and local governments, as well as private conservation entities. The database includes attributes such as managing agency, acreage, and description, as well as GIS boundaries for each managed area. Currently more than 2,500 individual managed areas are documented in the FNAI database. The managed areas may be viewed online via Florida's Conservation Lands Interactive Map or downloaded as a shapefile at http://www.fnai.org/.

The FNAI managed areas database is the most comprehensive, up-to-date source of boundaries and information for conservation lands in Florida. The GIS coverage is used as the source coverage for conservation lands by federal, state, and local government agencies throughout the state. Although all federal and state conservation lands are documented in the database, not all local government lands are currently included. The Inventory is dependent on the efforts of 67 counties and more than 300 municipalities to document this information. However, local governments with substantial environmental land acquisition programs, such as Hillsborough, Brevard, Duval, and Miami-Dade Counties, are active partners and are well-represented in the database. The database also does not attempt to address conservation easements from a variety of federal, state, and local regulatory and incentive programs.

Cooperative Land Cover

The Florida Cooperative Land Cover Map, published August 2010 (FNAI 2010a), was a project to develop an improved statewide land cover map from existing sources and expert review of aerial photography for focal communities. The final land cover map includes over 6 million acres derived from local, regional and site-specific sources and 1.4 million acres classified during aerial photo review. The remaining area (32 million acres) consists of Land Use Land Cover data (FLUCCS) developed by the Florida Department of Environmental Protection, St. Johns River Water Management District, Southwest Florida Water Management District and South Florida Water Management District. All data were crosswalked into the Florida Land Cover Classification System.

This dataset represents the best available statewide land cover for ecological analyses. It is used in the development of several Needs Assessment datasets including Under-represented Natural Communities and Functional Wetlands. This dataset largely supersedes use of the FLUCCS data which was a primary base layer for many FFCNA datasets prior to publication of the CLC. The CLC, now maintained by FWC, is updated regularly. The latest version is 3.3, an interim version provided by FWC in August 2018. The specific CLC version used is referenced in the methods for individual Needs Assessment datasets. The full list of CLC land cover classes, along with an alternate grouping for major types such as Natural, Semi-natural, Non-natural, etc. are found in Appendix E.

FNAI Potential Natural Areas

The Potential Natural Areas (PNA) data layer identifies, throughout the State of Florida, privately owned lands that are not managed or listed for conservation purposes, which may contain good quality natural communities. These areas were delineated by FNAI scientific staff through interpretation of natural vegetation from 1988-1993 FDOT aerial photographs and from input received during Regional Ecological Workshops held for each regional planning council. These workshops were attended by experts familiar with natural areas in the region. All PNA classifications and rankings were made based on the combined judgment of at least two scientists making independent determinations. Element occurrences in the FNAI database may or may not be present on these sites.

In order to be classified as a Potential Natural Area the natural communities identified through aerial photographs had to meet the following criteria:

1. Must be a minimum of 500 acres. *Exceptions*: sandhill, min. 320 acres; scrub, min. 80 acres; pine rockland, min. 20 acres; dry prairie, min. 320 acres; *or* any example of coastal rock barren, upland glade, coastal dune lake, spring-run stream or terrestrial cave.

2. Must contain at least one of the following:
   a. One or more high quality examples of FNAI state-ranked S3 or above natural communities.
   b. An outstanding example of any FNAI tracked natural community.

Potential Natural Areas were assigned ranks of Priority 1 through Priority 5 based on size, perceived quality, and type of natural community present. The areas included in Priority 5 are exceptions to the above criteria. These areas were identified through the same process of aerial photographic interpretation and regional workshops as the PNA 1 through 4 ranked sites, but do not meet the standard criteria. These PNA 5 areas are considered lower priority for conservation than areas ranked PNA 1- 4, but nonetheless are believed to be ecologically viable tracts of land representative of Florida's natural ecosystems.

The original PNAs were digitized based on 1:100,000 scale county maps and lacked the geographic precision desirable for the type of geographic overlay analyses undertaken in the *Conservation Needs Assessment*. In addition, the original PNAs did not take into consideration existing managed areas, Save Our Rivers (SOR) acquisition projects, or Conservation and Recreation Lands (CARL) acquisition projects that existed at the time of the original analysis (roughly 1995). In April 2011, we therefore revised the PNA boundaries by overlaying the original PNA polygons onto the Cooperative Land Cover (CLC) polygons (FNAI 2010a). The CLC boundaries conform more closely to land cover patterns than the original PNA boundaries, based on comparison with digital ortho-aerial photography.

We also added all CLC "natural" or "semi-natural" polygons (see Appendix E) within 1995 managed area or CARL project boundaries and 1997 SOR boundaries (all of these polygons were "clipped" by the boundaries of the managed area or CARL project). PNAs on CARL

projects were assigned a rank by FNAI staff; PNAs on conservation lands and SOR projects at the time of that analysis were not ranked, they have a grid value of 100.
In addition we added original FNAI Areas of Conservation Interest (ACI) sites, many of which were identified based on similar criteria to PNAs. ACI sites were never ranked by FNAI scientists in the same way as PNAs, so we developed an automatic ranking system based on the acres of priority natural communities each site contained. ACI ranks overall are a good match for PNA ranks, but the different methodology means that the two are not entirely comparable.

The April 2011 revisions also involved the demotion or deletion of some PNAs. These rank demotions and deletions were based on the percentage of the original PNA boundary filled by CLC-identified natural and semi-natural land cover. In other words, using the CLC as a representation of current landcover, we demoted fragmented PNAs and deleted highly fragmented PNAs.

In April 2014 PNAs underwent a minor revision to remove developed lands based on CLC v2.3, re-assess fragmentation based on this removal, and adjust priorities as determined by the re-assessment.

In July 2018 revisions were made to remove developed lands based on CLC v3.2.5, re-assess fragmentation based on this removal, and adjust priorities as determined by the re-assessment.

Although these revisions improve on the original dataset, it is important to note that PNAs have not been completely re-evaluated since they were originally created in the mid-1990s. For most uses, we strongly recommend grouping PNA ranks 1-4 and 100 (unprioritized conservation lands) as one class of "high value" potential natural areas, with PNA rank 5 as a separate "moderate value" class. This avoids issues with the different methodologies used to prioritize PNAs, ACIs, and CARL projects.

Potential Natural Areas represent a comprehensive, statewide coverage of natural areas. This is also the only natural community coverage that ranks communities based on estimates of quality (the PNA priorities 1 through 5). As with other land cover data layers based on aerial photography, it is difficult to make precise community classifications based on remote sensing. For this reason, FNAI scientists did not attempt to delineate individual community types within PNA boundaries. The PNAs remain accurate, however, as a coverage of general areas of natural vegetation.

FWC Landsat Vegetation and Land Cover

In the early 1990s, the Florida Game and Fresh Water Fish Commission (now known as the Florida Fish and Wildlife Conservation Commission, or FWC) collaborated with the Florida Department of Transportation to develop a statewide land cover map based on satellite imagery. This dataset was based on Landsat Thematic Mapper data at a resolution of 30 m square pixels, or grid cells. The satellite imagery was taken from 1985 to 1989. The data were classified into 22 land cover types, including 17 “natural” classes and 4 “disturbed” classes. For more information on the FWC satellite imagery, see Kautz et al. (1993) and Cox et al. (1994).

The FWC Landsat Vegetation and Land Cover was updated in 2003 (Stys et al. 2003). The current data contains 43 cover classes and is a 30m grid. This land cover layer is the basemap for the Strategic Habitat Conservation Areas model (measure B1).

Because the satellite imagery does not rely on human interpretation, it provides an objective classification that is consistent statewide. However, due to the limitations of satellite imagery analysis, the 43 classes of the satellite imagery are coarse, and not sufficient to capture the wide range of natural communities necessary to identify all habitat types. The satellite imagery also does not distinguish between pine plantation and natural pine communities.

UF Landscape Integrity Index

The Landscape Integrity Index (LSI) was developed by the UF Center for Landscape Conservation Planning and GeoPlan Center, specifically for the Critical Lands and Waters Identification Project (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. Since these analyses are dependent on landscape-scale analysis, buffer areas in Georgia and Alabama were included to provide accurate assessment of the areas of Florida near the Georgia or Alabama border. Note that this index is intended to primarily characterize terrestrial ecosystems and therefore values for large water bodies are not considered significant.

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 (see Appendix E). 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. The land use data used is from the 2017 Cooperative Land Cover (CLC) data set, version 2.3, 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 CLC land use intensity category (see Appendix E) 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 and all 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. The following are general descriptions of the landscape integrity priority levels: Index Level 10--areas with the highest ecological integrity where natural lands predominate in very large patches; Index Level 9--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 and 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 integrity due to predominance of intensive land uses.

The Landscape Integrity Index was used as an input for scoring Suitability of indigo snake and black bear species habitat models in the FNAI Rare Species Habitat Conservation Priorities model, while the sub-model Land Use Intensity Index is used as an input to prioritize the Wetlands and Natural Floodplain FFCNA layers. Note that in 2018 the LUI was updated based on CLC v3.3 but the most current Landscape Integrity Index is still based on CLC v2.3.

APPENDIX D

FLORIDA NATURAL AREAS INVENTORY RANK EXPLANATIONS

Elements and Element Occurrences

An **element** is any exemplary or rare component of the natural environment, such as a species, natural community, bird rookery, spring, sinkhole, cave, or other ecological feature.

An **element occurrence (EO)** is an area of land and/or water in which a species or natural community is, or was, present. An EO should have practical conservation value for the Element as evidenced by potential continued (or historical) presence and/or regular recurrence at a given location.

Element Ranking and Legal Status

Using a ranking system developed by NatureServe and the Natural Heritage Program Network, the Florida Natural Areas Inventory assigns two ranks for each element. The global rank is based on an element's worldwide status; the state rank is based on the status of the element in Florida. Element ranks are based on many factors, the most important ones being estimated number of Element Occurrences (EOs), estimated abundance (number of individuals for species; area for natural communities), geographic range, estimated number of adequately protected EOs, relative threat of destruction, and ecological fragility.

FNAI GLOBAL ELEMENT RANK

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
G2 = Imperiled globally because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
G3 = Either very rare and local throughout its range (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
G4 = Apparently secure globally (may be rare in parts of range).
G5 = Demonstrably secure globally.
GH = Of historical occurrence throughout its range, may be rediscovered (e.g., ivory-billed woodpecker).
GX = Believed to be extinct throughout range.
GXC = Extirpated from the wild but still known from captivity or cultivation.
G#? = Tentative rank (e.g., G2?).
G#G# = Range of rank; insufficient data to assign specific global rank (e.g., G2G3).
G#T# = Rank of a taxonomic subgroup such as a subspecies or variety; the G portion of the rank refers to the entire species and the T portion refers to the specific subgroup; numbers have same definition as above (e.g., G3T1).
G#Q = Rank of questionable species - ranked as species but questionable whether it is species or subspecies; numbers have same definition as above (e.g., G2Q).
G#T#Q = Same as above, but validity as subspecies or variety is questioned.
GU = Unrankable; due to a lack of information no rank or range can be assigned (e.g., GUT2).
GNA = Ranking is not applicable because the element is not a suitable target for conservation (e.g. a hybrid species).
GNR = Element not yet ranked (temporary).
GNRTNR = Neither the element nor the taxonomic subgroup has yet been ranked.

FNAI STATE ELEMENT RANK

S1 = Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2 = Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
S3 = Either very rare and local in Florida (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
S4 = Apparently secure in Florida (may be rare in parts of range).
S5 = Demonstrably secure in Florida.
SH = Of historical occurrence in Florida, possibly extirpated, but may be rediscovered (e.g., ivory-billed woodpecker).
SX = Believed to be extirpated throughout Florida.
SU = Unrankable; due to a lack of information no rank or range can be assigned.
SNA = State ranking is not applicable because the element is not a suitable target for conservation (e.g. a hybrid species).
SNR = Element not yet ranked (temporary).

FEDERAL LEGAL STATUS

Legal status information provided by FNAI for information only. For official definitions and lists of protected species, consult the relevant federal agency.

Definitions derived from U.S. Endangered Species Act of 1973, Sec. 3. Note that the federal status given by FNAI refers only to Florida populations and that federal status may differ elsewhere.

C = Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
E, T = Species currently listed endangered in a portion of its range but only listed as threatened in other areas
E, PDL = Species currently listed endangered but has been proposed for delisting.
E, PT = Species currently listed endangered but has been proposed for listing as threatened.
E, XN = Species currently listed endangered but tracked population is a non-essential experimental population.
T = Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.
PE = Species proposed for listing as endangered
PS = Partial status: some but not all of the species' infraspecific taxa have federal status
PT = Species proposed for listing as threatened
SAT = Treated as threatened due to similarity of appearance to a species which is federally listed such that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
SC = Not currently listed, but considered a "species of concern" to USFWS.

STATE LEGAL STATUS

Provided by FNAI for information only. For official definitions and lists of protected species, consult the relevant state agency.

Animals: Definitions derived from "Florida's Endangered Species and Species of Special Concern, Official Lists" published by Florida Fish and Wildlife Conservation Commission, 1 August 1997, and subsequent updates.

C = Candidate for listing at the Federal level by the U. S. Fish and Wildlife Service
FE = Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service
FT = Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service
FXN = Federal listed as an experimental population in Florida
FT(S/A) = Federal Threatened due to similarity of appearance
ST = State population listed as Threatened by the FFWCC. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.
SSC = Listed as Species of Special Concern by the FFWCC. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat modification,

environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species. (SSC* for Pandion haliaetus (Osprey) indicates that this status applies in Monroe county only.)
N = Not currently listed, nor currently being considered for listing.

Plants: Definitions derived from Sections 581.011 and 581.185(2), Florida Statutes, and the Preservation of Native Flora of Florida Act, 5B-40.001. FNAI does not track all state-regulated plant species; for a complete list of state-regulated plant species, call Florida Division of Plant Industry, 352-372-3505 or see: http://www.doacs.state.fl.us/pi/.

E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue; includes all species determined to be endangered or threatened pursuant to the U.S. Endangered Species Act.
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered.
N = Not currently listed, nor currently being considered for listing.

Element Occurrence Ranking

FNAI ranks of quality of the element occurrence in terms of its viability (EORANK). Viability is estimated using a combination of factors that contribute to continued survival of the element at the location. Among these are the size of the EO, general condition of the EO at the site, and the conditions of the landscape surrounding the EO (e.g. an immediate threat to an EO by local development pressure could lower an EO rank).

A = Excellent estimated viability
A? = Possibly excellent estimated viability
AB = Excellent or good estimated viability
AC = Excellent, good, or fair estimated viability
B = Good estimated viability
B? = Possibly good estimated viability
BC = Good or fair estimated viability
BD = Good, fair, or poor estimated viability
C = Fair estimated viability
C? = Possibly fair estimated viability
CD = Fair or poor estimated viability
D = Poor estimated viability
D? = Possibly poor estimated viability
E = Verified extant (viability not assessed)
F = Failed to find
H = Historical
NR = Not ranked, a placeholder when an EO is not (yet) ranked.
U = Unrankable
X = Extirpated

*For additional detail on the above ranks see: http://www.natureserve.org/explorer/eorankguide.htm

FNAI also uses the following EO ranks:

H? = Possibly historical
F? = Possibly failed to find
X? = Possibly extirpated

The following offers further explanation of the H and X ranks as they are used by FNAI:

The rank of H is used when there is a lack of recent field information verifying the continued existence of an EO, such as (a) when an EO is based only on historical collections data; or (b) when an EO was ranked A, B, C, D, or E at one time and is later, without field survey work, considered to be possibly extirpated due to general habitat loss or degradation of the environment in the area. This definition of the H rank is dependent on an interpretation of what constitutes "recent" field information. Generally, if there is no known survey of an EO within the last 20 to 40 years, it should be assigned an H rank. While these time frames represent suggested maximum limits, the actual time period for historical EOs may vary according to the biology of the element and the specific landscape context of each occurrence (including anthropogenic alteration of the environment). Thus, an H rank may be assigned to an EO before the maximum time frames have lapsed. Occurrences that have not been surveyed for periods exceeding these time frames should not be ranked A, B, C, or D. The higher maximum limit for plants and communities (i.e., ranging from 20 to 40 years) is based upon the assumption that occurrences of these elements generally have the potential to persist at a given location for longer periods of time. This greater potential is a reflection of plant biology and community dynamics. However, landscape factors must also be considered. Thus, areas with more anthropogenic impacts on the environment (e.g., development) will be at the lower end of the range, and less-impacted areas will be at the higher end.

The rank of X is assigned to EOs for which there is documented destruction of habitat or environment, or persuasive evidence of eradication based on adequate survey (i.e., thorough or repeated survey efforts by one or more experienced observers at times and under conditions appropriate for the Element at that location).

APPENDIX E
Crosswalk of Florida Cooperative Land Cover v.3.3 into Land Use Intensity Classes

Cooperative Land Cover v3.3 Class		5 Class System
1110	Upland Hardwood Forest	Natural
1111	Dry Upland Hardwood Forest	Natural
1112	Mixed Hardwoods	Natural
1120	Mesic Hammock	Natural
1122	Prairie Mesic Hammock	Natural
1123	Live Oak	Natural
1124	Pine - Mesic Oak	Natural
1125	Cabbage Palm	Natural
1130	Rockland Hammock	Natural
1131	Thorn Scrub	Natural
1140	Slope Forest	Natural
1150	Xeric Hammock	Natural
1210	Scrub	Natural
1211	Oak Scrub	Natural
1212	Rosemary Scrub	Natural
1213	Sand Pine Scrub	Natural
1214	Coastal Scrub	Natural
1220	Upland Mixed Woodland	Natural
1230	Upland Coniferous	Natural
1231	Upland Pine	Natural
1240	Sandhill	Natural
1300	Pine Flatwoods and Dry Prairie	Natural
1310	Dry Flatwoods	Natural
1311	Mesic Flatwoods	Natural
1312	Scrubby Flatwoods	Natural
1320	Pine Rockland	Natural
1330	Dry Prairie	Natural
1340	Palmetto Prairie	Natural
1400	Mixed Hardwood-Coniferous	Natural
1410	Successional Hardwood Forest	Natural
1500	Shrub and Brushland	Semi-Natural
1510	Other Shrubs and Brush	Semi-Natural
1600	Coastal Uplands	Natural
1610	Beach Dune	Natural
1620	Coastal Berm	Natural
1630	Coastal Grassland	Natural
1640	Coastal Strand	Natural
1650	Maritime Hammock	Natural
1660	Shell Mound	Natural
1670	Sand Beach (Dry)	Natural
1710	Sinkhole	Natural

Cooperative Land Cover v3.3 Class		5 Class System
1720	Upland Glade	Natural
1730	Limestone Outcrop	Natural
1740	Keys Cactus Barren	Natural
1750	Bare Soil	Semi-Natural
1760	Exposed Rock	Non-Natural
1800	Cultural - Terrestrial	Non-Natural
1810	Mowed Grass	Intensive Agric., Etc
1811	Vegetative Berm	Semi-Natural
1812	Highway Rights of Way	Intensive Agric., Etc
1821	Low Intensity Urban	Semi-Natural
18211	Urban Open Land	Semi-Natural
182111	Urban Open Forested	Semi-Natural
182112	Urban Open Pine	Semi-Natural
18212	Residential, Low Density	Semi-Natural
18213	Grass	Intensive Agric., Etc
182131	Parks and Zoos	Intensive Agric., Etc
182132	Golf courses	Intensive Agric., Etc
182133	Ballfields	Non-Natural
182134	Cemeteries	Non-Natural
182135	Community rec. facilities	Intensive Agric., Etc
18214	Trees	Semi-Natural
1822	High Intensity Urban	Non-Natural
18221	Residential, Med. Density	Non-Natural
18222	Residential, High Density	Non-Natural
18223	Commercial and Services	Non-Natural
18224	Industrial	Non-Natural
18225	Institutional	Non-Natural
1831	Rural Open	Semi-Natural
18311	Rural Open Forested	Semi-Natural
183111	Oak - Cabbage Palm Forests	Semi-Natural
18312	Rural Open Pine	Semi-Natural
1832	Rural Structures	Semi-Natural
18331	Cropland/Pasture	Impr. Pasture / Field Crops
183311	Row Crops	Intensive Agric., Etc
183312	Field Crops	Impr. Pasture / Field Crops
1833121	Sugarcane	Intensive Agric., Etc
183313	Improved Pasture	Impr. Pasture / Field Crops
183314	Unimproved/Woodland Pasture	Semi-Natural
183315	Other Open Lands - Rural	Semi-Natural
1833151	Fallow Cropland	Semi-Natural
18332	Orchards/Groves	Intensive Agric., Etc
183321	Citrus	Intensive Agric., Etc
183322	Fruit Orchards	Intensive Agric., Etc
183323	Pecan	Intensive Agric., Etc

Cooperative Land Cover v3.3 Class		5 Class System
183324	Fallow Orchards	Semi-Natural
18333	Tree Plantations	Semi-Natural
183331	Hardwood Plantations	Semi-Natural
183332	Coniferous Plantations	Semi-Natural
18334	Vineyard and Nurseries	Intensive Agric., Etc
183341	Tree Nurseries	Intensive Agric., Etc
183342	Sod Farms	Intensive Agric., Etc
183343	Ornamentals	Intensive Agric., Etc
183344	Vineyards	Intensive Agric., Etc
183345	Floriculture	Intensive Agric., Etc
18335	Other Agriculture	Intensive Agric., Etc
183351	Feeding Operations	Intensive Agric., Etc
183352	Specialty Farms	Intensive Agric., Etc
1840	Transportation	Non-Natural
1841	Roads	Non-Natural
1842	Rails	Non-Natural
1850	Communication	Non-Natural
1860	Utilities	Non-Natural
1870	Extractive	Non-Natural
1871	Strip Mines	Non-Natural
1872	Sand & Gravel Pits	Non-Natural
1873	Rock Quarries	Non-Natural
1874	Oil & Gas Fields	Non-Natural
1875	Reclaimed Lands	Semi-Natural
1876	Abandoned Mining Lands	Non-Natural
1877	Spoil Area	Intensive Agric., Etc
1880	Bare Soil/Clear Cut	Semi-Natural
2100	Freshwater Non-Forested Wetlands	Natural
2110	Prairies and Bogs	Natural
2111	Wet Prairie	Natural
21111	Wiregrass Savanna	Natural
21112	Cutthroat Seep	Natural
2112	Mixed Scrub-Shrub Wetland	Natural
21121	Shrub Bog	Natural
2113	Marl Prairie	Natural
2114	Seepage Slope	Natural
2120	Marshes	Natural
2121	Isolated Freshwater Marsh	Natural
21211	Depression Marsh	Natural
21212	Basin Marsh	Natural
2122	Coastal Interdunal Swale	Natural
2123	Floodplain Marsh	Natural
21231	Freshwater Tidal Marsh	Natural
2124	Slough Marsh	Natural

Cooperative Land Cover v3.3 Class		5 Class System
2125	Glades Marsh	Natural
2131	Sawgrass	Natural
2134	Maidencane	Natural
2140	Floating/Emergent Aquatic Vegetation	Natural
2141	Slough	Natural
2142	Water Lettuce	Natural
2145	Duck Weed	Natural
2146	Water Lily	Natural
2150	Submergent Aquatic Vegetation	Natural
2200	Freshwater Forested Wetlands	Natural
2210	Cypress/Tupelo(incl Cy/Tu mixed)	Natural
2211	Cypress	Natural
2212	Tupelo	Natural
2213	Isolated Freshwater Swamp	Natural
22131	Dome Swamp	Natural
221312	Gum Pond	Natural
22132	Basin Swamp	Natural
2214	Strand Swamp	Natural
2215	Floodplain Swamp	Natural
22151	Freshwater Tidal Swamp	Natural
2220	Other Coniferous Wetlands	Natural
2221	Wet Flatwoods	Natural
22211	Hydric Pine Flatwoods	Natural
222111	Cutthroat Grass Flatwoods	Natural
222112	Cabbage Palm Flatwoods	Natural
22212	Hydric Pine Savanna	Natural
2222	Pond Pine	Natural
2223	Atlantic White Cedar	Natural
2230	Other Hardwood Wetlands	Natural
2231	Baygall	Natural
22311	Bay Swamp	Natural
22312	South Florida Bayhead	Natural
2232	Hydric Hammock	Natural
22321	Coastal Hydric Hammock	Natural
22322	Prairie Hydric Hammock	Natural
22323	Cabbage Palm Hammock	Natural
2233	Mixed Wetland Hardwoods	Natural
22331	Bottomland Forest	Natural
22332	Alluvial Forest	Natural
2234	Titi Swamp	Natural
2240	Other Wetland Forested Mixed	Natural
2241	Cypress/Hardwood Swamps	Natural
2242	Cypress/Pine/Cabbage Palm	Natural
2300	Non-vegetated Wetland	Natural

Cooperative Land Cover v3.3 Class		5 Class System
2400	Cultural - Palustrine	Semi-Natural
2410	Impounded Marsh	Semi-Natural
2420	Impounded Swamp	Semi-Natural
2430	Grazed Wetlands	Semi-Natural
2440	Clearcut Wetland	Semi-Natural
2450	Wet Coniferous Plantation	Semi-Natural
3000	Lacustrine	Water
3100	Natural Lakes and Ponds	Water
3110	Limnetic	Water
3111	Clastic Upland Lake	Water
3112	Coastal Dune Lake	Water
3113	Flatwoods/Prairie/Marsh Lake	Water
3114	River Floodplain Lake/Swamp Lake	Water
3115	Sinkhole Lake	Water
3116	Coastal Rockland Lake	Water
3117	Sandhill Lake	Water
3118	Major Springs	Water
3120	Littoral	Water
3200	Cultural - Lacustrine	Water
3210	Artificial/Farm Pond	Water
3211	Aquacultural Ponds	Water
3220	Artificial Impoundment/Reservoir	Water
3230	Quarry Pond	Water
3240	Sewage Treatment Pond	Water
3250	Stormwater Treatment Areas	Intensive Agric., Etc
3260	Industrial Cooling Pond	Water
4000	Riverine	Water
4100	Natural Rivers and Streams	Water
4110	Alluvial Stream	Water
4120	Blackwater Stream	Water
4130	Spring-run Stream	Water
4140	Seepage Stream	Water
4160	Tidally-influenced Stream	Water
4170	Riverine Sandbar	Natural
4200	Cultural - Riverine	Water
4210	Canal	Water
4220	Ditch/Artificial Intermittent Stream	Water
5000	Estuarine	Water
5100	Subtidal	Water
5200	Intertidal	Natural
5210	Exposed Limestone	Natural
52111	Keys Tidal Rock Barren	Natural
5212	Non-vegetated	Natural
5220	Tidal Flat	Natural

Cooperative Land Cover v3.3 Class		5 Class System
5221	Mud	Natural
5222	Sand	Natural
5230	Oyster Bar	Natural
5240	Salt Marsh	Natural
5250	Mangrove Swamp	Natural
5251	Buttonwood Forest	Natural
5252	Scrub Mangrove	Natural
5300	Cultural - Estuarine	Water
5310	Estuarine Ditch/Channel	Water
5320	Estuarine Artificial Impoundment	Water
6000	Marine	Water
6100	Surf Zone	Water
7000	Exotic Plants	Intensive Agric., Etc
7100	Australian Pine	Intensive Agric., Etc
7200	Melaleuca	Intensive Agric., Etc
7300	Brazilian Pepper	Intensive Agric., Etc
7400	Exotic Wetland Hardwoods	Intensive Agric., Etc
9100	Unconsolidated Substrate	Natural

APPENDIX F

Species Conservation Needs Weight Scoring for FNAI Habitat Conservation Priorities version 4.0

Scientific Name	Common Name	GRANK	GRANK Pts	Total Habitat Acres	Total Acres Points	October 2013 Protected Acres	Percent Protected	% Prot. Points	Large Area Pts	Final Score
Acipenser oxyrinchus desotoi	Gulf Sturgeon	G3T2	120	403,690	40	260,204	64%	40		**200**
Aletris bracteata	Bracted Colic-root	G2	133	6	100	6	100%	0		**233**
Amblema neislerii	Fat Threeridge	G1	400	123,706	40	65,907	53%	50		**490**
Ambystoma bishopi	Reticulated Flatwoods Salamander	G2	133	45,809	55	9,569	21%	80		**268**
Ambystoma cingulatum	Frosted Flatwoods Salamander	G2	133	138,922	40	106,310	77%	25		**198**
Ammodramus maritimus macgillivraii	Macgillivray's Seaside Sparrow	G4T2	104	33,513	55	20,200	60%	40		**199**
Ammodramus maritimus mirabilis	Cape Sable Seaside Sparrow	G4T1	240	148,925	40	148,872	100%	0		**280**
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	G5T1	124	46,317	55	37,358	81%	20	15	**214**
Amorpha herbacea var. crenulata	Crenulate Lead-plant	G4T1	240	454	85	419	92%	10		**335**
Anodonta heardi	Apalachicola Floater	G1G2	400	113,434	40	64,206	57%	45		**485**
Aphaostracon asthenes	Blue Spring Hydrobe Snail	G1	400	117	85	117	100%	5		**490**
Aphaostracon chalarogyrus	Freemouth Hydrobe Snail	G1	400	55	100	0	0%	100		**600**
Aphaostracon monas	Wekiwa Hydrobe Snail	G1	400	257	85	225	88%	15		**500**
Aphaostracon pycnus	Dense Hydrobe Snail	G1	400	75	100	75	100%	0		**500**
Aphaostracon theiocrenetum	Clifton Springs Hydrobe Snail	G1	400	22	100	2	10%	90		**590**
Aphaostracon xynoelictum	Fenney Springs Hydrobe Snail	G1	400	69	100	0	0%	100		**600**
Aphelocoma coerulescens	Florida Scrub-jay	G2	133	514,105	40	392,634	76%	25		**198**
Aquilegia canadensis var. australis	Marianna Columbine	G5T1Q	124	4,086	70	2,105	52%	50		**244**
Arnoglossum album	Chalky Indian-plantain	G1	400	321	85	0	0%	100		**585**
Arnoglossum diversifolium	Variable-leaved Indian-plantain	G2	133	15,625	55	6,384	41%	60		**248**
Asimina tetramera	Four-petal Pawpaw	G1	400	1,890	70	1,535	81%	20		**490**
Asplenium verecundum	Modest Spleenwort	G1	400	690	85	492	71%	30		**515**
Asplenium x biscaynianum	Eaton's Spleenwort	GNA	40	776	85	683	88%	15		**140**
Aster fragilis var. brachypholis	Apalachicola River Aster	G4G5T1Q	240	1,348	70	125	9%	95		**405**
Aster spinulosus	Pine-woods Aster	G1	400	53,239	55	3,023	6%	95		**550**
Atrytonopsis loammi	Loammi Skipper	G1	400	39,995	55	37,780	94%	10		**465**
Balduina atropurpurea	Purple Honeycomb-head	G2	133	2,047	70	232	11%	90		**293**
Baptisia calycosa var. calycosa	Canby's Wild Indigo	G3T1	312	878	85	875	100%	5		**402**
Baptisia megacarpa	Apalachicola Wild Indigo	G2	133	9,294	70	2,598	28%	75		**278**
Basiphyllaea corallicola	Rockland Orchid	G1G3	133	1,024	70	842	82%	20		**223**
Bigelowia nuttallii	Nuttall's Rayless Goldenrod	G3G4	40	69	100	17	25%	80		**220**
Bonamia grandiflora	Florida Bonamia	G3	40	51,527	55	45,446	88%	15		**110**
Bourreria cassinifolia	Smooth Strongbark	G3?	40	1,663	70	1,438	86%	15		**125**
Bourreria radula	Rough Strongbark	G2?	133	36	100	10	29%	75		**308**

Scientific Name	Common Name	GRANK	GRANK Pts	Total Habitat Acres	Total Acres Points	October 2013 Protected Acres	Percent Protected	% Prot. Points	Large Area Pts	Final Score
Brickellia cordifolia	Flyr's Brickell-bush	G2G3	133	3,674	70	2,336	64%	40		**243**
Brickellia mosieri	Florida Brickell-bush	G1	400	1,171	70	1,065	91%	10		**480**
Caecidotea hobbsi	Florida Cave Isopod	G2G3	133	895	85	214	24%	80		**298**
Caecidotea sp. 7	Rock Springs Cave Isopod	G1	400	75	100	74	99%	5		**505**
Caecidotea sp. 8	Econfina Springs Cave Isopod	G1	400	75	100	67	90%	10		**510**
Caesalpinia pauciflora	Few-flower Caesalpinia	G2G4	40	329	85	254	77%	25		**150**
Calydorea coelestina	Bartram's Ixia	G2G3	133	16,444	55	2,459	15%	85		**273**
Cambarus cryptodytes	Dougherty Plain Cave Crayfish	G2	133	1,772	70	507	29%	75		**278**
Campanula robinsiae	Brooksville Bellflower	G1	400	69	100	58	84%	20		**520**
Caretta caretta	Loggerhead	G3	40	15,433	55	5,665	37%	65		**160**
Caracara cheriway	Crested Caracara	G5	12	1,808,281	25	453,712	25%	75		**119**
Centrosema arenicola	Sand Butterfly Pea	G2Q	133	11,709	55	7,301	62%	40		**228**
Chamaecrista lineata var. keyensis	Big Pine Partridge Pea	G5T2	80	2,195	70	1,840	84%	20		**170**
Chamaesyce deltoidea ssp. adhaerens	Hairy Deltoid Spurge	G2T1	360	254	85	164	65%	40		**485**
Chamaesyce deltoidea ssp. deltoidea	Deltoid Spurge	G2T1	360	1,001	70	880	88%	15		**445**
Chamaesyce deltoidea ssp. pinetorum	Pinelands Spurge	G2T1	360	7,265	70	7,209	99%	5		**435**
Chamaesyce deltoidea ssp. serpyllum	Wedge Spurge	G2T1	360	1,605	70	1,419	88%	15		**445**
Chamaesyce garberi	Garber's Spurge	G1	400	6,093	70	5,546	91%	10		**480**
Charadrius melodus	Piping Plover	G3	40	21,349	55	13,967	65%	35		**130**
Charadrius nivosus	Snowy Plover	G3	40	7,360	70	5,322	72%	30		**140**
Chelonia mydas	Green Turtle	G3	40	9,845	70	3,465	35%	65		**175**
Chionanthus pygmaeus	Pygmy Fringe Tree	G2G3	133	17,306	55	8,039	46%	55		**243**
Chrysopsis floridana	Florida Goldenaster	G1	400	2,417	70	1,935	80%	20		**490**
Cicindela highlandensis	Highlands Tiger Beetle	G2	133	16,647	55	10,776	65%	40		**228**
Cladonia perforata	Perforate Reindeer Lichen	G1	400	3,231	70	1,765	55%	50		**520**
Clitoria fragrans	Scrub Pigeon-wing	G3	40	26,099	55	16,956	65%	35		**130**
Colubrina cubensis var. floridana	Cuban Snake-bark	G2G3T1	360	3,353	70	3,205	96%	5		**435**
Conradina brevifolia	Short-leaved Rosemary	G2Q	133	5,224	70	2,287	44%	60		**263**
Conradina etonia	Etonia Rosemary	G1	400	2,122	70	1,896	89%	15		**485**
Conradina glabra	Apalachicola Rosemary	G1	400	5,550	70	2,561	46%	55		**525**
Cordulegaster sayi	Say's Spiketail	G2	133	73,467	55	65,208	89%	15		**203**
Coreopsis integrifolia	Ciliate-leaf Tickseed	G1G2	400	4,379	70	584	13%	90		**560**
Crangonyx grandimanus	Florida Cave Amphipod	G2G3	133	2,386	70	294	12%	90		**293**
Crangonyx hobbsi	Hobbs' Cave Amphipod	G2G3	133	2,683	70	557	21%	80		**283**
Crocodylus acutus	American Crocodile	G2	133	325,489	40	297,368	91%	10	15	**198**
Crotalaria avonensis	Avon Park Rabbit-bells	G1	400	1,343	70	1,005	75%	30		**500**

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Crystallaria asprella	Crystal Darter	G3	40	7,169	70	3,049	43%	60		**170**
Ctenogobius stigmaturus	Spottail Goby	G2	133	20,385	55	15,775	77%	25		**213**
Cucurbita okeechobeensis	Okeechobee Gourd	G1	400	5,775	70	648	11%	90		**560**
Cyprinodon variegatus hubbsi	Lake Eustis Pupfish	G5T2Q	80	19,401	55	4,968	26%	75		**210**
Dalea carthagenensis var. floridana	Florida Prairie Clover	G5T1	124	384	85	354	92%	10		**219**
Dasyscias franzi	Shaggy Ghostsnail	G1	400	75	100	67	90%	10		**510**
Deeringothamnus pulchellus	Beautiful Pawpaw	G1	400	18,276	55	14,183	78%	25		**480**
Deeringothamnus rugelii	Rugel's Pawpaw	G1	400	10,069	55	5,167	51%	50		**505**
Dermochelys coriacea	Leatherback	G2	133	7,275	70	2,120	29%	75		**278**
Desmodium ochroleucum	Creamflower Tick-trefoil	G1G2	400	462	85	276	60%	45		**530**
Diadophis punctatus acricus	Key Ringneck Snake	G5T1	124	2,932	70	2,516	86%	15		**209**
Dicerandra christmanii	Garrett's Scrub Balm	G1	400	615	85	352	57%	45		**530**
Dicerandra cornutissima	Longspurred Mint	G1	400	7,001	70	3,484	50%	55		**525**
Dicerandra frutescens	Scrub Mint	G1	400	3,636	70	1,962	54%	50		**520**
Dicerandra immaculata	Lakela's Mint	G1	400	1,419	70	988	70%	35		**505**
Dicerandra thinicola	Titusville Balm	G1Q	400	530	85	0	0%	100		**585**
Digitaria floridana	Florida Fingergrass	G1	400	470	85	467	99%	5		**490**
Digitaria gracillima	Longleaf Fingergrass	G1	400	2,218	70	1,512	68%	35		**505**
Dryachloa dauca	Carrot Glass Snail	G2	133	371	85	0	0%	100		**318**
Drymarchon couperi	Eastern Indigo Snake	G3	40	7,764,073	10	2,909,279	37%	65	15	**130**
Elimia clenchi	Clench's Goniobasis	G3Q	40	41,272	55	28,999	70%	30		**125**
Elliptio chipolaensis	Chipola Slabshell	G1	400	44,452	55	11,179	25%	75		**530**
Elliptoideus sloatianus	Purple Bankclimber	G2	133	138,203	40	68,461	50%	55		**228**
Elytraria caroliniensis var. angustifolia	Narrow-leaved Carolina Scalystem	G4T2	104	12,952	55	11,903	92%	10		**169**
Encyclia cochleata var. triandra	Clamshell Orchid	G4G5T2	104	7,132	70	6,844	96%	5		**179**
Eretmochelys imbricata	Hawksbill	G3	40	728	85	421	58%	45		**170**
Eriocaulon nigrobracteatum	Dark-headed Hatpins	G1	400	324	85	12	4%	100		**585**
Eriogonum longifolium var. gnaphalifolium	Scrub Buckwheat	G4T3	36	52,673	55	43,621	83%	20		**111**
Eryngium cuneifolium	Wedge-leaved Button-snakeroot	G1	400	3,111	70	1,255	40%	60		**530**
Etheostoma okaloosae	Okaloosa Darter	G2	133	31,018	55	29,806	96%	5		**193**
Eumops floridanus	Florida bonneted bat	G1	400	52,874	55	34,440	65%	35		**490**
Eupatorium frustratum	Cape Sable Thoroughwort	G1	400	582	85	507	87%	15		**500**
Euphorbia pinetorum	Rockland Painted-leaf	G2	133	1,651	70	1,505	91%	10		**213**
Euphorbia rosescens	Scrub Spurge	G1	400	487	85	326	67%	35		**520**
Euphorbia telephioides	Telephus Spurge	G1	400	16,591	55	5,713	34%	70		**525**
Euphyes berryi	Berry's Skipper	G1G3	133	22,376	55	19,834	89%	15		**203**

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Eurycea wallacei	Georgia Blind Salamander	G2	133	14,142	55	2,635	19%	85		**273**
Floridobia alexander	Alexander Siltsnail	G1	400	2,323	70	2,295	99%	5		**475**
Floridobia helicogyra	Crystal Siltsnail	G1	400	1,079	70	345	32%	70		**540**
Floridobia mica	Ichetucknee Siltsnail	G1	400	75	100	75	100%	0		**500**
Floridobia monroensis	Enterprise Siltsnail	G1	400	530	85	27	5%	95		**580**
Floridobia parva	Pygmy Siltsnail	G1	400	75	100	75	100%	0		**500**
Floridobia petrifons	Rock Springs Siltsnail	G1	400	104	85	100	96%	5		**490**
Floridobia ponderosa	Ponderous Spring Siltsnail	G1	400	141	85	0	0%	100		**585**
Floridobia porterae	Green Cove Springsnail	G1	400	1	100	0	0%	100		**600**
Floridobia vanhyningi	Seminole Spring Siltsnail	G1	400	75	100	0	0%	100		**600**
Floridobia wekiwae	Wekiwa Siltsnail	G1	400	89	100	84	95%	10		**510**
Forestiera godfreyi	Godfrey's Swampprivet	G2	133	8,051	70	5,033	63%	40		**243**
Fusconaia burkei	Tapered Pigtoe	G2G3	133	75,230	55	32,850	44%	60		**248**
Fusconaia escambia	Narrow Pigtoe	G2	133	40,604	55	23,756	59%	45		**233**
Fusconaia rotulata	Round Ebonyshell	G1	400	25,070	55	17,596	70%	30		**485**
Galactia pinetorum	Pineland Milkpea	G2Q	133	2,550	70	2,472	97%	5		**208**
Galactia smallii	Small's Milkpea	G1Q	400	927	85	741	80%	25		**510**
Galeandra bicarinata	Two-keeled Helmet Orchid	G1	400	418	85	389	93%	10		**495**
Glandularia tampensis	Tampa Vervain	G2	133	6,468	70	2,587	40%	60		**263**
Govenia floridana	Sheathing Govenia	G1Q	400	229	85	229	100%	0		**485**
Graptemys barbouri	Barbour's Map Turtle	G2	133	180,142	40	90,280	50%	50		**223**
Graptemys ernsti	Escambia Map Turtle	G2	133	95,614	55	60,743	64%	40		**228**
Guaiacum sanctum	Lignum-vitae	G2	133	1,964	70	1,564	80%	25		**228**
Halophila johnsonii	Johnson's Seagrass	G2	133	6,318	70	3,784	60%	45		**248**
Hamiota subangulata	Shiny-rayed Pocketbook	G2	133	77,360	55	27,570	36%	65		**253**
Harperocallis flava	Harper's Beauty	G1	400	2,057	70	2,039	99%	5		**475**
Harrisia aboriginum	Aboriginal Prickly Apple	G1	400	1,120	70	752	67%	35		**505**
Harrisia fragrans	Fragrant Prickly Apple	G1	400	974	85	521	54%	50		**535**
Hasteola robertiorum	Florida Hasteola	G1	400	6,048	70	3,240	54%	50		**520**
Helianthus carnosus	Lake-side Sunflower	G1G2	400	14,672	55	776	5%	95		**550**
Helianthus debilis ssp. vestitus	Hairy Beach Sunflower	G5T2	80	1,850	70	1,252	68%	35		**185**
Hojeda inaguensis	Keys Mudcloak	G1	400	629	85	468	74%	30		**515**
Hymenocallis godfreyi	Godfrey's Spiderlily	G1	400	1,697	70	1,582	93%	10		**480**
Hypericum cumulicola	Highlands Scrub Hypericum	G2	133	13,059	55	7,630	58%	45		**233**
Indigofera mucronata var. keyensis	Florida Keys Indigo	G5?T1Q	124	112	85	87	78%	25		**234**
Ipomoea microdactyla	Wild Potato Morning Glory	G2	133	1,199	70	1,119	93%	10		**213**

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Ipomoea tenuissima	Rocklands Morning Glory	G3	40	941	85	883	94%	10		**135**
Jacquemontia reclinata	Beach Jacquemontia	G1	400	970	85	788	81%	20		**505**
Justicia cooleyi	Cooley's Water-willow	G2	133	6,268	70	2,598	41%	60		**263**
Kinosternon baurii pop. 1	Striped Mud Turtle - Lower Florida Keys	G5T2Q	80	5,957	70	4,589	77%	25		**175**
Lantana depressa var. depressa	Florida Lantana	G2T1	360	2,154	70	1,828	85%	20		**450**
Lantana depressa var. floridana	Atlantic Coast Florida Lantana	G2T1	360	6,092	70	5,633	92%	10		**440**
Lantana depressa var. sanibelensis	Gulf Coast Florida Lantana	G2T1	360	1,530	70	1,390	91%	10		**440**
Lepidochelys kempii	Kemp's Ridley	G1	400	4,091	70	1,727	42%	60		**530**
Liatris gholsonii	Gholson's Blazing Star	G1	400	6,002	70	5,235	87%	15		**485**
Liatris ohlingerae	Florida Blazing Star	G2	133	26,084	55	13,851	53%	50		**238**
Lindera subcoriacea	Bog Spicebush	G2G3	133	224	85	89	40%	65		**283**
Linum arenicola	Sand Flax	G1G2	400	3,348	70	2,522	75%	25		**495**
Linum carteri var. carteri	Carter's Small-flowered Flax	G2T1	360	566	85	232	41%	60		**505**
Linum carteri var. smallii	Small's Flax	G2T2	133	3,486	70	2,753	79%	25		**228**
Lobelia boykinii	Boykin's Lobelia	G2G3	133	1,156	70	273	24%	80		**283**
Lomariopsis kunzeana	Holly Vine Fern	G2G4	40	306	85	281	92%	10		**135**
Lupinus aridorum	Scrub Lupine	G1	400	841	85	175	21%	80		**565**
Lythrum curtissii	Curtiss' Loosestrife	G1	400	11,646	55	9,172	79%	25		**480**
Lythrum flagellare	Lowland Loosestrife	G2	133	2,346	70	1,874	80%	25		**228**
Macbridea alba	White Birds-in-a-nest	G2	133	36,781	55	18,253	50%	55		**243**
Marshallia ramosa	Southern Marshallia	G2G3	133	1,515	70	291	19%	85		**288**
Matelea baldwyniana	Baldwyn's Spiny-pod	G3	40	1,375	70	428	31%	70		**180**
Medionidus penicillatus	Gulf Moccasinshell	G2	133	62,129	55	24,803	40%	65		**253**
Medionidus simpsonianus	Ochlockonee Moccasinshell	G1	400	18,132	55	5,469	30%	70		**525**
Medionidus walkeri	Suwannee Moccasinshell	G1	400	62,528	55	20,713	33%	70		**525**
Micropterus cataractae	Shoal Bass	G3	40	27,510	55	4,926	18%	85		**180**
Microtus pennsylvanicus dukecampbelli	Salt Marsh Vole	G5T1	124	4,920	70	2,759	56%	45		**239**
Minuartia godfreyi	Godfrey's Sandwort	G1	400	783	85	0	0%	100		**585**
Monotropsis reynoldsiae	Pygmy Pipes	G1Q	400	6,093	70	5,020	82%	20		**490**
Mycteria americana	Wood Stork	G4	13	5,356,014	25	3,589,334	67%	35	15	**88**
Myotis grisescens	Gray Bat	G3	40	441	85	91	21%	80		**205**
Najas filifolia	Narrowleaf Naiad	G1	400	17,540	55	2,480	14%	90		**545**
Neotoma floridana smalli	Key Largo Woodrat	G5T1	124	2,770	70	2,390	86%	15		**209**
Nerodia clarkii taeniata	Atlantic Salt Marsh Snake	G4T1Q	240	7,757	70	1,099	14%	90		**400**
Nolina brittoniana	Britton's Beargrass	G3	40	24,149	55	15,212	63%	40		**135**
Notropis melanostomus	Blackmouth Shiner	G2	133	4,634	70	298	6%	95		**298**

Scientific Name	Common Name	GRANK	GRANK Pts	Total Habitat Acres	Total Acres Points	October 2013 Protected Acres	Percent Protected	% Prot. Points	Large Area Pts	Final Score
Odocoileus virginianus clavium	Key Deer	G5T1	124	18,411	55	13,550	74%	30		**209**
Oncidium floridanum	Florida Dancinglady Orchid	G2Q	133	190	85	190	100%	0		**218**
Opuntia corallicola	Florida Semaphore Cactus	G1	400	82	100	82	100%	5		**505**
Opuntia triacantha	Three-spined Prickly Pear	G2G4	40	477	85	377	79%	25		**150**
Orbexilum virgatum	Pineland Scurfpea	G1	400	4,182	70	3,985	95%	5		**475**
Oryzomys palustris pop. 1	Pine Island Rice Rat	G5T1Q	124	1,711	70	1,623	95%	10		**204**
Oryzomys palustris pop. 2	Sanibel Island Rice Rat	G5T1Q	124	2,635	70	1,960	74%	30		**224**
Oryzomys palustris pop. 3	Key Rice Rat	G5T2Q	80	8,663	70	6,943	80%	20		**170**
Palaemonetes cummingi	Squirrel Chimney Cave Shrimp	G1	400	75	100	0	0%	100		**600**
Pantherophis guttatus pop. 1	Red Rat Snake, Fl Lower Keys Pop	G5T2Q	80	7,624	70	5,054	66%	35		**185**
Paronychia chartacea ssp. chartacea	Paper-like Nailwort	G3T3	40	31,203	55	18,166	58%	45		**140**
Paronychia chartacea ssp. minima	Crystal Lake Nailwort	G3T1	312	1,179	70	289	25%	80		**462**
Peromyscus gossypinus pop. 1	Key Largo Cotton Mouse	G5T1Q	124	2,705	70	2,301	85%	15		**209**
Peromyscus polionotus allophrys	Choctawhatchee Beach Mouse	G5T1	124	2,716	70	2,502	92%	10		**204**
Peromyscus polionotus leucocephalus	Santa Rosa Beach Mouse	G5T1	124	5,509	70	4,758	86%	15		**209**
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	G5T1	124	7,294	70	7,009	96%	5		**199**
Peromyscus polionotus peninsularis	St. Andrews Beach Mouse	G5T1	124	3,266	70	2,591	79%	25		**219**
Peromyscus polionotus phasma	Anastasia Island Beach Mouse	G5T1	124	1,577	70	1,061	67%	35		**229**
Peromyscus polionotus trissyllepsis	Perdido Key Beach Mouse	G5T1	124	844	85	799	95%	10		**219**
Picoides borealis	Red-cockaded Woodpecker	G3	40	1,392,891	25	1,237,359	89%	15		**80**
Pilosocereus bahamensis	Bahamian Treecactus	G3?	40	112	85	75	67%	35		**160**
Pilosocereus robinii	Tree Cactus	G1	400	492	85	255	52%	50		**535**
Pinguicula ionantha	Godfrey's Butterwort	G2	133	38,115	55	33,380	88%	15		**203**
Pisonia rotundata	Devil's Smooth-claw	G1G3	133	3,357	70	2,920	87%	15		**218**
Plestiodon egregius egregius	Florida Keys Mole Skink	G5T2	80	11,061	55	9,322	84%	20		**155**
Plestiodon egregius insularis	Cedar Key Mole Skink	G5T1	124	72	100	48	66%	35		**259**
Plestiodon egregius lividus	Blue-tailed Mole Skink	G5T2	80	15,896	55	8,674	55%	50		**185**
Plestiodon reynoldsi	Sand Skink	G2	133	78,510	55	59,528	76%	25		**213**
Pleurobema pyriforme	Oval Pigtoe	G2	133	100,123	40	27,460	27%	75		**248**
Pleurobema strodeanum	Fuzzy Pigtoe	G2G3	133	106,254	40	61,201	58%	45		**218**
Polygala lewtonii	Lewton's Polygala	G2G3	133	22,908	55	18,011	79%	25		**213**
Polygala smallii	Tiny Polygala	G1	400	526	85	420	80%	20		**505**
Polygonella basiramia	Florida Jointweed	G3	40	33,790	55	19,156	57%	45		**140**
Polygonella myriophylla	Small's Jointweed	G3	40	25,588	55	11,533	45%	55		**150**
Potamogeton floridanus	Florida Pondweed	G1	400	3,621	70	326	9%	95		**565**
Procambarus acherontis	Orlando Cave Crayfish	G1	400	76	100	39	51%	50		**550**

Scientific Name	Common Name	GRANK	GRANK Pts	Total Habitat Acres	Total Acres Points	October 2013 Protected Acres	Percent Protected	% Prot. Points	Large Area Pts	Final Score
Procambarus attiguus	Silver Glen Springs Crayfish	G1	400	75	100	54	72%	30		**530**
Procambarus delicatus	Big-cheeked Cave Crayfish	G1	400	66	100	66	100%	0		**500**
Procambarus econfinae	Panama City Crayfish	G1G2	400	13,314	55	47	0%	100		**555**
Procambarus erythrops	Santa Fe Cave Crayfish	G1	400	2,175	70	8	0%	100		**570**
Procambarus franzi	Orange Lake Cave Crayfish	G1	400	76	100	0	0%	100		**600**
Procambarus horsti	Big Blue Spring Cave Crayfish	G1	400	200	85	198	99%	5		**490**
Procambarus leitheuseri	Coastal Lowland Cave Crayfish	G1G2	400	393	85	205	52%	50		**535**
Procambarus lucifugus	Light-fleeing Cave Crayfish	G2G3	133	4,183	70	131	3%	100		**303**
Procambarus morrisi	Putnam County Cave Crayfish	G1	400	72	100	0	0%	100		**600**
Procambarus orcinus	Woodville Karst Cave Crayfish	G1	400	765	85	347	45%	55		**540**
Procambarus pallidus	Pallid Cave Crayfish	G2G3	133	3,249	70	397	12%	90		**293**
Procambarus pictus	Black Creek Crayfish	G2	133	66,853	55	27,025	40%	60		**248**
Procambarus youngi	Florida Longbeak Crayfish	G2	133	2,829	70	126	4%	100		**303**
Procyon lotor auspicatus	Key Vaca Raccoon	G5T1?	124	958	85	775	81%	20		**229**
Procyon lotor incautus	Key West Raccoon	G5T2	80	7,082	70	4,992	70%	30		**180**
Prunus geniculata	Scrub Plum	G3	40	27,754	55	15,741	57%	45		**140**
Pseudemys nelsoni pop. 1	Florida Red-bellied Turtle - Florida Panhandle	G5T2Q	80	17,389	55	7,126	41%	60		**195**
Pseudobranchus striatus lustricolus	Gulf Hammock Dwarf Siren	G5T1	124	3,925	70	99	3%	100		**294**
Puma concolor coryi	Florida Panther	G5T1	124	3,239,029	25	2,277,807	70%	30	15	**194**
Remasellus parvus	Swimming Little Florida Cave Isopod	G1G2	400	74	100	0	0%	100		**600**
Rhododendron chapmanii	Chapman's Rhododendron	G1	400	31,011	55	1,864	6%	95		**550**
Rhynchosia swartzii	Swartz's Snoutbean	G3	40	388	85	291	75%	30		**155**
Rhynchospora megaplumosa	Large-plumed Beaksedge	G2	133	1,806	70	1,763	98%	5		**208**
Rhynchospora thornei	Thorne's Beaksedge	G3	40	431	85	60	14%	90		**215**
Ribes echinellum	Miccosukee Gooseberry	G1	400	274	85	151	55%	45		**530**
Rostrhamus sociabilis plumbeus	Snail Kite	G4G5T2	104	1,176,505	25	1,093,082	93%	10	15	**154**
Sachsia polycephala	Bahama Sachsia	G2	133	2,107	70	1,842	87%	15		**218**
Sacoila lanceolata var. paludicola	Fahkahatchee Ladies' -tresses	G4T1	240	130	85	130	100%	5		**330**
Schizachyrium niveum	Scrub Bluestem	G1G2	400	14,197	55	9,017	64%	40		**495**
Schwalbea americana	Chaffseed	G2G3	133	1,975	70	1,299	66%	35		**238**
Sciurus niger avicennia	Mangrove Fox Squirrel	G5T2	80	206,213	40	73,518	36%	65	15	**200**
Scutellaria floridana	Florida Skullcap	G2	133	23,785	55	9,754	41%	60		**248**
Selaginella eatonii	Eaton's Spike Moss	G2G3	133	804	85	804	100%	0		**218**
Sideroxylon alachuense	Silver Buckthorn	G1	400	738	85	560	76%	25		**510**
Sideroxylon reclinatum ssp. austrofloridense	Everglades Bully	G4G5T1	240	172	85	167	97%	5		**330**
Sideroxylon thornei	Thorne's Buckthorn	G2	133	18,793	55	17,396	93%	10		**198**

Scientific Name	Common Name	GRANK	GRANK Pts	Total Habitat Acres	Total Acres Points	October 2013 Protected Acres	Percent Protected	% Prot. Points	Large Area Pts	Final Score
Sigmodon hispidus exsputus	Lower Keys Cotton Rat	G5T2	80	6,272	70	4,802	77%	25		**175**
Sigmodon hispidus insulicola	Insular Cotton Rat	G5T1T2	124	3,153	70	2,566	81%	20		**214**
Silene polypetala	Fringed Campion	G2	133	2,295	70	466	20%	80		**283**
Spigelia gentianoides	Gentian Pinkroot	G1	400	3,269	70	1,632	50%	55		**525**
Spiranthes brevilabris	Small Ladies'-tresses	G1	400	649	85	645	99%	5		**490**
Stachys hyssopifolia var. lythroides	Tallahassee Hedge-nettle	G5T1Q	124	1,091	70	215	20%	85		**279**
Storeria dekayi pop. 1	Lower Keys Brown Snake	G5T1Q	124	2,949	70	2,544	86%	15		**209**
Stygobromus sp. 25	An Aquatic Cave Amphipod	G1	400	163	85	29	18%	85		**570**
Sylvilagus palustris hefneri	Lower Keys Rabbit	G5T1	124	16,729	55	11,954	71%	30		**209**
Tantilla oolitica	Rim Rock Crowned Snake	G1G2	400	2,198	70	1,782	81%	20		**490**
Tephrosia angustissima var. corallicola	Rockland Hoary-pea	G1T1	400	98	100	97	99%	5		**505**
Tephrosia angustissima var. curtissii	Coastal Hoary-pea	G1T1	400	567	85	344	61%	40		**525**
Tettigidea empedonepia	Torreya Pygmy Grasshopper	G1	400	282	85	275	97%	5		**490**
Thalictrum cooleyi	Cooley's Meadowrue	G2	133	34	100	22	64%	40		**273**
Thamnophis sauritus pop. 1	Lower Keys Ribbon Snake	G5T1Q	124	10,688	55	7,488	70%	30		**209**
Torreya taxifolia	Florida Torreya	G1	400	14,811	55	7,622	51%	50		**505**
Trichechus manatus	Manatee	G2	133	409,092	40	208,315	51%	50		**223**
Trichomanes punctatum ssp. floridanum	Florida Filmy Fern	G4G5T1	240	325	85	140	43%	60		**385**
Triphora craigheadii	Craighead's Nodding-caps	G1	400	1,534	70	121	8%	95		**565**
Triphora rickettii	Rickett's Nodding-caps	G1?	400	371	85	214	58%	45		**530**
Troglocambarus maclanei	North Florida Spider Cave Crayfish	G2	133	2,570	70	157	6%	95		**298**
Troglocambarus sp. 1	Orlando Spider Cave Crayfish	G1	400	54	100	39	72%	30		**530**
Ursus americanus floridanus	Florida Black Bear	G5T2	80	9,922,795	10	4,623,899	47%	55	15	**160**
Vicia ocalensis	Ocala Vetch	G1	400	581	85	377	65%	40		**525**
Villosa choctawensis	Choctaw Bean	G2G3	133	52,863	55	31,778	60%	40		**228**
Warea amplexifolia	Clasping Warea	G1	400	648	85	259	40%	60		**545**
Warea carteri	Carter's Warea	G3	40	12,136	55	9,404	77%	25		**120**
Xyris isoetifolia	Quillwort Yellow-eyed Grass	G1	400	2,797	70	951	34%	70		**540**
Xyris stricta var. obscura	Kral's Yellow-eyed Grass	G3T3	40	2,238	70	1,370	61%	40		**150**
Zephyranthes simpsonii	Redmargin Zephyrlily	G2G3	133	2,314	70	2,314	100%	0		**203**
Ziziphus celata	Scrub Ziziphus	G1	400	5,312	70	2,558	48%	55		**525**

APPENDIX G

Mapping Method for Species Included in the Rare Species Habitat Conservation Priorities

Scientific Name	Common Name	Method*	Sources†	Radius (m)	TYPE
n/a	Terrestrial Plants‡	Standard		400	Plants
Acipenser oxyrinchus desotoi	Gulf Sturgeon	Aquatic	USFWS 2003, Final Critical Habitat determined primary aquatic habitat	n/a	Animals
Aletris bracteata	Bracted Colic-root	Version 2.2		400	Plants
Amblema neislerii	Fat Threeridge	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Ambystoma bishopi	Reticulated Flatwoods Salamander	Standard		1,000	Animals
Ambystoma cingulatum	Frosted Flatwoods Salamander	Standard		1,000	Animals
Ammodramus maritimus macgillivraii	Macgillivray's Seaside Sparrow	Custom	NeSmith and Jue 2003	n/a	Animals
Ammodramus maritimus mirabilis	Cape Sable Seaside Sparrow	Custom	USFWS 2006, Proposed Critical Habitat (all suitable land cover within PCH boundaries); Pimm et al. 2002	n/a	Animals
Ammodramus savannarum floridanus	Florida Grasshopper Sparrow	Custom	Delany et al. 2007	2,000	Animals
Anodonta heardi	Apalachicola Floater	Aquatic	Consulted with Jim Williams, ret. USGS, on aquatic habitat extent	n/a	Inverts-other
Aphaostracon asthenes	Blue Spring Hydrobe Snail	Spring		n/a	Inverts-other
Aphaostracon chalarogyrus	Freemouth Hydrobe Snail	Spring		n/a	Inverts-other
Aphaostracon monas	Wekiwa Hydrobe Snail	Spring		n/a	Inverts-other
Aphaostracon pycnus	Dense Hydrobe Snail	Spring		n/a	Inverts-other
Aphaostracon theiocrenetum	Clifton Springs Hydrobe Snail	Spring		n/a	Inverts-other
Aphaostracon xynoelictum	Fenney Springs Hydrobe Snail	Spring		n/a	Inverts-other
Aphelocoma coerulescens	Florida Scrub-jay	Custom	Stith 1999; Pranty et al. 1997; Fitzpatrick et al. 1994; Jaywatch 2002-2009	n/a	Animals
Atrytonopsis loammi	Loammi Skipper	Standard		400	Inverts-insects
Balduina atropurpurea	Purple Honeycomb-head	Version 2.2		400	Plants
Bigelowia nuttallii	Nuttall's Rayless Goldenrod	Version 2.2		400	Plants
Caecidotea hobbsi	Florida Cave Isopod	Cave		250	Inverts-other
Caecidotea sp. 7	Rock Springs Cave Isopod	Cave		250	Inverts-other
Caecidotea sp. 8	Econfina Springs Cave Isopod	Cave		250	Inverts-other
Calydorea coelestina	Bartram's Ixia	Version 2.2		400	Plants

Scientific Name	Common Name	Method*	Sources†	Radius (m)	TYPE
Cambarus cryptodytes	Dougherty Plain Cave Crayfish	Cave		250	Inverts-other
Caracara cheriway	Crested Caracara	Version 2.2	Morrison 1996	n/a	Animals
Caretta caretta	Loggerhead	Custom	FWC/FWRI Sea Turtle Nesting, 2008-2012; Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Charadrius melodus	Piping Plover	Custom	IPPC 2001, 2006; USFWS Final Critical Habitat	n/a	Animals
Charadrius nivosus	Snowy Plover	Version 2.2		n/a	Animals
Chelonia mydas	Green Turtle	Custom	FWC/FWRI Sea Turtle Nesting, 2008-2012; Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Chionanthus pygmaeus	Pygmy Fringe Tree	Version 2.2		400	Plants
Cicindela highlandensis	Highlands Tiger Beetle	Standard		400	Inverts-insects
Clitoria fragrans	Scrub Pigeon-wing	Version 2.2		400	Plants
Cordulegaster sayi	Say's Spiketail	Standard		400	Inverts-insects
Crangonyx grandimanus	Florida Cave Amphipod	Cave		250	Inverts-other
Crangonyx hobbsi	Hobbs' Cave Amphipod	Cave		250	Inverts-other
Crocodylus acutus	American Crocodile	Custom	Priority Amphibian and Reptile Conservation Areas 2012 - provided by J. Apodaca; Sutherland and deMaynadier 2012	n/a	Animals
Crystallaria asprella	Crystal Darter	Aquatic		n/a	Animals
Ctenogobius stigmaturus	Spottail Goby	Aquatic		n/a	Animals
Cyprinodon variegatus hubbsi	Lake Eustis Pupfish	Aquatic		n/a	Animals
Dasyscias franzi	Shaggy Ghostsnail	Cave		250	Inverts-other
Dermochelys coriacea	Leatherback	Custom	FWC/FWRI Sea Turtle Nesting, 2008-2012; Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Diadophis punctatus acricus	Key Ringneck Snake	Standard		Island Extent	Animals
Dryachloa dauca	Carrot Glass Snail	Standard		400	Inverts-other
Drymarchon couperi	Eastern Indigo Snake	Custom	Moler 1992.	5,000	Animals
Elimia clenchi	Clench's Goniobasis	Aquatic		n/a	Inverts-other

Scientific Name	Common Name	Method*	Sources†	Radius (m)	TYPE
Elliptio chipolaensis	Chipola Slabshell	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Elliptoideus sloatianus	Purple Bankclimber	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Eriogonum longifolium var. gnaphalifolium	Scrub Buckwheat	Version 2.2		400	Plants
Eretmochelys imbricata	Hawksbill	Version 2.2		n/a	Animals
Etheostoma okaloosae	Okaloosa Darter	Aquatic		n/a	Animals
Eumops floridanus	Florida bonneted bat	Custom		5,000	Animals
Euphyes berryi	Berry's Skipper	Standard		400	Inverts-insects
Eurycea wallacei	Georgia Blind Salamander	Cave		250	Animals
Floridobia alexander	Alexander Siltsnail	Spring		250	Inverts-other
Floridobia helicogyra	Crystal Siltsnail	Spring		250	Inverts-other
Floridobia mica	Ichetucknee Siltsnail	Spring		250	Inverts-other
Floridobia monroensis	Enterprise Siltsnail	Spring		250	Inverts-other
Floridobia parva	Pygmy Siltsnail	Spring		250	Inverts-other
Floridobia petrifons	Rock Springs Siltsnail	Spring		250	Inverts-other
Floridobia ponderosa	Ponderous Spring Siltsnail	Spring		250	Inverts-other
Floridobia porterae	Green Cove Springsnail	Spring		250	Inverts-other
Floridobia vanhyningi	Seminole Spring Siltsnail	Spring		250	Inverts-other
Floridobia wekiwae	Wekiwa Siltsnail	Spring		250	Inverts-other
Fusconaia burkei	Tapered Pigtoe	Aquatic	USFWS 2012, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Fusconaia escambia	Narrow Pigtoe	Aquatic	USFWS 2012, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Fusconaia rotulata	Round Ebonyshell	Aquatic	USFWS 2012, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Graptemys barbouri	Barbour's Map Turtle	Aquatic		n/a	Animals
Graptemys ernsti	Escambia Map Turtle	Aquatic		n/a	Animals
Halophila johnsonii	Johnson's Seagrass	Version 2.2		400	Plants
Hamiota subangulata	Shiny-rayed Pocketbook	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Hojeda inaguensis	Keys Mudcloak	Standard		400	Inverts-other
Kinosternon baurii pop. 1	Striped Mud Turtle - Lower Florida Keys	Version 2.2		n/a	Animals

Scientific Name	Common Name	Method*	Sources†	Radius (m)	TYPE
Lepidochelys kempii	Kemp's Ridley	Version 2.2		n/a	Animals
Medionidus penicillatus	Gulf Moccasinshell	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Medionidus simpsonianus	Ochlockonee Moccasinshell	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Medionidus walkeri	Suwannee Moccasinshell	Aquatic		n/a	Inverts-other
Micropterus cataractae	Shoal Bass	Aquatic		n/a	Animals
Microtus pennsylvanicus dukecampbelli	Salt Marsh Vole	Standard		1,000	Animals
Mycteria americana	Wood Stork	Custom	Tsai et al. 2011	25,000	Animals
Myotis grisescens	Gray Bat	Version 2.2		400	Animals
Najas filifolia	Narrowleaf Naiad	Aquatic		n/a	Plants
Neotoma floridana smalli	Key Largo Woodrat	Standard		1,000	Animals
Nerodia clarkii taeniata	Atlantic Salt Marsh Snake	Standard		1,000	Animals
Notropis melanostomus	Blackmouth Shiner	Aquatic		n/a	Animals
Odocoileus virginianus clavium	Key Deer	Standard		Island Extent	Animals
Oryzomys palustris pop. 1	Pine Island Rice Rat	Standard		1,000	Animals
Oryzomys palustris pop. 2	Sanibel Island Rice Rat	Standard		1,000	Animals
Oryzomys palustris pop. 3	Key Rice Rat	Standard		1,000	Animals
Palaemonetes cummingi	Squirrel Chimney Cave Shrimp	Cave		250	Inverts-other
Pantherophis guttatus pop. 1	Red Rat Snake, Fl Lower Keys Pop	Standard		Island Extent	Animals
Peromyscus gossypinus pop. 1	Key Largo Cotton Mouse	Standard		Island Extent	Animals
Peromyscus polionotus allophrys	Choctawhatchee Beach Mouse	Custom	Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Peromyscus polionotus leucocephalus	Santa Rosa Beach Mouse	Custom	Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Peromyscus polionotus niveiventris	Southeastern Beach Mouse	Custom	Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Peromyscus polionotus peninsularis	St. Andrews Beach Mouse	Custom	Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Peromyscus polionotus phasma	Anastasia Island Beach Mouse	Custom	Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Peromyscus polionotus trissyllepsis	Perdido Key Beach Mouse	Custom	Florida Beaches Habitat Conservation Plan Draft 2012	n/a	Animals
Picoides borealis	Red-cockaded Woodpecker	Custom		n/a	Animals

Scientific Name	Common Name	Method[*]	Sources†	Radius (m)	TYPE
Plestiodon egregius egregius	Florida Keys Mole Skink	Version 2.2		1,000	Animals
Plestiodon egregius insularis	Cedar Key Mole Skink	Standard		1,000	Animals
Plestiodon egregius lividus	Blue-tailed Mole Skink	Standard		1,000	Animals
Plestiodon reynoldsi	Sand Skink	Standard		1,000	Animals
Pleurobema pyriforme	Oval Pigtoe	Aquatic	USFWS 2007, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Pleurobema strodeanum	Fuzzy Pigtoe	Aquatic	USFWS 2012, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other
Potamogeton floridanus	Florida Pondweed	Aquatic		n/a	Plants
Procambarus acherontis	Orlando Cave Crayfish	Cave		250	Inverts-other
Procambarus attiguus	Silver Glen Springs Crayfish	Cave		250	Inverts-other
Procambarus delicatus	Big-cheeked Cave Crayfish	Cave		250	Inverts-other
Procambarus econfinae	Panama City Crayfish	Standard		400	Inverts-other
Procambarus erythrops	Santa Fe Cave Crayfish	Cave		250	Inverts-other
Procambarus franzi	Orange Lake Cave Crayfish	Cave		250	Inverts-other
Procambarus horsti	Big Blue Spring Cave Crayfish	Cave		250	Inverts-other
Procambarus leitheuseri	Coastal Lowland Cave Crayfish	Cave		250	Inverts-other
Procambarus lucifugus	Light-fleeing Cave Crayfish	Cave		250	Inverts-other
Procambarus morrisi	Putnam County Cave Crayfish	Cave		250	Inverts-other
Procambarus orcinus	Woodville Karst Cave Crayfish	Cave		250	Inverts-other
Procambarus pallidus	Pallid Cave Crayfish	Cave		250	Inverts-other
Procambarus pictus	Black Creek Crayfish	Aquatic		n/a	Inverts-other
Procambarus youngi	Florida Longbeak Crayfish	Aquatic		n/a	Inverts-other
Procyon lotor auspicatus	Key Vaca Raccoon	Standard		Island Extent	Animals
Procyon lotor incautus	Key West Raccoon	Version 2.2		n/a	Animals
Pseudemys nelsoni pop. 1	Florida Red-bellied Turtle - Florida Panhandle	Aquatic		n/a	Animals
Pseudobranchus striatus lustricolus	Gulf Hammock Dwarf Siren	Standard		1,000	Animals
Puma concolor coryi	Florida Panther	Custom	Florida Fish and Wildlife Conservation Commission in conjunction with USFWS South Florida Multi-species and Ecosystem Recovery Implementation Team; Thatcher et al. 2006	n/a	Animals
Remasellus parvus	Swimming Little Florida Cave Isopod	Cave		250	Inverts-other

Scientific Name	Common Name	Method*	Sources†	Radius (m)	TYPE
Rhynchospora thornei	Thorne's Beaksedge	Version 2.2		400	Plants
Rostrhamus sociabilis plumbeus	Snail Kite	Version 2.2	USFWS 1981	n/a	Animals
Schwalbea americana	Chaffseed	Version 2.2		400	Plants
Sciurus niger avicennia	Mangrove Fox Squirrel	Custom	Michelle Eisenberg at Univ. of Central Florida; Courtney Tye at FWC/IFAS	5,000	Animals
Sideroxylon thornei	Thorne's Buckthorn	Version 2.2		400	Plants
Sigmodon hispidus exsputus	Lower Keys Cotton Rat	Standard		1,000	Animals
Sigmodon hispidus insulicola	Insular Cotton Rat	Standard		1,000	Animals
Storeria dekayi pop. 1	Lower Keys Brown Snake	Standard		Island Extent	Animals
Stygobromus sp. 25	An Aquatic Cave Amphipod	Cave		250	Inverts-other
Sylvilagus palustris hefneri	Lower Keys Rabbit	Standard	Additional location data from Faulhaber et al. 2007 & Eaton et al. 2011	1,000	Animals
Tantilla oolitica	Rim Rock Crowned Snake	Standard		1,000	Animals
Tettigidea empedonepia	Torreya Pygmy Grasshopper	Standard		400	Inverts-insects
Thalictrum cooleyi	Cooley's Meadowrue	Version 2.2		400	Plants
Thamnophis sauritus pop. 1	Lower Keys Ribbon Snake	Standard		1,000	Animals
Trichechus manatus	Manatee	Aquatic	Manatee Workshop (see text)	n/a	Animals
Troglocambarus maclanei	North Florida Spider Cave Crayfish	Cave		250	Inverts-other
Troglocambarus sp. 1	Orlando Spider Cave Crayfish	Cave		250	Inverts-other
Ursus americanus floridanus	Florida Black Bear	Custom	Consulted FWC black bear experts and Tom Hoctor (UF)	n/a	Animals
Villosa choctawensis	Choctaw Bean	Aquatic	USFWS 2012, Final Critical Habitat determined primary aquatic habitat	n/a	Inverts-other

*The habitat mapping method follows protocols for standard, aquatic, and cave/spring species as described in this technical report; custom methods were applied to some species as described in this technical report; Version 2.2 indicates the species habitat map was not updated for the current version and methods are described in Version 2.2 of the Florida Forever Conservation Needs Assessment Technical Report.

†Sources other than FNAI staff or element occurrence database that informed occurrence extent, appropriate buffer radius distance, or other relevant mapping information. Note that for many elements FNAI was the sole source of information.

‡ All terrestrial plants were mapped with the standard mapping method and radius of 400 m unless otherwise noted in table.

Appendix H

Meetings of the Florida Forever Technical Expert Advisory Group and Expert Sub-groups

The following is a record of dates, goals and participants of meetings held by FNAI to review methods and results of data, analysis, and reporting related to the Florida Forever Conservation Needs Assessment. In addition to these formal meetings, FNAI has consulted with many individuals throughout the FFCNA process that are documented elsewhere in this or other reports.

August 17, 2000

Water Resources Expert Workshop

Review and provide feedback on how best to define and represent the Florida Forever measures related to water.

Participants: Jon Arthur (FGS), Eric Brockwell (DEP/Bureau of Information Systems), Ruark Cleary (DEP/Division of State Lands/Bureauof Invasive Plant Management), Mark Dietrich (DEP/Division of Water Resource Management [DWRM]), Amy Knight (FNAI), Gary Knight (FNAI), Karl Kurka (DEP/DWRM), Gary Mahon (USGS), Larry Nall (DEP/ Coastal and Aquatic Managed Areas [CAMA]), Jon Oetting (FNAI), Earl Pearson (DEP/CAMA), Kathleen Swanson (DEP/DWRM), Terry Bengtsson (SFWMD),Jacque Rippe (SFWMD),Jeff Herr (SFWMD), Don Boniol (SJRWMD),David Reed (SJRWMD),Gene Kelly (SWFWMD),Cheryl Hill (SWFWMD)

April 18, 2001

Florida Forever Workshop with National Center for Ecological Analysis and Synthesis (NCEAS)

Goal: Review the datasets and analyses of Florida Forever Conservation Needs Assessment

Participants: Sandy Andelman (UC Santa Barbara-NCEAS), Hilary Swain (Archbold Biological Station), Randy Kautz (FWC), Greg Brock (DEP), John Barrow (DEP), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI)

February 4-5, 2002

Florida Forever Technical Expert Advisory Group: Data Analysis Workshop

Goal: To design a scientifically supported method of integrating a diverse set of place-based natural resource data and synthesizing the resulting large, unwieldy amount of information into a practical format to help guide decision-makers and ensure progress toward meeting the goals of the Florida Forever program.

Participants: David Stoms (UC Santa Barbara), Hilary Swain (Archbold Biological Station), Jora Young (TNC), Doria Gordon (TNC), Richard Hilsenbeck (TNC), Fran James (FSU), Randy Kautz (FWC), Tom Hoctor (UF), Jim Cox (Tall Timbers Research Station), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI).

Duane Meeter (FSU), Sandy Andelman (UC Santa Barbara) and Steve Bohl (Div. Forestry) were unable to attend but are still part of the work group.

May 8, 2002

Florida Forever Technical Expert Advisory Group: Data Analysis Review Workshop for ARC

Goal: 1) Review the recommendations and results of an expert workshop held in February 2002 to develop a practical, scientifically sound evaluation method for Florida Forever projects based on Conservation Needs Assessment data; 2) Receive feedback from work group and ARC members on workshop results and final revisions to be made prior to June 6 ARC meeting; 3) Preview future analyses and discuss long-term application of the Conservation Needs Assessment data to the Florida Forever process.

Participants : ARC members & staff: Jack Moller, Paula Sessions, Hilary Swain*, Doug Bailey (FWC), Steve Bohl* (DOF), John Barrow (DEP/OES), Greg Brock* (DEP/OES), Mark Glisson (DEP/OES), Scott Sanders (FWC); FF Data Analysis Work Group: Fran James (FSU), Randy Kautz (FWC), Amy Knight (FNAI), Gary Knight (FNAI), Jon Oetting (FNAI); Others: Samantha Browne (DEP/OGT), Larry Nall (DEP/CAMA), Ellen Stere (DEP/CAMA), Suzanne Walker (DEP/OGT)

October 16, 2002

Florida Forever Technical Expert Advisory Group: Florida Forever Sites Workshop

Goal: Discuss the Sites reserve design model and receive input on setting acquisition targets for the Florida Forever program based on the legislative goals and measures.

Participants: David Stoms (UC Santa Barbara), Hilary Swain (Archbold Biological Station), Jora Young (TNC), Doria Gordon (TNC), Richard Hilsenbeck (TNC), Reed Noss (UCF), Randy Kautz (FWC), Tom Hoctor (UF), Duane Meeter (FSU), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI). (Note: final participant list could not be confirmed and may inadvertently exclude some participants)

October 22, 2002

Recreation Expert Workshop

GOAL: Discuss development of recreation data layer based on recommended criteria from recreation subgroups.

Participants: Suzanne Walker (OGT), Samantha Browne (OGT), Jerrie Lindsey (FWC), John Waldron (DOF), Greg Brock (DSL), Gary Knight (FNAI), Jon Oetting (FNAI), Amy Knight (FNAI)

April 16, 2003

Florida Forever Technical Expert Advisory Group: Florida Forever Sites Analysis Workshop II

Goal: To review iterative site selection analyses for both statewide planning and Florida Forever project evaluation. The work group will provide feedback on different model scenarios and how to interpret and present model results.

Participants: Hilary Swain (Archbold Biological Station), Jora Young (TNC), Doria Gordon (TNC), Fran James (FSU), Randy Kautz (FWC), Tom Hoctor (UF), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI), Steve Bohl (Div. Forestry), John Browne (Div. Forestry), Reed Noss (UCF), Greg Brock (DEP)

October 21, 2003

Florida Forever Expert Technical Advisory Group Workshop

Goal: To provide continued review and feedback of iterative site selection analysis, single resource ranking analysis, Florida Forever project evaluation, and presentation format for ARC.

Participants: Hilary Swain (Archbold Biological Station), Doria Gordon (TNC), Randy Kautz (FWC), Tom Hoctor (UF), Amy Knight (FNAI), Jon Oetting (FNAI), Reed Noss (UCF), Greg Brock (DEP)

April 24, 2006

Groundwater Recharge Expert Meeting

Participants: Amy Knight (FNAI), Jon Arthur (FGS), Tom Greenhalgh (FGS), Harley Means (FGS), Rick Copeland (FGS), David Anderson (FGS)

October 25, 2007

Groundwater Recharge Expert Meeting (via WebEx)

Participants: Amy Knight (FNAI), Terry Bengtsson (SFWMD), Chris Sweazy (SFWMD), Emily Richardson (SFWMD)Chris Richards (NWFWMD), Mark Barcelo (SWFWMD), Doug Munch (SJRWMD), David Hornsby (SJRWMD)

December 9, 2009

Florida Forever Expert Technical Advisory Group Workshop

Goal: Address potential revisions to Florida Forever data and analyses in light of new measures and a new project ranking scheme proposed in rule. Work group will provide feedback on data prioritization, project scoring methods, and overall analysis guidance.

Participants: Heather Pence (FDEP/OGT), Jim Wood (FDEP/OGT), Greg Brock (FDEP/Div. State Lands),Vickie Larson (Ecospatial Analysts; ARC), Paul Thorpe (NWFWMD), Robert Christianson (SJRWMD), Peter Frederick (UF; ARC), Dennis Hardin (DOF), Randy Kautz (Breedlove, Dennis & Associates), Hilary Swain (Archbold Biological Station), Tom Hoctor (UF), George Willson (The Conservation Fund), Jim Muller (Muller & Associates), Beth Stys (FWC), Joe North (FDEP/Watershed Data Services), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI) , Alicia Newberry (FNAI)

March 2010

Water Resource Expert Meeting

Goal: Review and provide input on proposed revisions to base map and prioritization for natural floodplain data layer.

Participants: Amy Knight (FNAI), Jon Oetting (FNAI), Robert Christianson (SJRWMD), Karen Kebart (NWFWMD), Tom Hoctor (UF), Joe North (DEP)

October 28, 2010

Florida Forever Expert Technical Advisory Group Workshop

Goal: Address potential revisions to Florida Forever data and analyses. Work group will provide feedback on data prioritization, project scoring methods, and overall analysis guidance.

Participants: Hilary Swain (Archbold Biological Station), Tom Hoctor (UF), Doria Gordon (The Nature Conservancy), Jim Muller (Muller & Associates), Robert Christianson (SJRWMD), Gary Cochran (FWC), Mike Hallock-Solomon (FFWC), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI). WebEx Participants: Greg Brock (FDEP/Div. State Lands), Dennis Hardin (DOF), Randy Kautz (Breedlove, Dennis & Associates), Beth Stys (FWC), Joe North (FDEP/Watershed Data Services), LuAnne Wilson (SJRWMD).

May 2, 2011

Florida Forever Expert Technical Advisory Group Workshop

Goal: Review and provide feedback on proposed Florida Forever Benchmarks analyses.

Participants: Jim Muller (Muller & Associates), Mike Hallock-Solomon (FFWC), Greg Brock (FDEP/Div. State Lands), Randy Kautz (Breedlove, Dennis & Associates), Paul Thorpe (NWFWMD), Carol Bert (NWFWMD), Amy Knight (FNAI), Jon Oetting (FNAI), Gary Knight (FNAI). WebEx Participants: Hilary Swain (Archbold Biological Station), Doria Gordon (The Nature Conservancy), Vickie Larson (Ecospatial Analysts), Beth Stys (FWC), Heather Pence (FDEP/Office of Greenways and Trails).

September 7, 2011

Florida Forever Expert Technical Advisory Group Workshop

Goal: Review and provide feedback on Florida Forever Benchmarks results.

Participants: Jim Muller (Muller & Associates), Mike Hallock-Solomon (FFWC), Greg Brock (FDEP/Div. State Lands), Randy Kautz (Breedlove, Dennis & Associates), Amy Knight (FNAI), Jon Oetting (FNAI). WebEx Participants: Doria Gordon (The Nature Conservancy), Robert Christianson (SJRWMD)

November 1, 2011

Florida Forever Expert Technical Advisory Group Workshop

Goal: Review and provide feedback on revisions to FFCNA data layers including prioritized natural communities, species for F-TRAC, natural floodplain, large landscapes, sea level rise and Greenways for F-TRAC.

Participants: Randy Kautz (Breedlove, Dennis & Associates), Greg Brock (DEP), Tom Hoctor (UF), Jim Muller (Muller & Associates), Amy Knight (FNAI), Jon Oetting (FNAI)

August 21, 2014

Florida Forever Expert Technical Advisory Group Workshop

Goal: Review and provide feedback on revisions to FFCNA data layers and proposed revisions to product formats and F-TRAC methods.

Participants: Larame Ferry (FFS), Brian Camposano (FFS), Dennis Hardin, Marianne Gengenbach (DEP), Janis Morrow (DEP), David Alden (FWC), Lance Jacobson (FWC), Peter van de Burgt (FWC), Beth Stys (FWC), Tom Hoctor (UF), J. B. Miller (SJRWMD), Doria Gordon (TNC), Jim Muller (Bay County), George Willson (TCF), Nathan Pasco (FNAI), Amy Knight (FNAI), Jon Oetting (FNAI), Hilary Swain (ABS), Karen Cummins (FFS)

April 28, 2015

Groundwater Recharge FGS Meeting

Goal: Review and provide recommendations for updates to prioritized Aquifer Recharge data layer.

Participants: Alan Baker (FGS), Jim Cichon (FGS), Tom Greenhalgh (FGS), Frank Rupert (FGS), Harley Means (FGS), Amy Knight (FNAI), Jon Oetting (FNAI), Nathan Pasco (FNAI)

May 11, 2015

Management Feasibility Agencies Meeting

Goal: To develop an approach for evaluating Florida Forever projects based on how well acquisition could enhance management of existing managed lands.

Participants: Marianne Gengenbach (DEP/DSL); David Clark (DEP/DSL); Larame Ferry (FFS); John Browne (FFS); Todd Knapp (FFS); Parks Small (DEP/DRP); Sine Murray (DEP/DRP); David Alden (FWC); Tom Houston (FWC); Gary Knight (FNAI); Jon Oetting (FNAI); Amy Knight (FNAI)

APPENDIX I

Recharge Potential Report from Advanced Geospatial, Inc.

FNAI - Recharge Component

Prepared For:
Florida Natural Areas Inventory
In fulfillment of FNAI FSU Subcontract No. R00914

Prepared by

Advanced GeoSpatial Inc., Raymond Diehl Rd., Ste D, Tallahassee, Florida 32308

March 2009

Professional Geologist Certification

I, Alan E. Baker, P.G., no. 2324, agree with the findings in this map and brief summary titled "**FNAI – Recharge Component"** and do hereby certify that I currently hold an active professional geology license in the state of Florida. The model and report were prepared by Advanced GeoSpatial Inc., a State of Florida Licensed Geology Business (GB491), and have been reviewed by me and found to be in conformance with currently accepted geologic practices, pursuant to Chapter 492 of the Florida Statutes.

Alan E. Baker, P.G.
Florida License No. 2324

April 7, 2009
Date

Introduction

Advanced GeoSpatial Inc. (AGI) was retained by the Florida Natural Areas Inventory (FNAI) to come up with a recharge model component to incorporate and enhance the way the agency represents aquifer recharge and hydrogeologic data in its spatial modeling process. After several meetings it was decided that AGI would simplify the process and come up with a layer (raster) that could be used in the models and was not biased towards any one aquifer. The inputs that were used were consistent with the Florida Aquifer Vulnerability Assessment (FAVA) developed by the Florida Geological Survey, part of the Florida Department of Environmental Protection (FDEP). The model layers or inputs were combined using a spatial analysis called Fuzzy Logic. To gather more information on the topic of Fuzzy Logic you look at the following websites.
http://www.seattlerobotics.org/encoder/Mar98/fuz/flindex.html
http://www.fuzzy-logic.com/

As stated in the previous paragraph the input layers used in the model were derived from the FAVA model (http://www.dep.state.fl.us/geology/programs/hydrogeology/fava.htm). These layers were; overburden (Fig 1), depth to water or thickness of the unsaturated zone (Fig 2), soil hydraulic conductivity (Fig 3) and karst or topographic depressions (Fig 4). Because the model was not aquifer specific a general map of recharge was desired. The layers were combined in a logical fashion based on observations derived from the FAVA model.

The final product was the delineation of areas in the state that are more likely to be active recharge areas based on available information at the time of this project. Likewise, this map of probable recharge does not attempt to "quantify" the amount of recharge in a particular area it merely sets out to designate areas that have the potential to be recharging the underlying aquifer(s). Areas delineated on the map as not likely recharging should not be excluded completely. The goal of this project was to set out and define the most probable areas. Some areas outside the range may actually be recharging, however, there is less confidence in these areas when compared to others based on the data available. These areas also may be recharging at a slower rate that is not related to quantity but more a factor of time. To clarify, the areas with higher confidence in recharge should be seen as areas that have a shorter timeframe for water at land surface reaching the aquifer. In areas with low confidence that have been identified as recharging by previous studies it could be implied that water reaches the aquifer in a much longer timeframe.

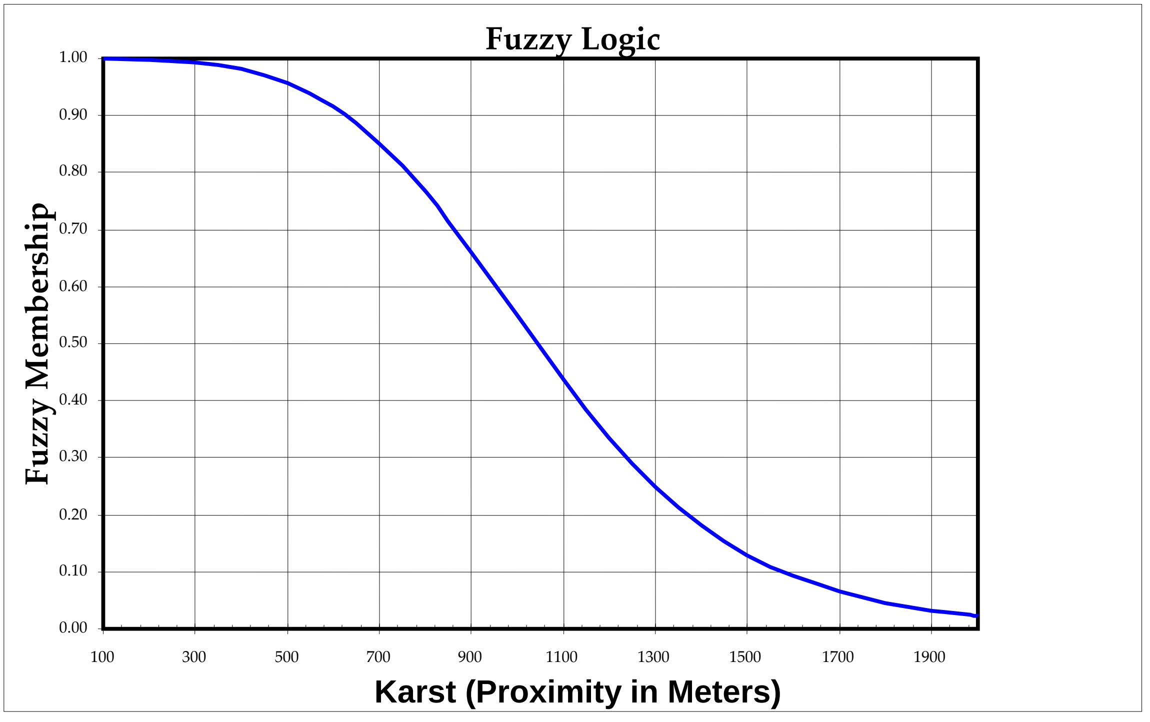
Methods

The maps were created by combing the individual map layers using fuzzy logic. Fuzzy logic is another way to combine weighted maps that is more flexible then index and overlay methods. This method is used to quantify conceptual processes because it emulates the flexibility of human reasoning by drawing conclusions from imprecise and incomplete information (Fang, 1997). This modeling technique is particularly useful when applied to evaluate fuzzy inputs because they tolerate imprecision and uncertainty and show marked reduction in information loss (Burrough et al., 1992).

The following text was taken from the Florida Aquifer Vulnerability Assessment or (FAVA): Contamination potential of Florida's principal aquifer systems, see references:

Fuzzy logic is a model that takes into account expert scientific knowledge to relate datasets and their relative level of importance with respect to the desired output. Fuzzy set theory uses gradational membership values to characterize continuous data, where the membership values reflect the degree of truth of some pre-position.

Fuzzy logic is comparable to Boolean logic (e.g., "and" and "or") because it addresses the concept of partial truths. The fuzzy logic model can be described as the process of assigning values to events using a gradational or continuous scale between 1 and 0, which represent true and false respectively. Fuzzy logic is an expert-driven progression in which the developer of the model assigns membership values based on their experience and knowledge of the data. Fuzzy set theory or fuzzy memberships address partial truths where 1 is full membership and 0 is full non-membership. For example, a partial truth using this method to define its membership can have a value of 0.8.



Graph 1. Fuzzy membership values relative to "proximity to karst" where areas within 100 m of a karst feature represent full membership and areas located 2,000 m from a karst feature is full non-membership. Figure for informational purposes only, data not used in FAVA results.

As an example, fuzzy membership assignment to the FAVA input data layer, "proximity to closed topographic depressions" is provided. An area's proximity to a karst feature is an important factor in determining its relative vulnerability. Distance to karst, for example, can be categorized into 100-m intervals and fuzzy logic can be used to assign values to those intervals. A value of 1 representing full membership would be assigned to areas closest to a karst feature. Areas that are farthest away from a karst feature would be given a value of 0 to represent full non-membership. Values between would then be interpolated from 1 and 0 (Graph 1).

Two or more maps with fuzzy memberships can be combined using a variety of fuzzy operators. They can be combined in a relational sense using Boolean operators to calculate the new data layer. The operators include: AND, OR, ALGEBRAIC and GAMMA. Each one of these operators has very different effects on a set of values.

Fuzzy Operator AND

The fuzzy operator AND is used to combine input data layers resulting in a new data layer which is controlled by the smallest fuzzy membership value occurring at a given location. The AND operation is appropriate where two or more pieces of evidence for a hypothesis must be present together for the hypothesis to be true (Bonham-Carter, 1994). This conservative operation involves the intersection of a set of values for which only the smallest of the membership values for a particular location are considered:

Fuzzy AND operator

Minimum (value 1, value 2)

Minimum (0.8, 0.45) = 0.45

Fuzzy Operator OR

The fuzzy operator OR involves the union of a set of values where maximum input data layer values control the output. The membership value in this case is limited by the best of the input data layers. It should be noted that both the operators AND and OR assign values for the new data layer from only one of the input data layers:

Fuzzy operator OR

Maximum (value 1, value 2)

Maximum (0.8, 0.45) = 0.8

Fuzzy Operator ALGEBRAIC (SUM & PRODUCT)

The fuzzy ALGEBRAIC operator comprises SUM and PRODUCT (PRD) functions. The fuzzy ALGEBRAIC operator SUM is an increasing association between two input data layers where two pieces of evidence that favor a hypothesis strengthen each other. The combined evidence is more supportive than the input data layers are individually and the new data layer is greater or equal to the largest contributing membership value:

Fuzzy SUM operator

$$1 - [(1 - \text{value } 1) * (1 - \text{value } 2)]$$

$$1 - [(1 - 0.8) * (1 - 0.45)]$$

$$1 - [(0.2)(0.55)]$$

$$1 - (0.11) = 0.89$$

The fuzzy ALGEBRAIC operator PRD is the decreasing association between two input data layers and is calculated by multiplying the fuzzy values to produce a new data layer. Because fuzzy input data layer values will be between 1 and 0, when these values are multiplied to produce a new data layer, their product will be equal to or lesser than the input data layer values. An example is below:

Fuzzy PRD operator

$$(\text{value } 1 * \text{value } 2)$$

$$(0.8 * 0.45) = 0.36$$

Fuzzy Operator GAMMA (γ)

The gamma operation is a combination of the ALGEBRAIC PRD and the ALGEBRAIC SUM where the γ is a parameter in the range of (0, 1). The function is defined as the fuzzy ALGEBRAIC SUM factored by γ, multiplied by the fuzzy algebraic PRD factored by 1- γ.

$$\text{GAMMA} = (\text{Fuzzy algebraic SUM})^{\gamma} * (\text{Fuzzy algebraic PRD})^{1-\gamma}$$

When the $\gamma = 1$ the outcome of the operation is the same as the ALGEBRAIC SUM, when $\gamma = 0$ the outcome is the same as the ALGEBRAIC PRODUCT. A γ value between 0 and 1 allows for variable compromises between the SUM and PRODUCT outputs. For example, if $\gamma = 0.7$ with the combination of (0.8, 0.45), the result equals 0.677. In this example the combination of the two grids decreases the output. Conversely, using a γ = 0.9 to combine the two layers using (0.8, 0.45) yields 0.813, which increases the association between the two layers. These examples are shown below:

If $\gamma = 0.7$,

and results from Fuzzy SUM and Fuzzy PRD

calculated above (0.89 and 0.36) are used, then:

$$[(0.89)^{0.7} * (0.36)^{1-0.7}]$$

$$[(0.92) * (0.74)] = 0.677$$

If $\gamma = 0.9$, then

and results from Fuzzy SUM and Fuzzy PRD

calculated above (0.89 and 0.36) are used, then:

$$[(0.89)^{0.9} * (0.36)^{1-0.9}]$$

$$[(0.90) * (0.90)] = 0.813$$

The first step was to combine the depth to water layer with the overburden layer. Overburden is defined for this analysis as the thickness of sediments overlying the Floridan aquifer system (FAS). Areas where the overburden was absent or thin were weighted heavier than areas that were thick. Likewise, areas where the depth to water table or vadose zone were thin was weighted heavier than thicker areas. The two map layers were then combined using an "or" statement where the best available evidence from the two layers is retained (Fig 5).

Next we took the Overburden/Depth to Water layer that was created and combined it with two other layers, soil hydraulic conductivity (Fig 3) and proximity to karst (Fig 4). Six different scenarios were evaluated using the fuzzy operators "OR" and "GAMMA". For the purposes of this submittal we will only talk about test 2 (Fig's 6 & 7) which is the combination of all fuzzy layers using a gamma value of 0.7. This is a value that slightly decreases the output from combining all of the other evidence. Other values were tested that over exaggerated the results and didn't do a good job of discerning between probable areas and non probable recharge areas.

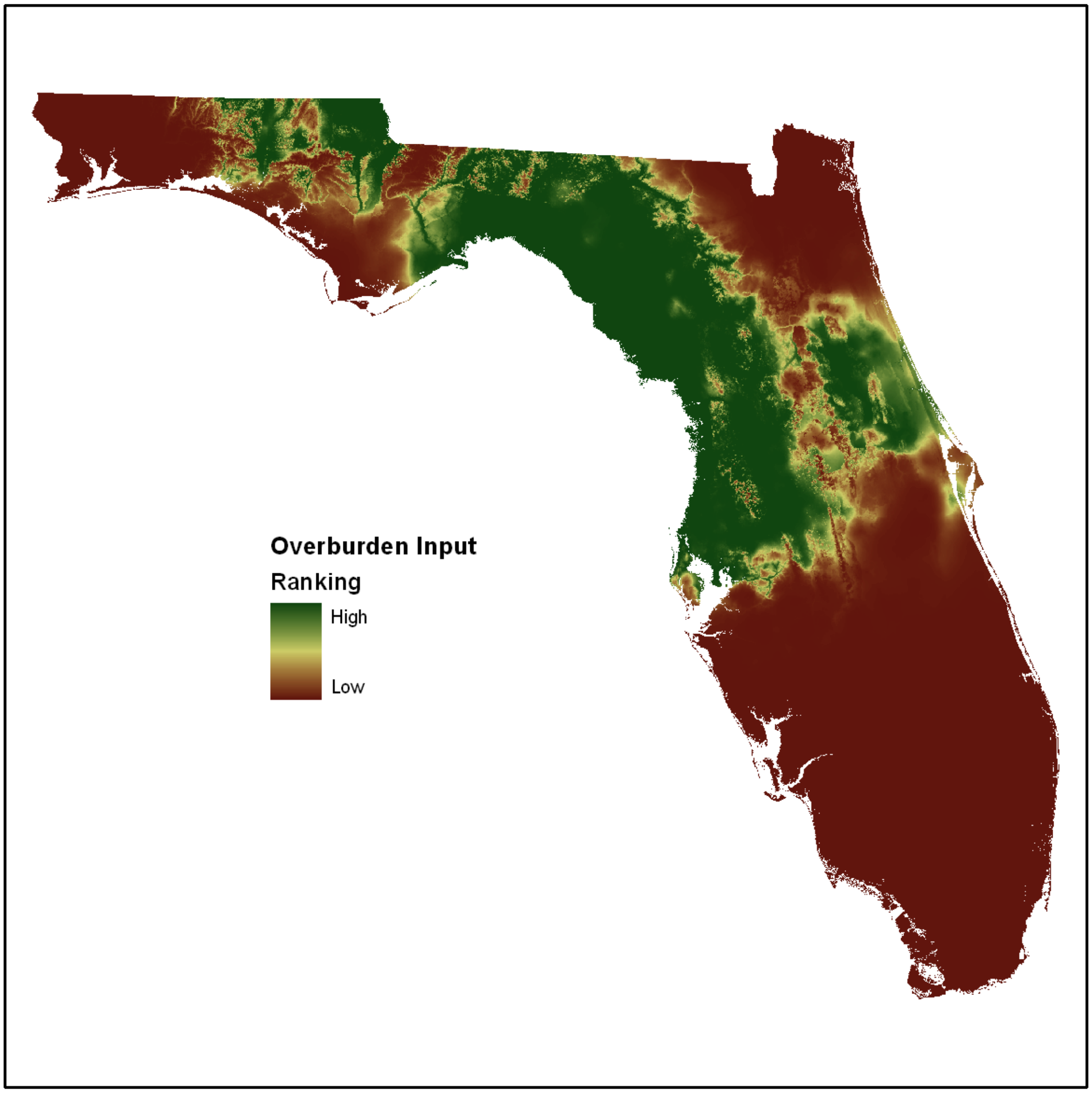


Figure 1, Overburden or thickness of sediments overlying the Floridan aquifer system. The layer is created by subtracting the modeled surface of the top of the Floridan aquifer from the digital elevation model for the state. Areas where the overburden is thin or absent were weighted higher than areas where the overburden was thick.

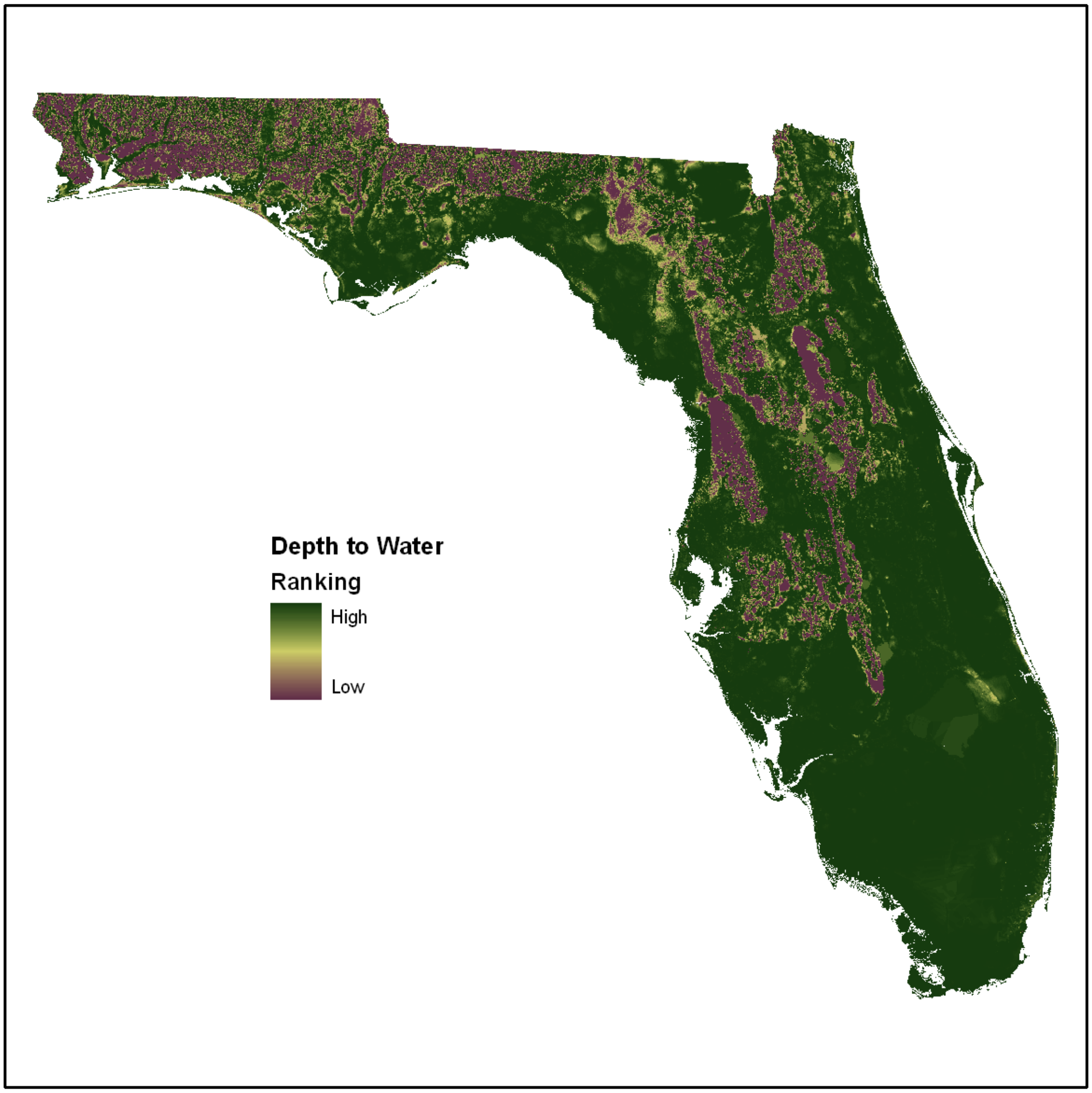


Figure 2. Depth to water. Layer was developed and used in the FAVA Surficial aquifer system model. This layer represents the thickness of unsaturated surficial sediments measured in feet. Thinner areas were assigned a higher value than thicker areas. Values ranged from 0 ft thick to a maximum thickness of approximately 100 ft.

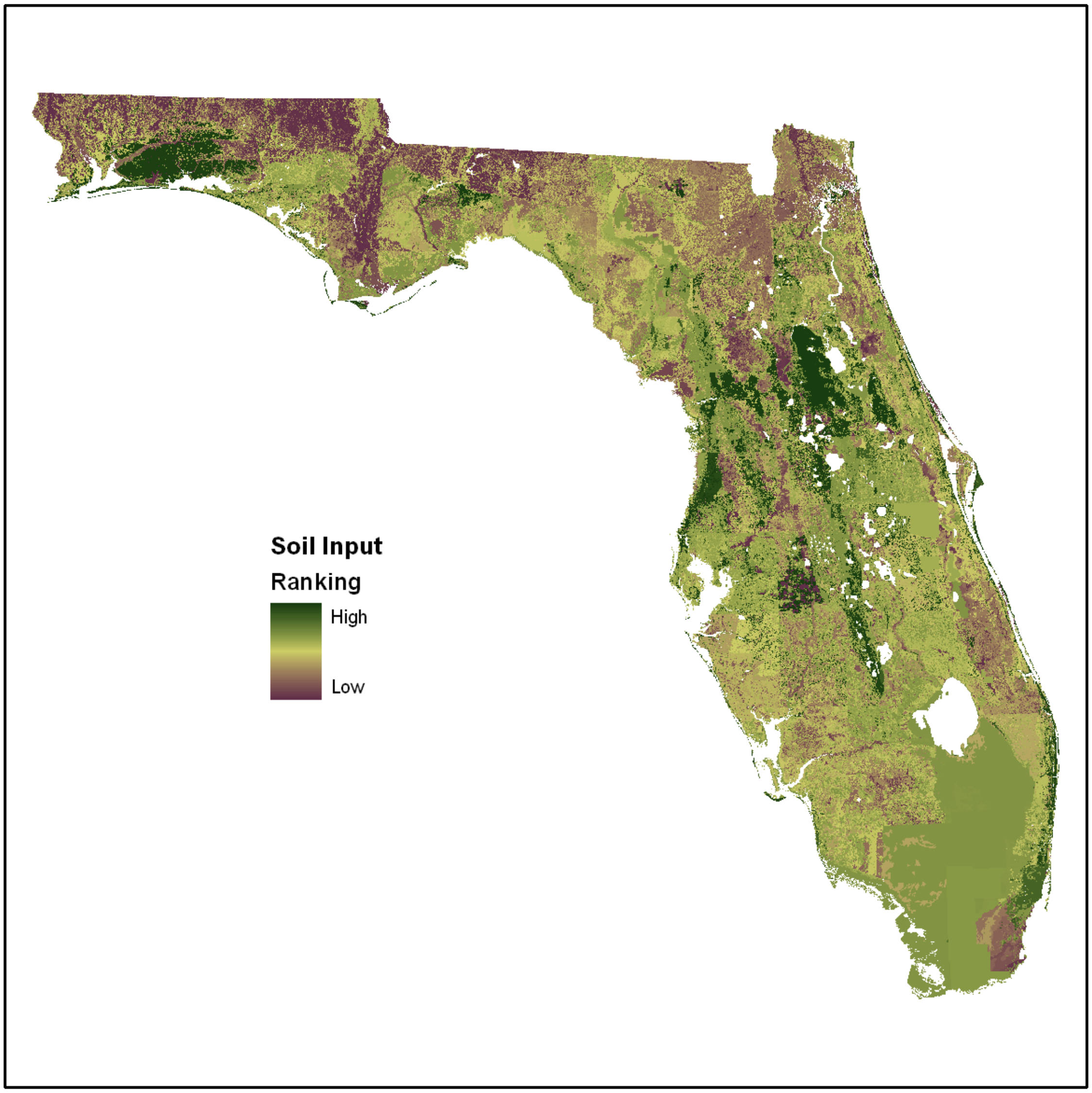


Figure 3, Soil Hydraulic Conductivity measured in inches per hour. This layer is derived from the USGS Soils coverages and their corresponding data tables were obtained from two sources: Florida Geographic Data Library [FGDL (2003)] and U.S. Department of Agriculture (USDA) NRCS. Average soil permeability values were calculated for each soil horizon layer using STATSGO and SSURGO permeability values. Then, based on soil horizon thicknesses, weighted-average permeability values were calculated for the entire soil column. This allowed the generation of a statewide data coverage of soils containing a single permeability value per soil polygon. Average weighted soil permeability values calculated for the State of Florida range from 0.1 in/hr to 59.6 in/hr. High permeability soils were given a higher value than lower permeability soils.

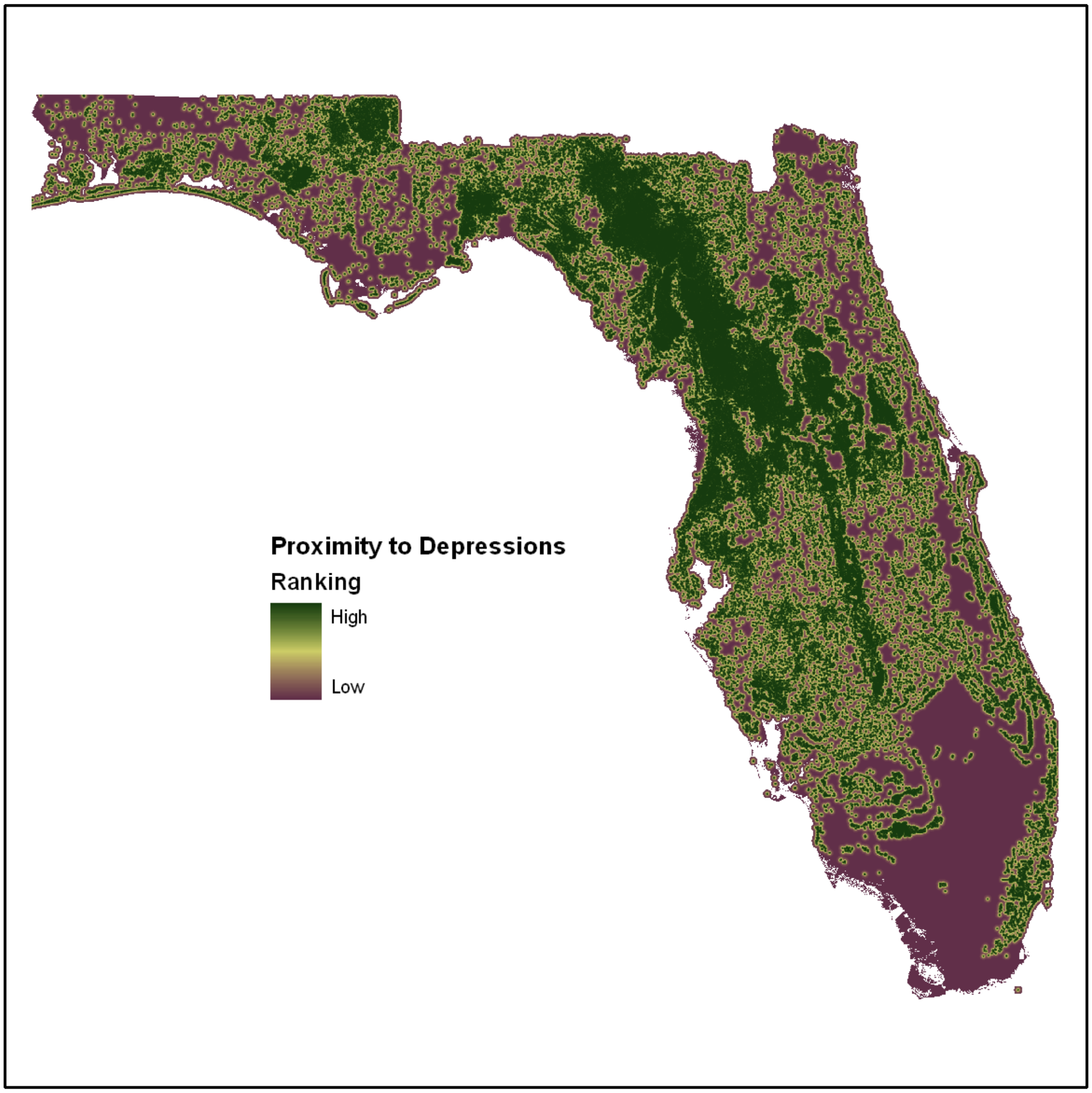


Figure 4, Proximity to karst features. This layer represents every topographic depression taken from the USGS 1:24,000 topographic maps. Each feature is buffered in 300m intervals up to a distance of 3,000m. The layer was weighted so that areas nearer to a closed depression were stronger than areas farther away. Areas over 3,000m away were given a value of zero.

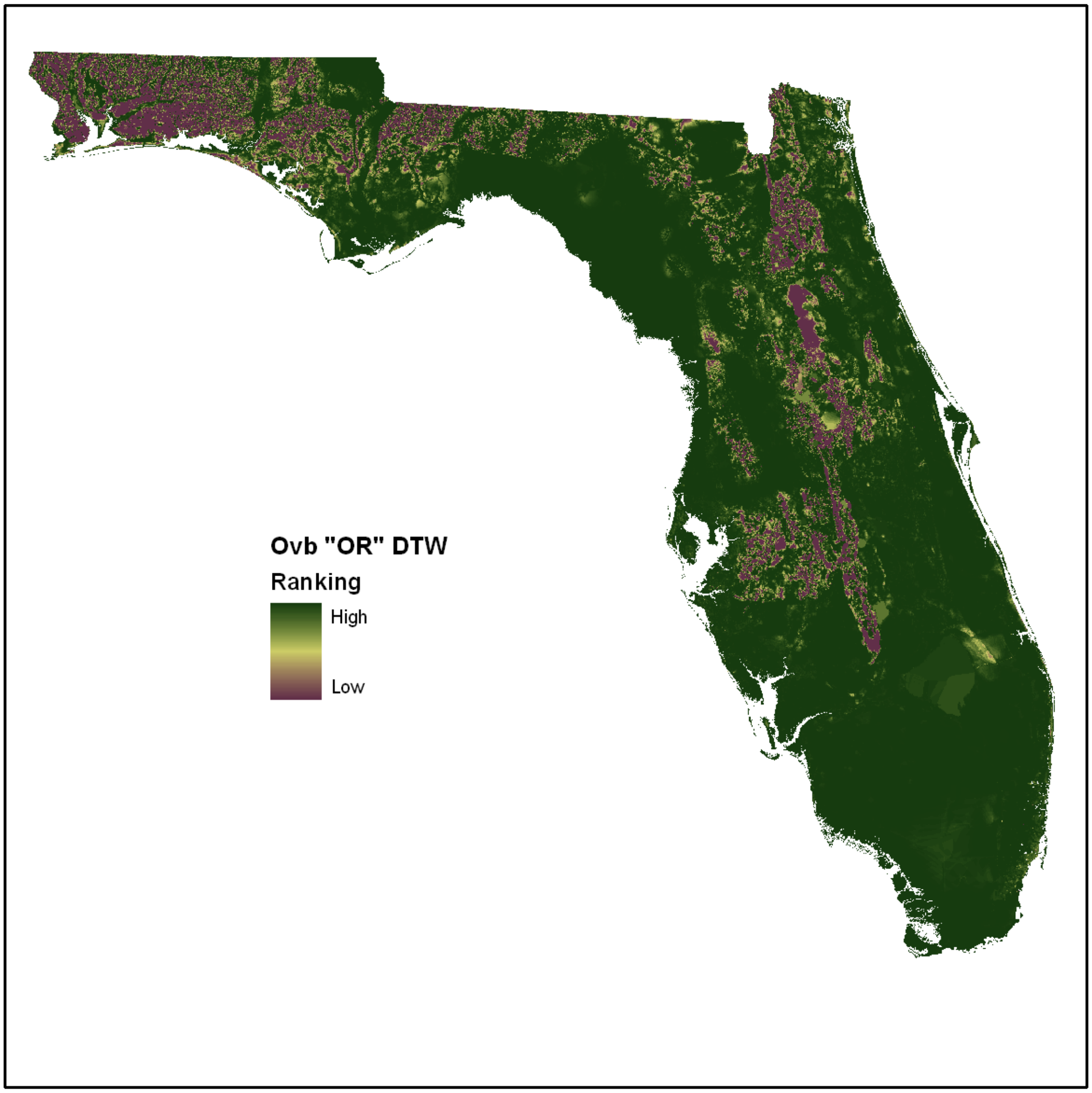


Figure 5, Depth to water "OR" overburden. The input layers overburden and depth to water were combined using an "OR" statement. By combining the two layers in this way we are taking the higher values of each layer where they overlap. This was done to remove any advantage of adding one more layer to the model that would bias the recharge component toward the Floridan aquifer system.

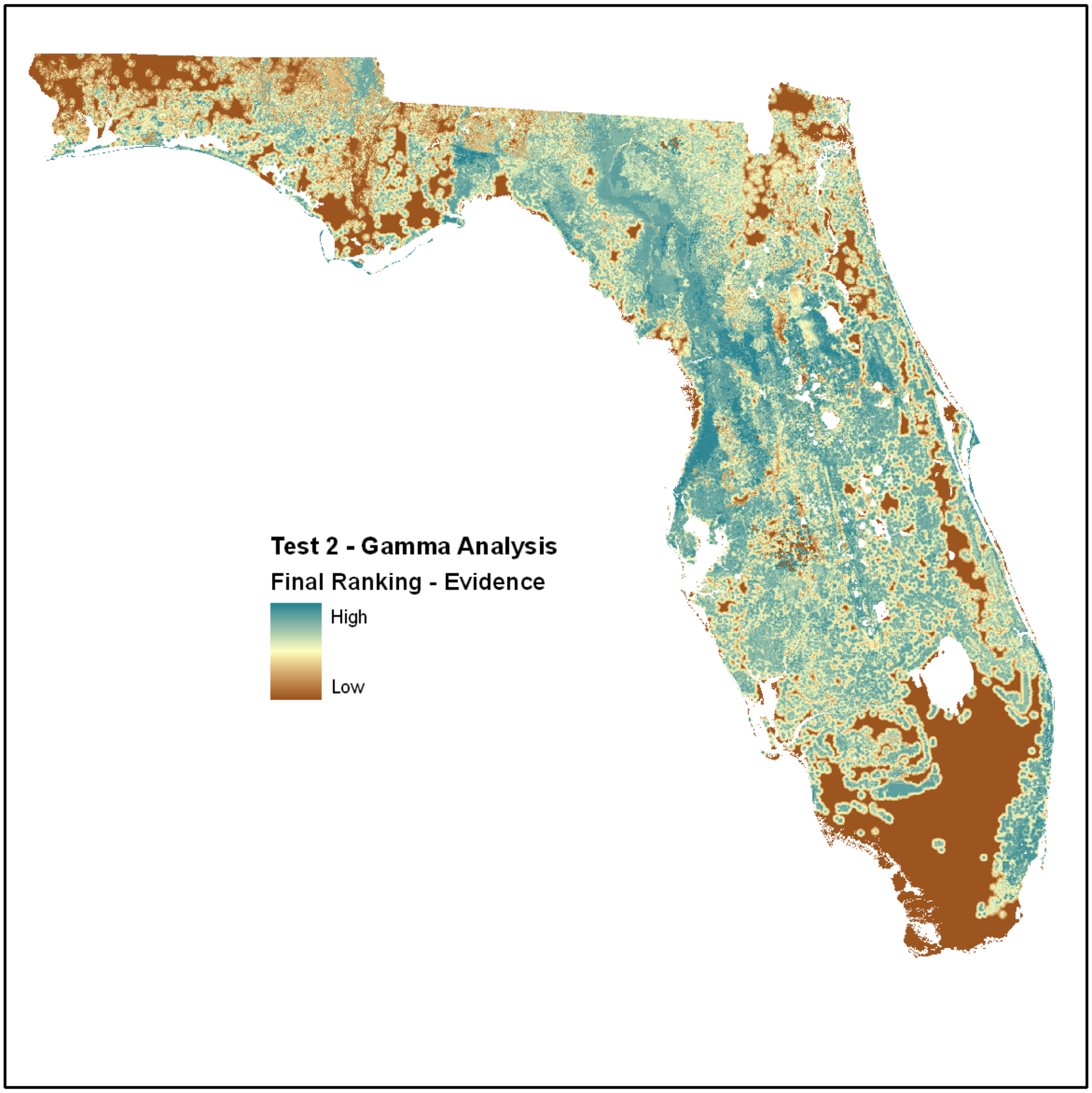


Figure 6, Test 2 – Gamma analysis represents the combination of the overburden-depth to water layer, the closed topographic depression proximity layer and the soils layer into a single map. Dark brown areas are less likely to be recharge areas and the darker green areas are more likely.

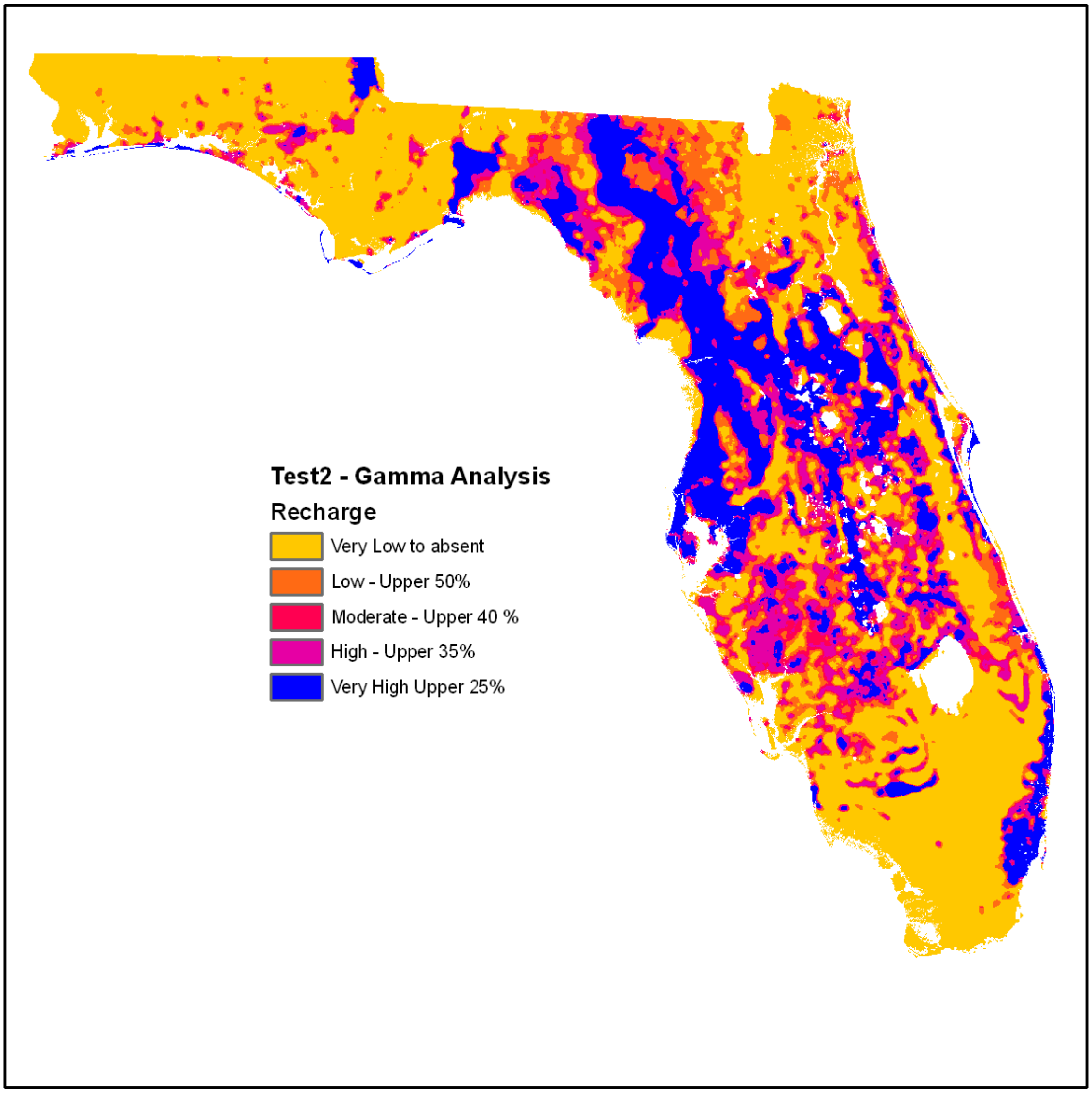


Figure 7, Test 2 – Gamma analysis symbolized by percentage of area. The orange areas are in the last 50% or area and are less likely to be recharge areas. Dark blue areas are more likely to be recharge areas and represent the upper 25%.

After comments received from SFWMD and SWFWMD AGI attempted to revise the maps and remove areas where recharge is not happening based on ground-water flow direction as in up, discharge or down, recharge. To do this AGI mapped the areas where the potentiomentric surface of the FAS is greater than the land surface elevation. The results were combined and a final map (Fig 8 & Fig 9) was created.

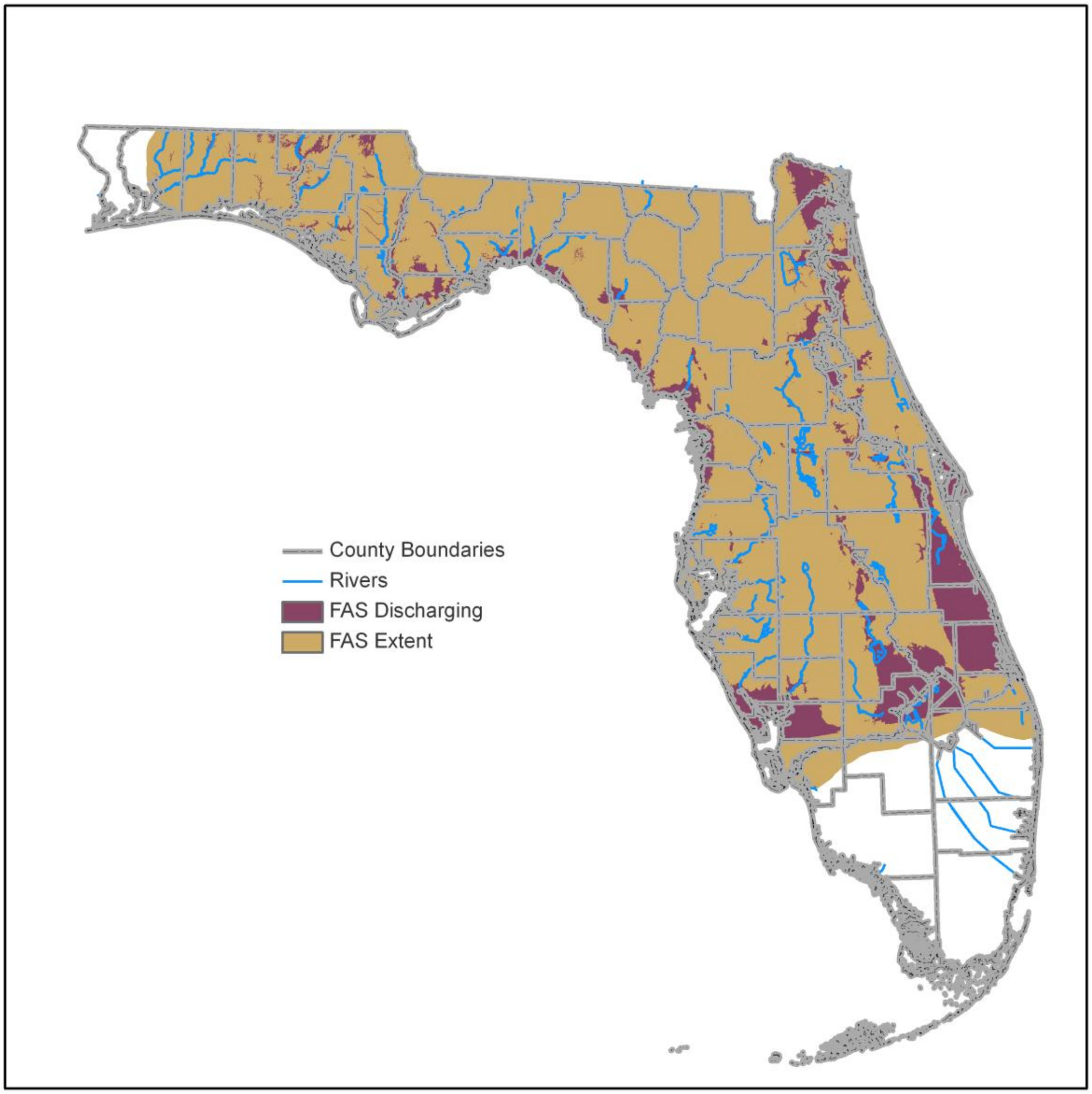


Figure 8. Discharge areas for the Floridan Aquifer System. Areas calculated by finding locations where the USGS 2000 FAS potentiometric surface map exceeds land surface. These areas should be combined with the results from the recharge potential map on a site by site basis.

Figure 9, Discharge areas for the Surficial Aquifer Systems. Areas calculated by finding locations where the simulated water table surface map exceeds land surface. These areas should be combined with the results from the recharge potential map on a site by site basis.

These discharging areas should be used as a separate overlay when using the recharge layer in evaluating a site for it's potential to be recharging. It should be noted that the spatial accuracy of the FAS potentiometric surface can be off by as much as 10 feet which is equal to the contour interval used to develop this surface.

REFERENCES

Arthur, J.D., Baker, A.E., Cichon, J.R., Wood, H.A.R., and Rudin, A., 2005, Florida Aquifer Vulnerability Assessment (FAVA): Contamination potential of Florida's principal aquifer systems: Report submitted to Division of Water Resource Management, Florida Department of Environmental Protection, 148 p

Bonham-Carter, G. F., 1994, Geographic Information Systems for Geoscientists, Modeling with GIS: Oxford, Pergamon, 398 p.

Burrough, P.A., MacMillan, R.A. and Van Deursen, W., 1992, Fuzzy classification methods for determining land suitability from soil profile observations: Journal of Soil Science, v. 43, p. 193-210.

Fang, J.H., 1997, Fuzzy Logic and Geology: Geotimes: News and Trends in Geoscience, v. 42, no. 10, p. 23-26.

Comments from Water Management District and Florida Department of Environmental Protection Staff

South Florida Water Management District - Terry Bengtsson

The analysis is an interesting approach. The text portion suggests (Figures 8 and 9) that results from Test 6 represents the Everglades better than Test 2. These results indicate that potential recharge is more likely south of Lake Okeechobee than in most areas of Collier County. I disagree with that. Test 2 results are more consistent for south Florida, though suggests very low likelihood of recharge in the central Collier County as well. I think there is a significant component that is overlook in the analysis, and it is related to how recharge is defined. Looking at recharge from a flow direction point of view, you have areas with a downward or upward flow component; recharge and discharge areas. Following classic work by Toth (1963) and Freeze and Witherspoon (1967), regional, intermediate and local flow patterns create local and regional recharge and discharge areas. The abundance of closed-circular depressions (karst) in central highlands is likely to define a recharge area, while karst areas along the coast are likely discharge areas. The Withlacoochee River Basin in West-Central Florida has karst and is likely a discharge area from an intermediate flow pattern. The Silver Bluff area in Dade County has a micro-karst and is a significant local recharge area. Can the approach accommodate another gamma analysis using a data layer with up and down ground-water flow directions?

AGI Response:

Hi Terry thanks for your input. The model can certainly accommodate another analysis. The only dilemma I see is the availability of a layer that is statewide depicting upward/downward movement. I have looked at this issue before while working on projects that were regional and aquifer specific but never using multiple aquifers from very different regions. I suppose one approach may be to locate areas that have an upward signal and remove those areas from the analyses. This could be done by compiling the regional potsurface maps and then locating all areas where the potsurface or water table exceeds or is very near land surface. Might you have any other suggestions on how to approach this concept?

Florida Geological Survey - Tom Greenhalgh

printed attachment and gave it a cursory review. I don't know if you could include but very significant recharge occurs via swallets at the margins of low permeability soils that border and are topographically higher in elevation than high permeability soils, overburden thickness abrupt changes, scarps or scarplets.

Southwest Florida Water Management District - Dave DeWitt

I've looked over the chapter on recharge analysis a few times now, and I've also read Terry Bengtsson's reply (Terry used to work here at the SWFWMD so he's familiar with the Withlacoochee River area and the ridge hydrogeology also). I'm not sure if you can test his suggestion regarding upward or downward flow potentials, it may be too complicated and beyond the purpose of your immediate task, or conversely too over-simplified if you would use old existing generalized maps showing regions of groundwater discharge. I do agree that Test 6 appears to rank the northern Everglades region too high, but there is some pretty complex hydrostrat in the southeastern peninsula.

I think the west coastal area does exibit high localized recharge, even though regionally it is considered a discharge zone (for the Upper Floridan aquifer) so the Test 2 results with emphasis on proximity to karst or closed topo depressions makes sense to me. That area doesn't change much in Test 6 and I suppose it's from both the shallower depth to water (or thinner overburden, which can be the reason for the shallower water table in some areas). I do get Terry's meaning about the Withlacoochee corridor too, but for purposes of the FNAI report, it may not be that significant.

Northwest Florida Water Management District - Chris Richards

As you will note in my comments, the active recharge occurring in Santa Rosa and Escambia counties was not identified by the criteria and methods applied. Stream base flow and the susceptibility to contamination (and known contamination) show this to be an area of active recharge. As you know, the aquifer being recharged is also a sole source aquifer.
Figures 7, 9 and 10 essentially eliminate the probability that this is as area of active recharge, when in fact; it is a known area of active recharge.

AGI Response:

Thank you for your response and comments. I agree that the Sand & Gravel is not well represented here and your point about high base flow in the streams in the area is a great point. That part of the state does not fare well in modeling efforts when we compare those areas with ones further south in those counties. The main factors driving the model in those areas, as you suggest is depth to water and soil hydraulic conductivity. I will admit that the soils data available from the USDA implies more precision than there really is. Do you have any information on recharge rates in that region? I would like to research it a little further and see if there is something we can add to the model.

I may not have stated this clearly in my introduction but this component will be used in the FNAI model that helps them identify and secure vulnerable land. That being said, I don't want to make the statement that recharge is not happening in certain areas. Rather that we have high confidence that recharge is happening in these areas based on the input into the model. The main reason for the poor confidence in that region is that the soils in that area are not as conductive as in other parts of the county. With that being said, we realize that this is not a catchall for recharge and in no way should these results be used in place of Water Management District specific information. This was more of a broad attempt to locate vulnerable/higher recharge areas. We were also aiming to remove any bias there may be with specific aquifers.

Northwest Florida Water Management District Response 2 - Chris Richards

I did get the point that you were not saying recharge was not happening. However, a previous draft document (Aug 2007) noted the model results will be used to further prioritize important recharge areas by incorporating additional data related to springs and public water supply. It would be unfortunate if this area is not properly represented.
Two of the data layers bias the results to the Floridan Aquifer. The Floridan Aquifer overburden layer and the karst layer work well identify important (or likely important) recharge areas for the Floridan Aquifer, but serve to greatly reduce the probability that important recharge areas will be identified where the Floridan Aquifer is deeply buried and hence, karst not well developed. This bias favors Floridan Aquifer recharge. Unfortunately, unlike in south Florida, this bias is not overcome by the various applications of soil hydraulic conductivity and/or depth to water.

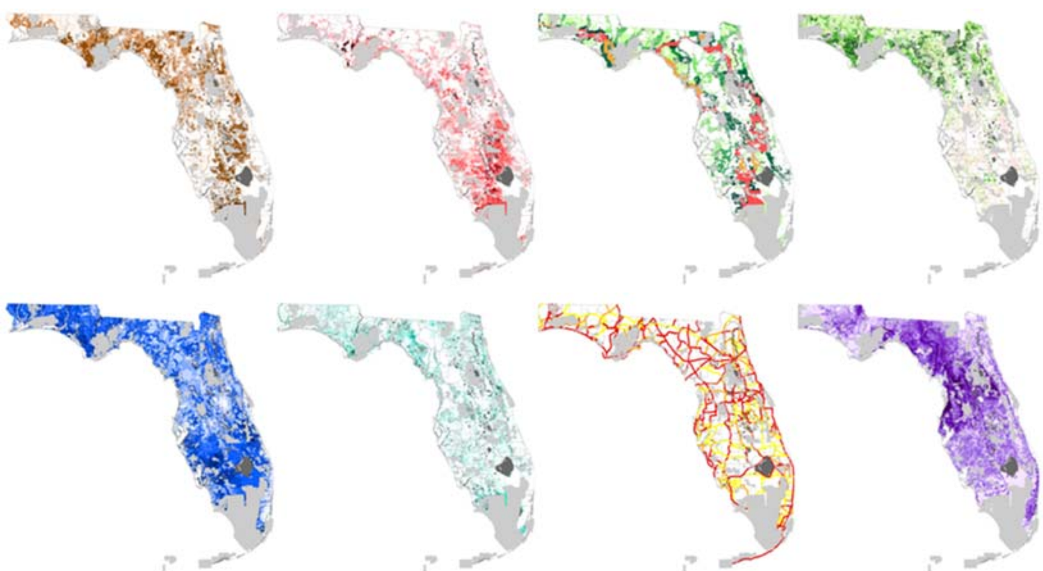
Yes, information regarding recharge rates to the Sand-and-Gravel Aquifer is available. I recommend you review two USGS reports which evaluate Sand-and-Gravel Aquifer recharge rates using stream base flow separation techniques. These provided good data and information regarding recharge rates for the Sand-and-Gravel Aquifer. The two reports are:

Water Resources Investigations Report 90-4195
http://pubs.er.usgs.gov/usgspubs/wri/wri904195
Water Resources Investigations Report 94
http://pubs.er.usgs.gov/usgspubs/wri/wri944179

Florida Forever Conservation Needs Assessment
Overview Maps

Prepared by Florida Natural Areas Inventory, November 2018

The maps in this document are derived from the Florida Forever Conservation Needs Assessment, an analysis of the geographic distribution of certain natural resources and resource-based land uses that have been identified in the Florida Forever Act (F.S. 259.105) as needing increased conservation attention. Data for the Needs Assessment are maintained and updated by Florida Natural Areas Inventory under contract to the Florida Department of Environmental Protection and in collaboration with many partners. The data represent a statewide view of resource distributions and are intended to inform state conservation priorities and measure progress of the Florida Forever program in protecting these resources.



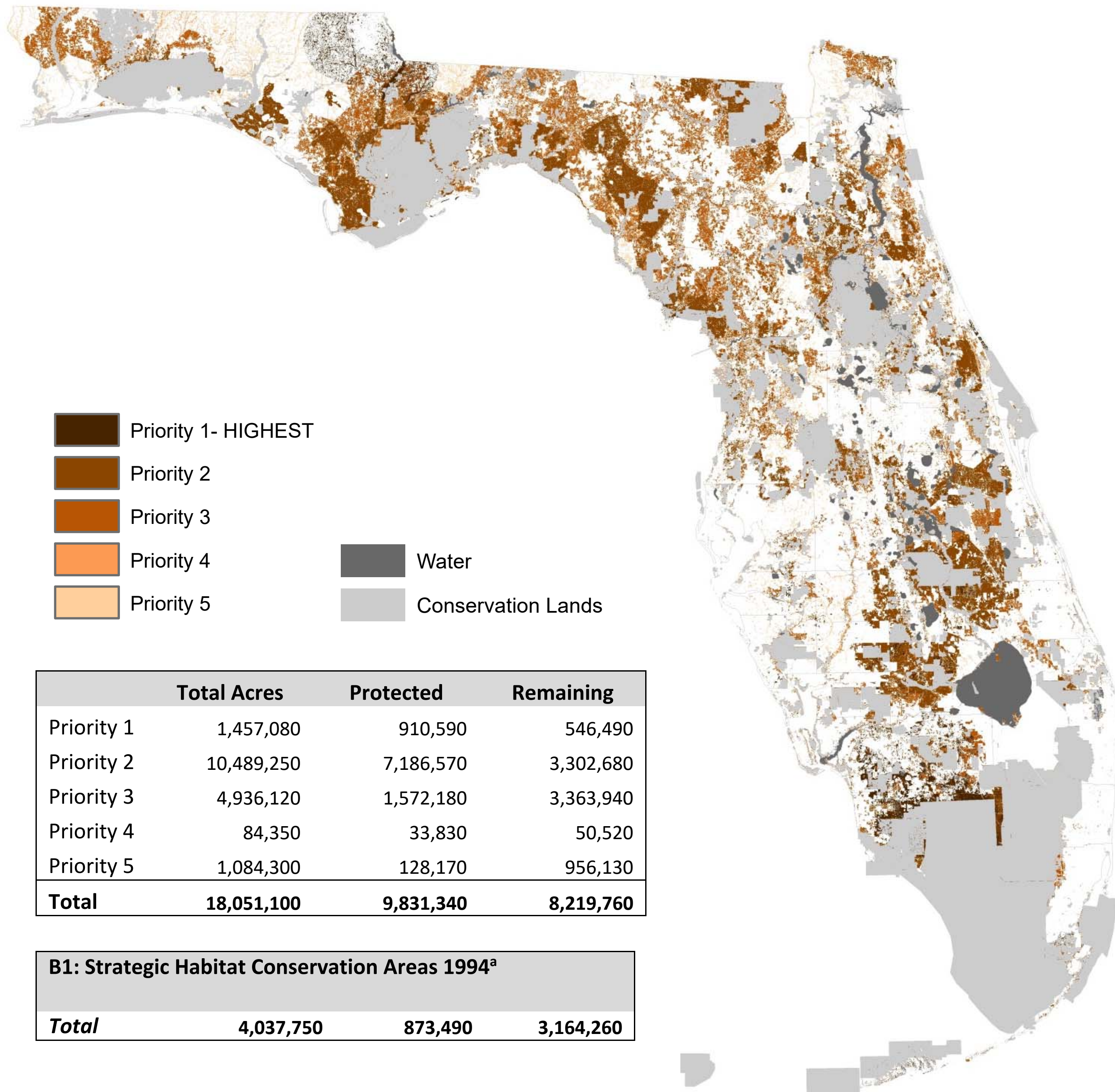
FLORIDA Natural Areas INVENTORY

DEPARTMENT OF ENVIRONMENTAL PROTECTION FLORIDA

Florida Forever Conservation Needs Assessment Overview Maps

Conservation Needs Assessment Maps

Strategic Habitat Conservation Areas *(modified for Florida Forever Conservation Needs Assessment)*



	Total Acres	Protected	Remaining
Priority 1	1,457,080	910,590	546,490
Priority 2	10,489,250	7,186,570	3,302,680
Priority 3	4,936,120	1,572,180	3,363,940
Priority 4	84,350	33,830	50,520
Priority 5	1,084,300	128,170	956,130
Total	**18,051,100**	**9,831,340**	**8,219,760**

B1: Strategic Habitat Conservation Areas 1994[a]			
Total	**4,037,750**	**873,490**	**3,164,260**

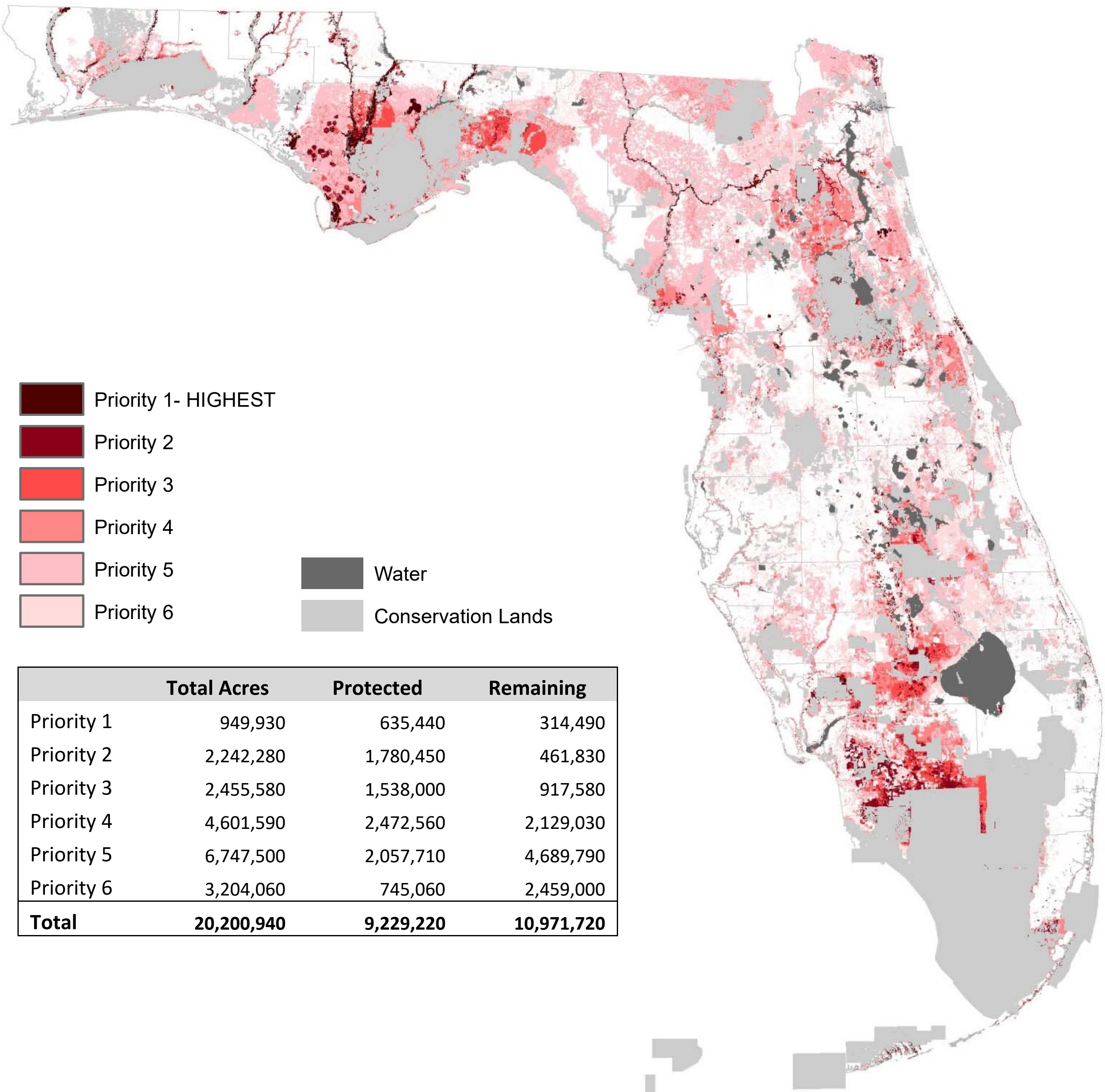
November 2018

The information displayed on this map was developed or provided to address specific performance measures of the Florida Forever program. The data may not be *appropriate* for general use and are not intended for use in a regulatory decision making process.

Source: Florida Fish and Wildlife Conservation Commission

Description: The 2009 SHCAs identify areas of habitat on private lands that are essential to sustain a minimum viable population for focal species of terrestrial vertebrates that are not adequately protected on existing conservation lands. To more adequately represent habitat within existing conservation lands, FNAI worked with FWC to augment the original SHCA dataset to include potential habitat within conservation lands for all 62 focal species. The modified SHCAs include habitat data for 62 terrestrial vertebrate species and are prioritized into five priority classes based on rarity (FNAI State and Global ranks). For more information on the modified SHCAs, see the Cons. Needs Assessment Tech. Report: http://www.fnai.org/FlForever.cfm. Note that the 2009 SHCAs constitute a significant revision of the original SHCAs published in 1994 which identified approximately 4 million acres for 30 focal vertebrate species. For more information: http://research.myfwc.com/features/view_article.asp?id=29815.

Rare Species Habitat Conservation Priorities



	Total Acres	Protected	Remaining
Priority 1	949,930	635,440	314,490
Priority 2	2,242,280	1,780,450	461,830
Priority 3	2,455,580	1,538,000	917,580
Priority 4	4,601,590	2,472,560	2,129,030
Priority 5	6,747,500	2,057,710	4,689,790
Priority 6	3,204,060	745,060	2,459,000
Total	**20,200,940**	**9,229,220**	**10,971,720**

November 2018

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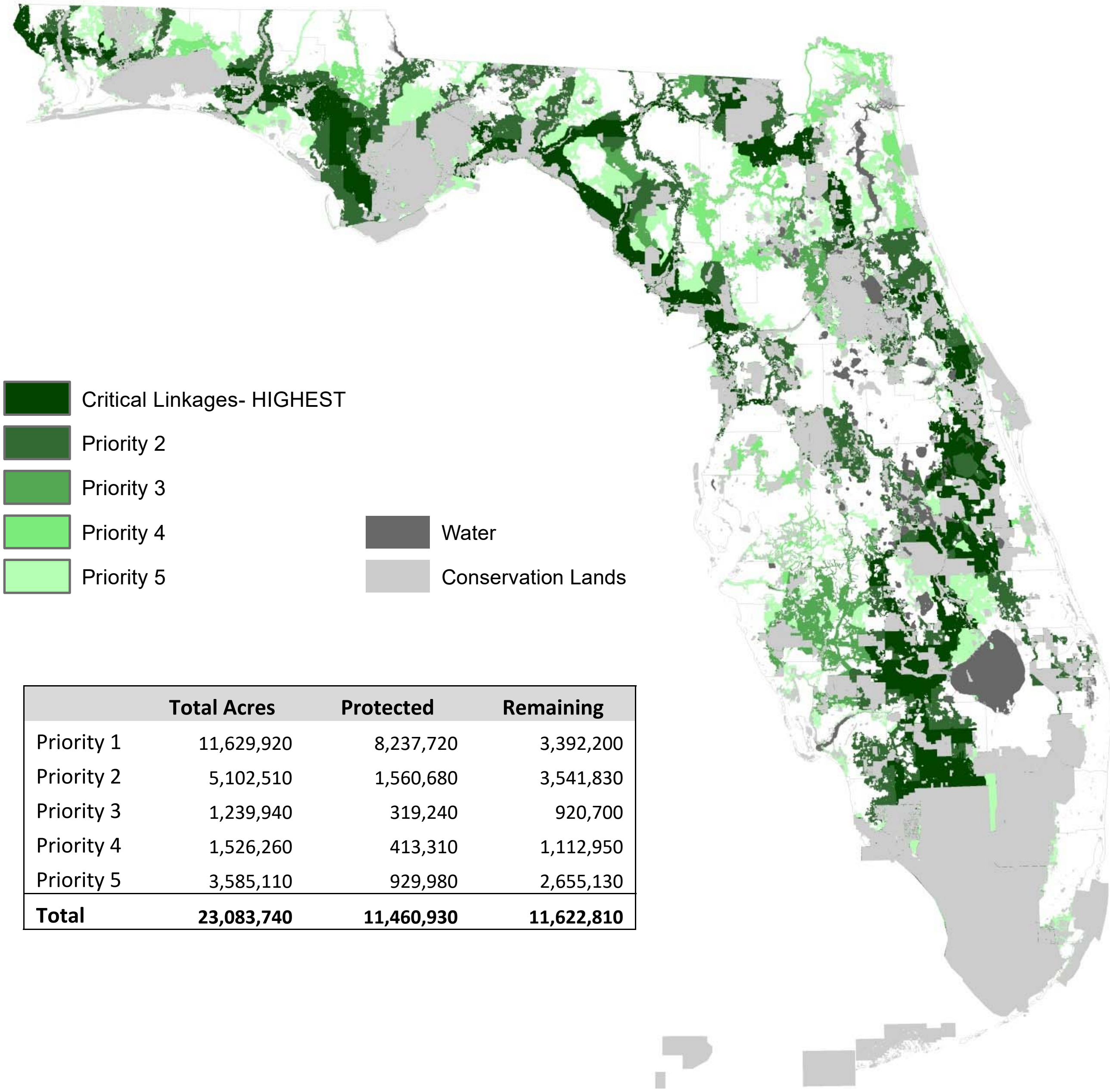
Primary Source: Florida Natural Areas Inventory

Description: The Rare Species Habitat Conservation Priorities data layer includes occurrence-based habitat for 281 species with a high conservation need including plants, invertebrates, and vertebrates. Individual species maps are weighted according to conservation need and overlaid to reflect values for both rarity and richness. The final layer prioritizes places on the landscape that would protect both the greatest number of rare species and those species with the greatest conservation need. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Landscape Linkage



	Total Acres	Protected	Remaining
Priority 1	11,629,920	8,237,720	3,392,200
Priority 2	5,102,510	1,560,680	3,541,830
Priority 3	1,239,940	319,240	920,700
Priority 4	1,526,260	413,310	1,112,950
Priority 5	3,585,110	929,980	2,655,130
Total	**23,083,740**	**11,460,930**	**11,622,810**

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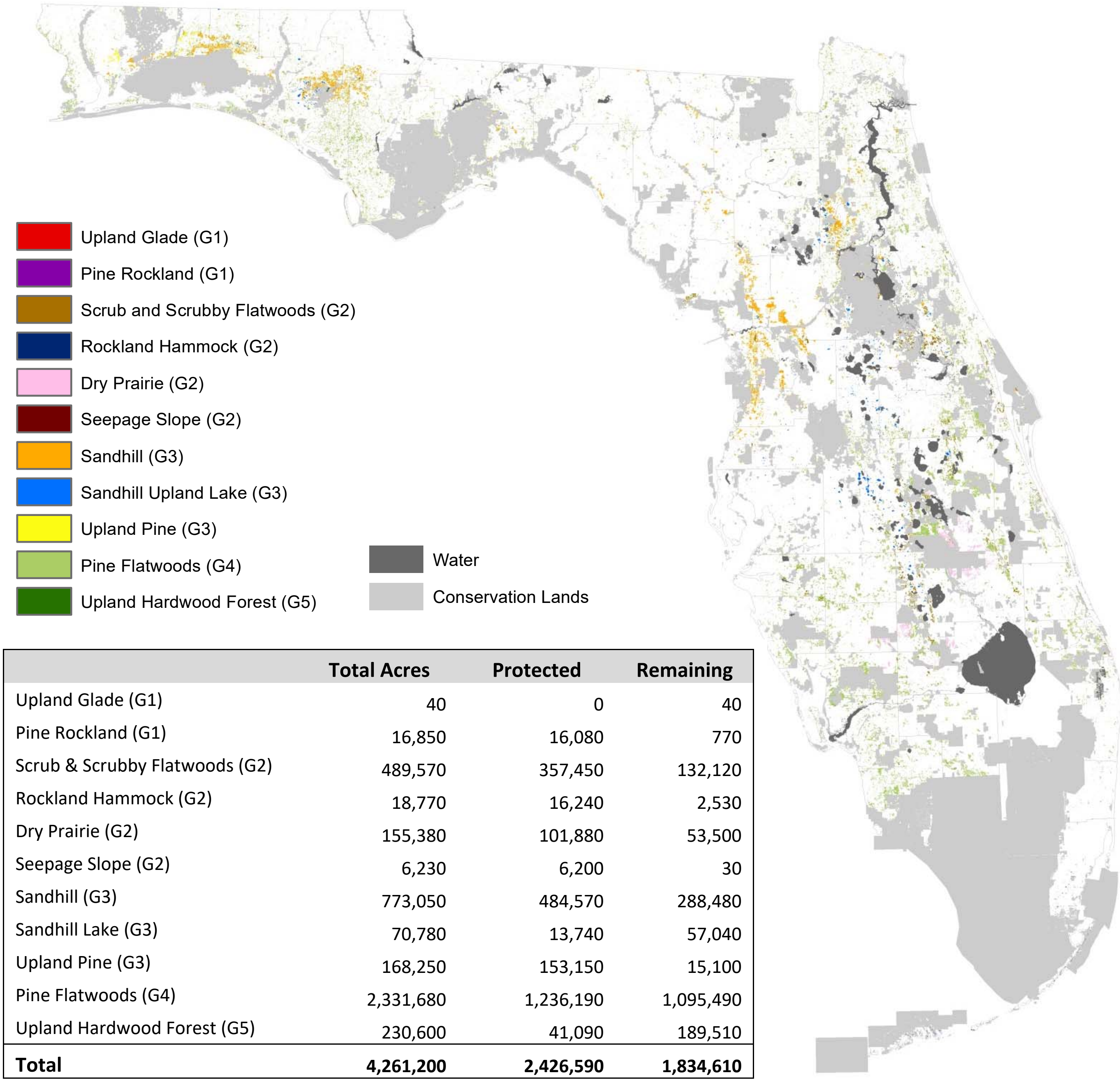
November 2018

Primary Source: University of Florida; FDEP/Office of Greenways and Trails

Description: Landscape Linkages is represented by the Florida Ecological Greenways Network as revised in 2016, a statewide system of landscape hubs, linkages, and conservation corridors. Prioritization is based on factors such as importance for wide-ranging species, importance for maintaining a connected reserve network, and riparian corridors. Critical Linkages are considered most important for completing a statewide ecological network of public and private conservation lands.

Under-represented Ecosystems



	Total Acres	Protected	Remaining
Upland Glade (G1)	40	0	40
Pine Rockland (G1)	16,850	16,080	770
Scrub & Scrubby Flatwoods (G2)	489,570	357,450	132,120
Rockland Hammock (G2)	18,770	16,240	2,530
Dry Prairie (G2)	155,380	101,880	53,500
Seepage Slope (G2)	6,230	6,200	30
Sandhill (G3)	773,050	484,570	288,480
Sandhill Lake (G3)	70,780	13,740	57,040
Upland Pine (G3)	168,250	153,150	15,100
Pine Flatwoods (G4)	2,331,680	1,236,190	1,095,490
Upland Hardwood Forest (G5)	230,600	41,090	189,510
Total	**4,261,200**	**2,426,590**	**1,834,610**

November 2018

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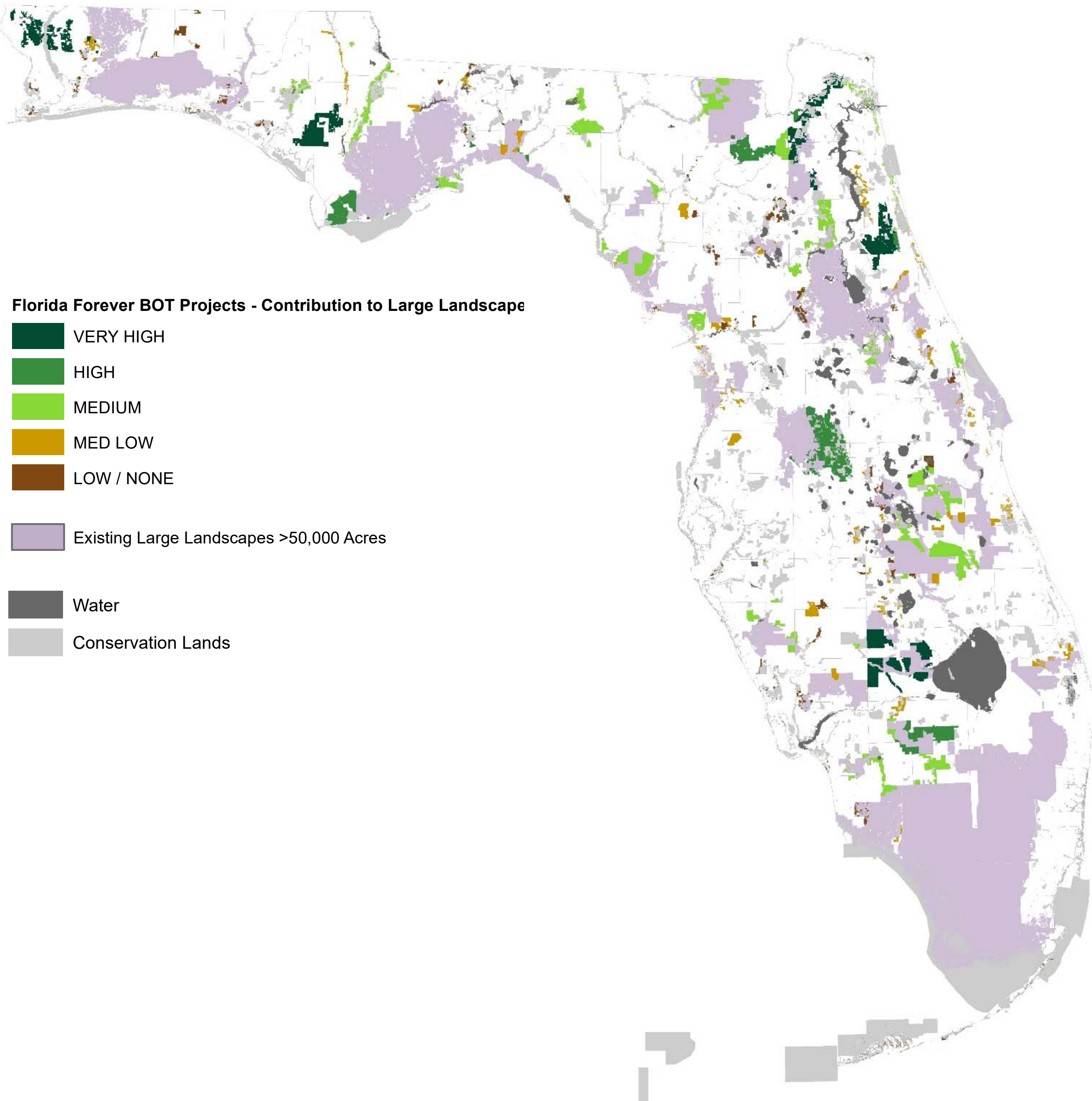
Primary Source: Florida Natural Areas Inventory

Description: This data layer includes natural communities that are inadequately represented on conservation lands. A natural community generally is considered under-represented if less than 15% of the original extent of that community in Florida is currently found on existing conservation lands. The natural communities are prioritized by rarity (FNAI Global rank). For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Large Landscapes



November 2018

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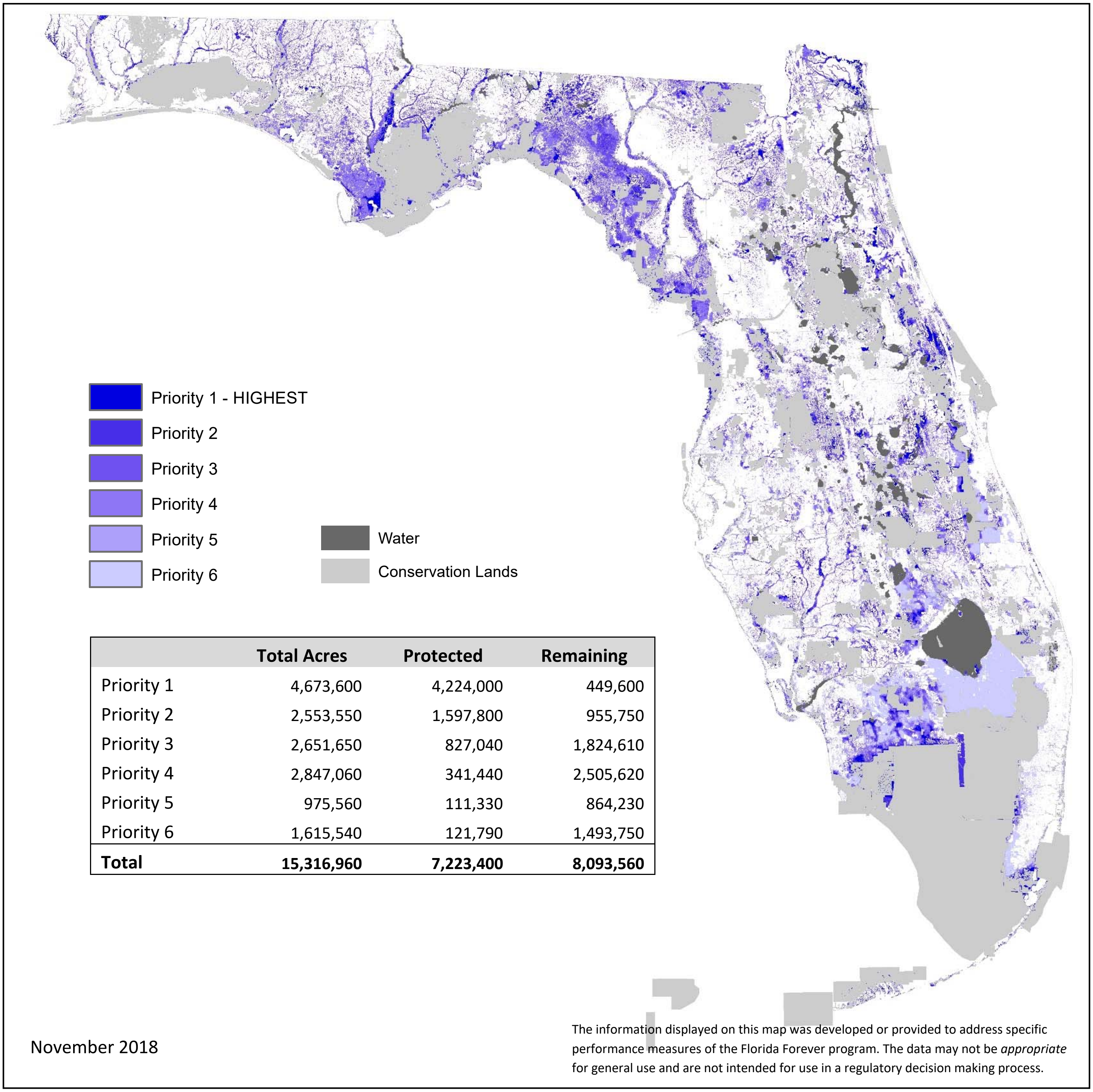
Primary Source: Florida Natural Areas Inventory

Description: The Large Landscapes dataset depicts existing conservation land complexes that comprise contiguous areas of >50,000 acres. Current Florida Forever BOT Projects are prioritized based on their potential contribution to large landscapes >50,000 acres. Protection of these areas would contribute to maintenance of ecosystem processes on a landscape level. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Natural Floodplain Function

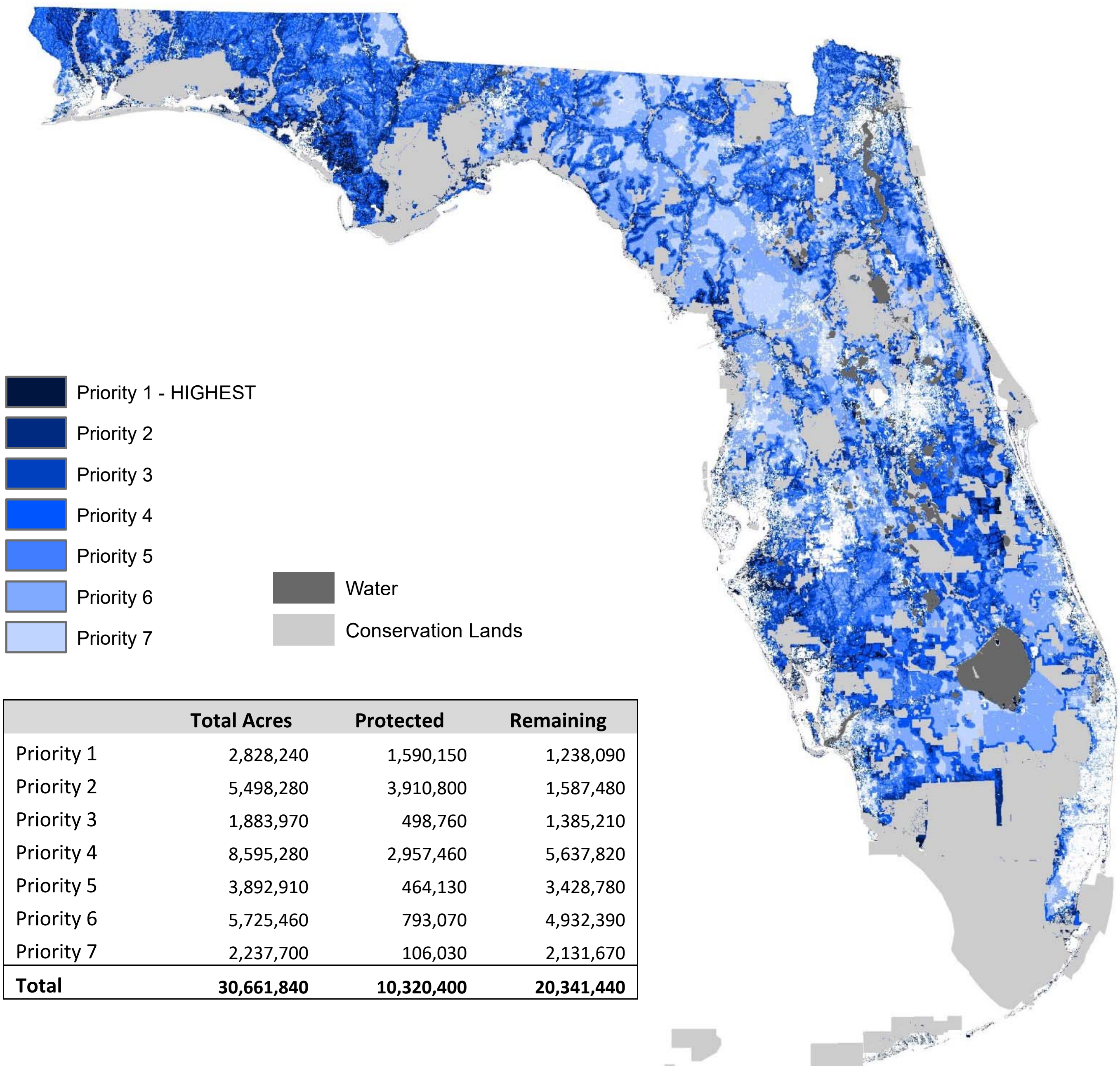


	Total Acres	Protected	Remaining
Priority 1	4,673,600	4,224,000	449,600
Priority 2	2,553,550	1,597,800	955,750
Priority 3	2,651,650	827,040	1,824,610
Priority 4	2,847,060	341,440	2,505,620
Priority 5	975,560	111,330	864,230
Priority 6	1,615,540	121,790	1,493,750
Total	**15,316,960**	**7,223,400**	**8,093,560**

Primary Source: Florida Natural Areas Inventory

Description: This data layer identifies natural features within the 100-year floodplain as determined by from three primary sources: 1) FEMA Digital Flood Insurance Rate Map database 2001-207 (DFIRM) for 63 counties; 2) FEMA Digital Q3 Flood Data 1996 for 4 counties; and 3) a surrogate floodplain dataset based on overlap of wetlands and hydric soils for gaps in FEMA data. The data were prioritized based on the degree of "naturalness" of the floodplain, which was estimated based on overlap with Land Use Intensity index and FNAI Potential Natural Areas. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Surface Water Protection



	Total Acres	Protected	Remaining
Priority 1	2,828,240	1,590,150	1,238,090
Priority 2	5,498,280	3,910,800	1,587,480
Priority 3	1,883,970	498,760	1,385,210
Priority 4	8,595,280	2,957,460	5,637,820
Priority 5	3,892,910	464,130	3,428,780
Priority 6	5,725,460	793,070	4,932,390
Priority 7	2,237,700	106,030	2,131,670
Total	**30,661,840**	**10,320,400**	**20,341,440**

November 2018

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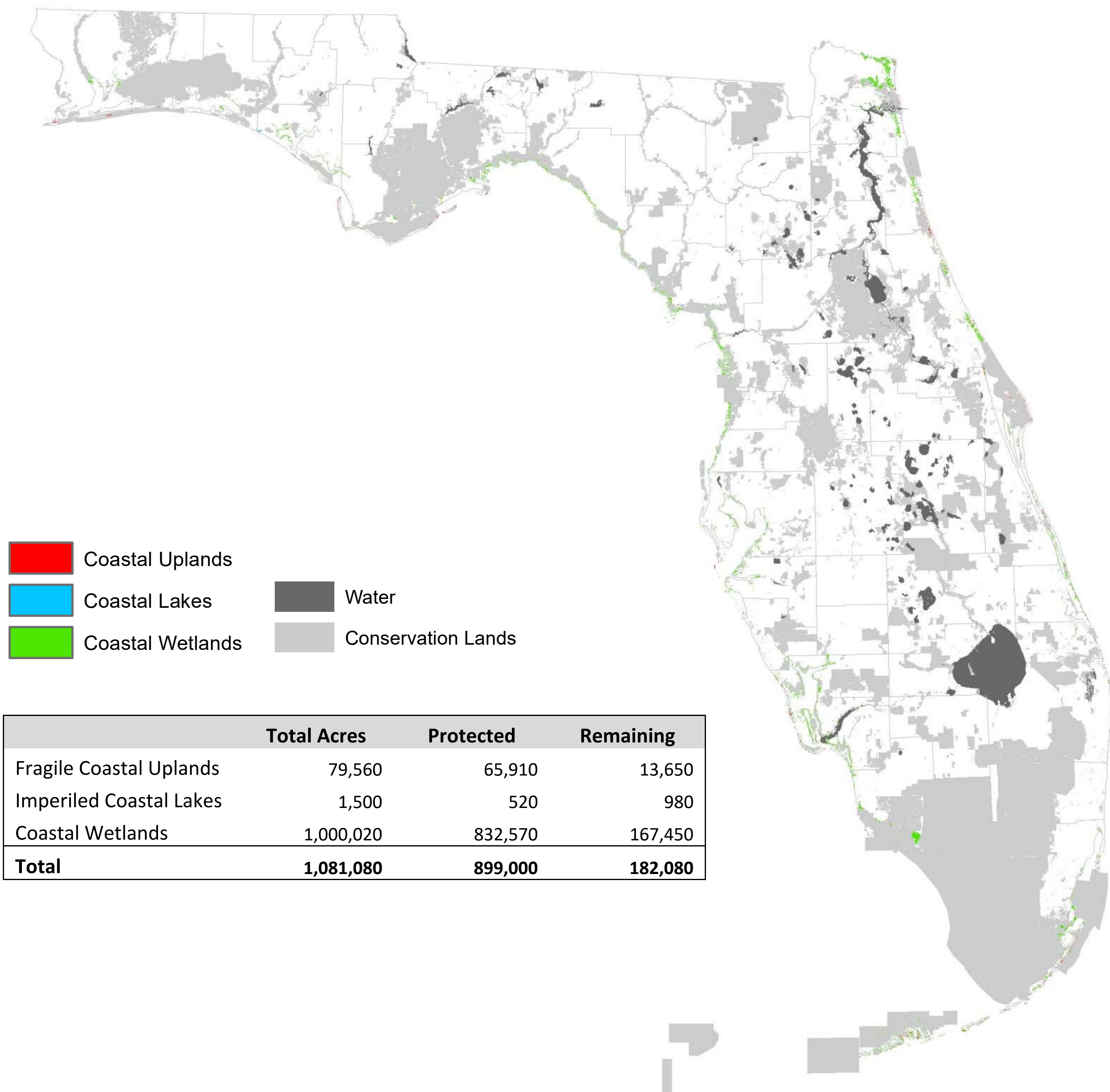
Primary Source: Florida Natural Areas Inventory in collaboration with water resource experts

Description: The surface water data identifies significant high quality surface waters of the state, which include the following: Outstanding Florida Waters, National Scenic Waters and National Estuaries, shellfish harvesting areas, seagrass beds, springs, water supply and waters important for imperiled fish. The data are prioritized based on proximity to a water body, stream order, downstream length, basin size and other factors. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Fragile Coastal Resources



	Total Acres	Protected	Remaining
Fragile Coastal Uplands	79,560	65,910	13,650
Imperiled Coastal Lakes	1,500	520	980
Coastal Wetlands	1,000,020	832,570	167,450
Total	**1,081,080**	**899,000**	**182,080**

November 2018

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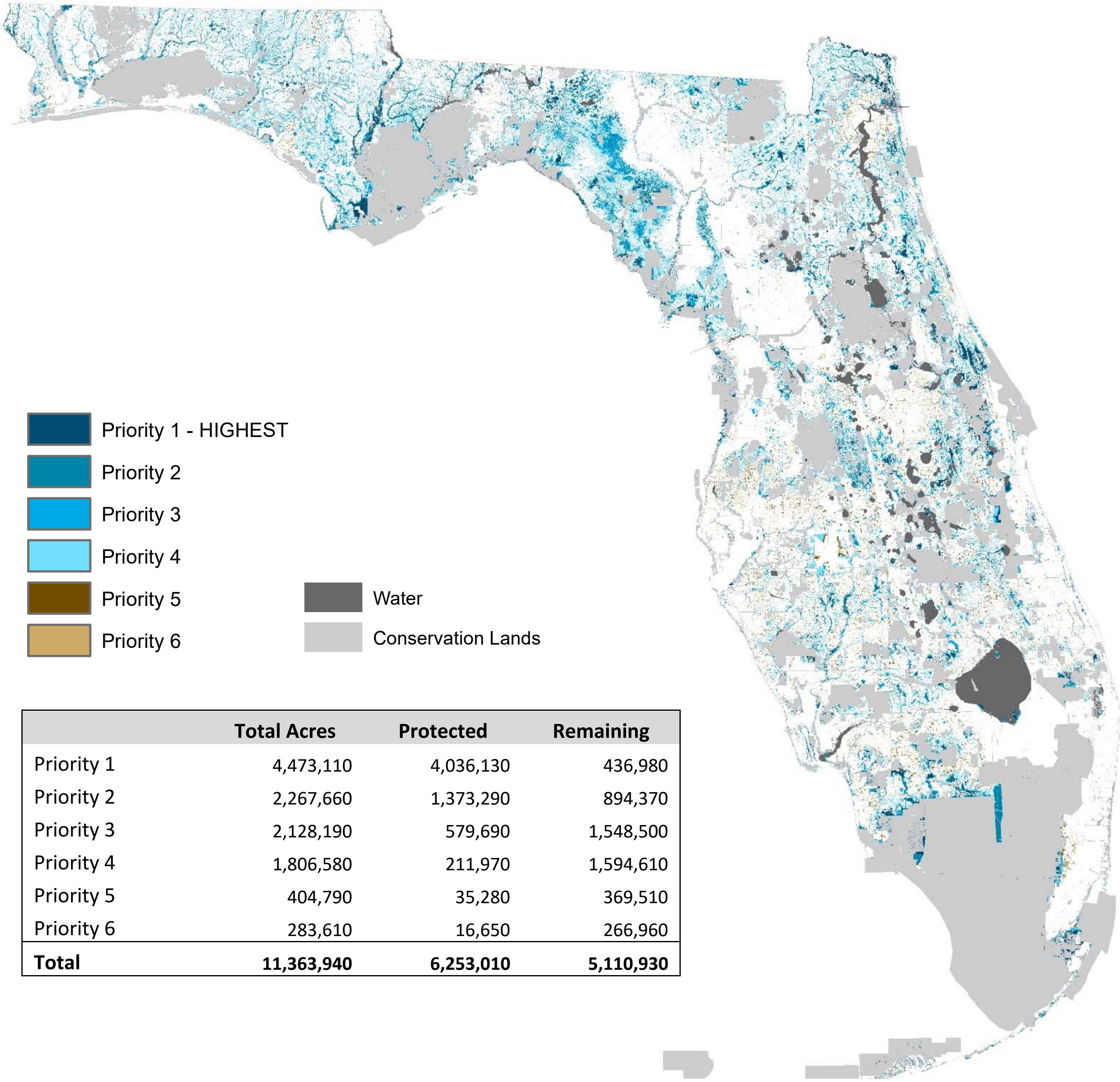
Primary Source: Florida Natural Areas Inventory

Description: The fragile coastal resources data layer identifies natural communities within one mile of the coast that are most vulnerable to disturbance or development including beach dune (G3), coastal scrub (G2), coastal grasslands (G3), coastal strand (G2), maritime hammock (G3), shell mound (G2), coastal dune lake (G2), coastal rockland lake (G2), mangrove wetlands (G5) and salt marsh (G5). For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Functional Wetlands



	Total Acres	Protected	Remaining
Priority 1	4,473,110	4,036,130	436,980
Priority 2	2,267,660	1,373,290	894,370
Priority 3	2,128,190	579,690	1,548,500
Priority 4	1,806,580	211,970	1,594,610
Priority 5	404,790	35,280	369,510
Priority 6	283,610	16,650	266,960
Total	**11,363,940**	**6,253,010**	**5,110,930**

November 2018

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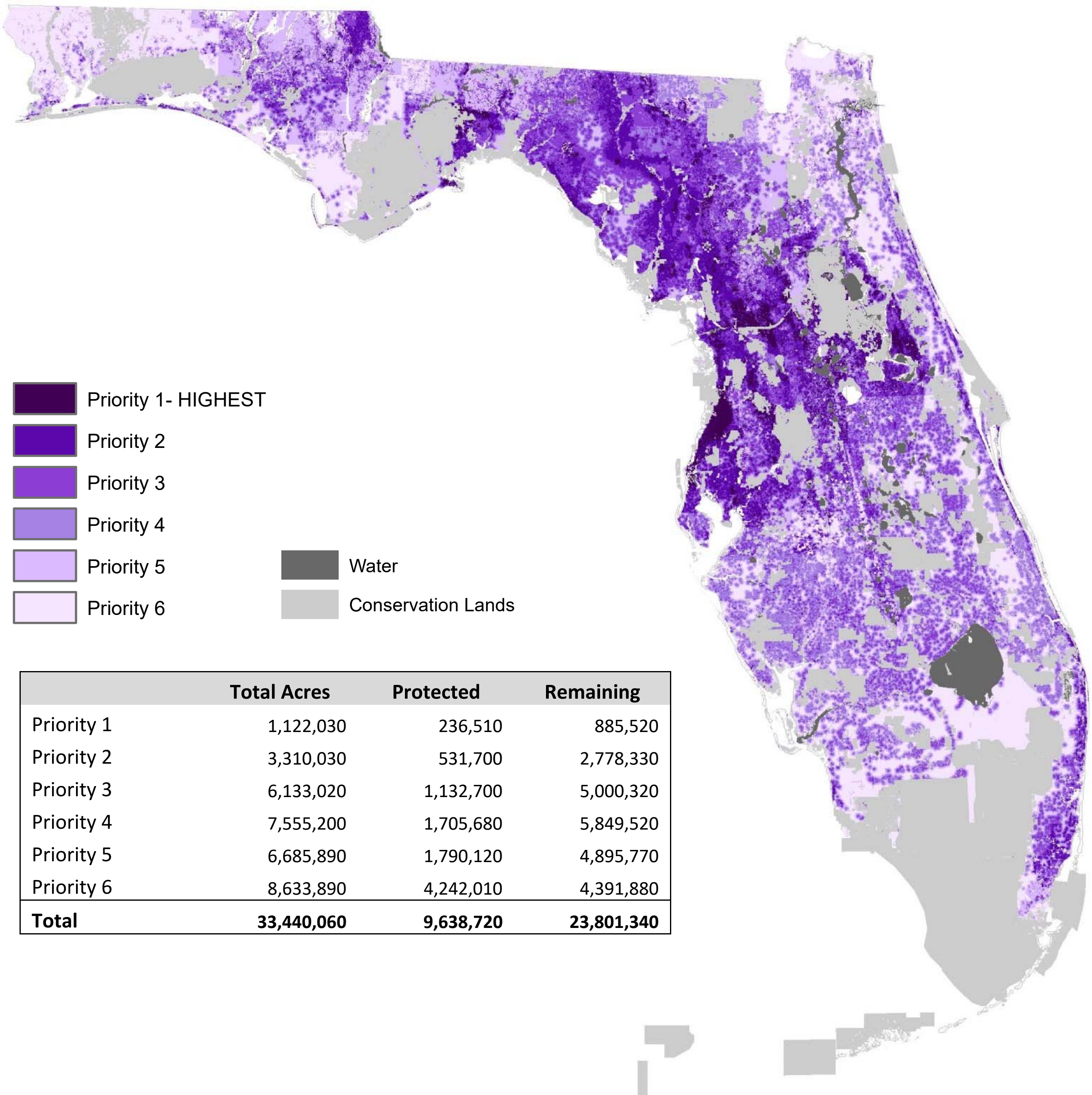
Primary Source: Florida Natural Areas Inventory

Description: The Functional Wetlands data layer is based on wetlands identified in the Cooperative Land Cover Map v3. Functional wetlands are defined as those in a more natural state and the prioritization is based on overlap with Land Use Intensity index and FNAI Potential Natural Areas. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Groundwater Recharge



	Total Acres	Protected	Remaining
Priority 1	1,122,030	236,510	885,520
Priority 2	3,310,030	531,700	2,778,330
Priority 3	6,133,020	1,132,700	5,000,320
Priority 4	7,555,200	1,705,680	5,849,520
Priority 5	6,685,890	1,790,120	4,895,770
Priority 6	8,633,890	4,242,010	4,391,880
Total	**33,440,060**	**9,638,720**	**23,801,340**

November 2018

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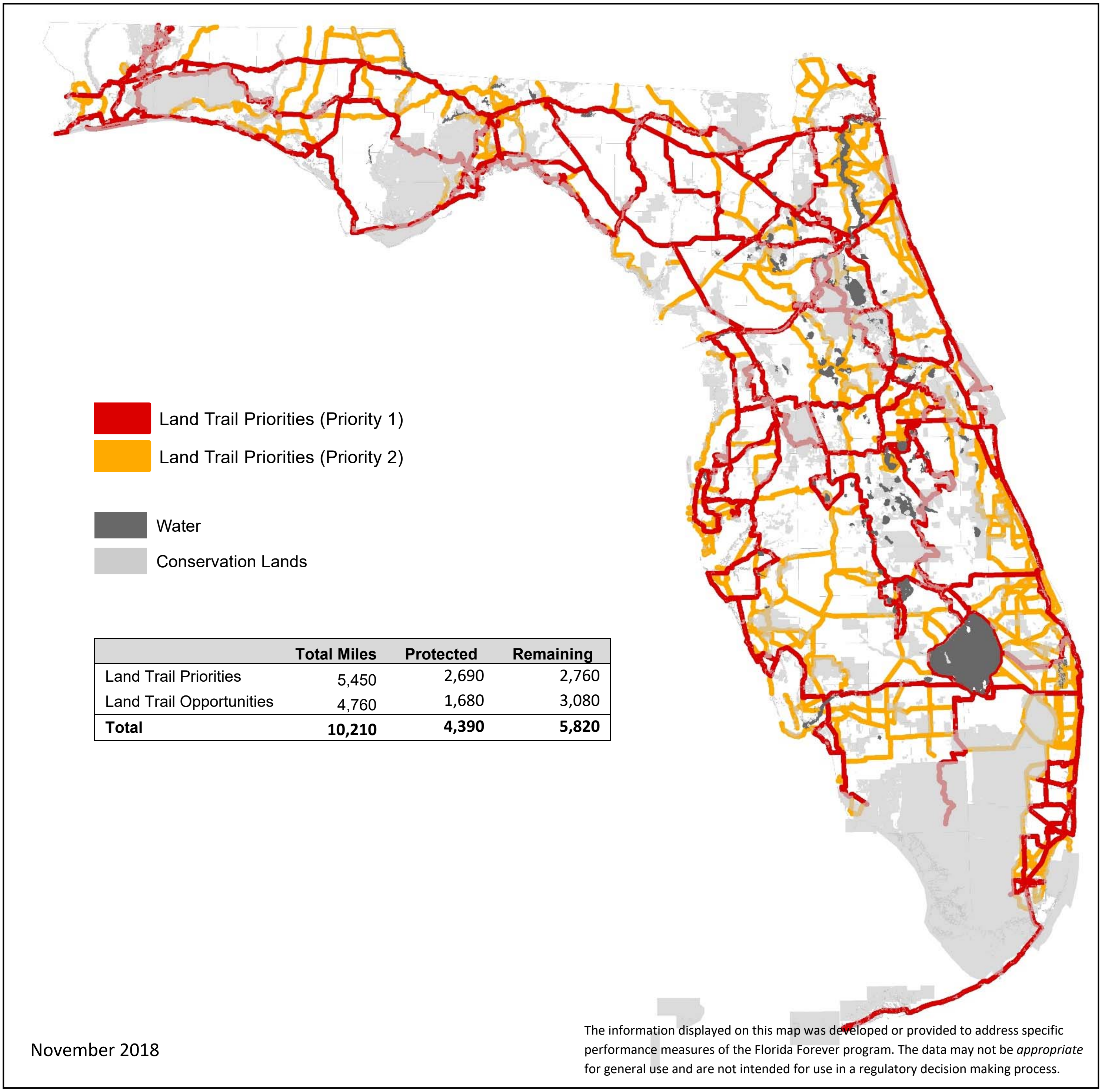
Primary Source: Advanced Geospatial, Inc; Florida Natural Areas Inventory

Description: The ground water 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 swallets, 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. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.

Recreational Trails



	Total Miles	Protected	Remaining
Land Trail Priorities	5,450	2,690	2,760
Land Trail Opportunities	4,760	1,680	3,080
Total	**10,210**	**4,390**	**5,820**

November 2018

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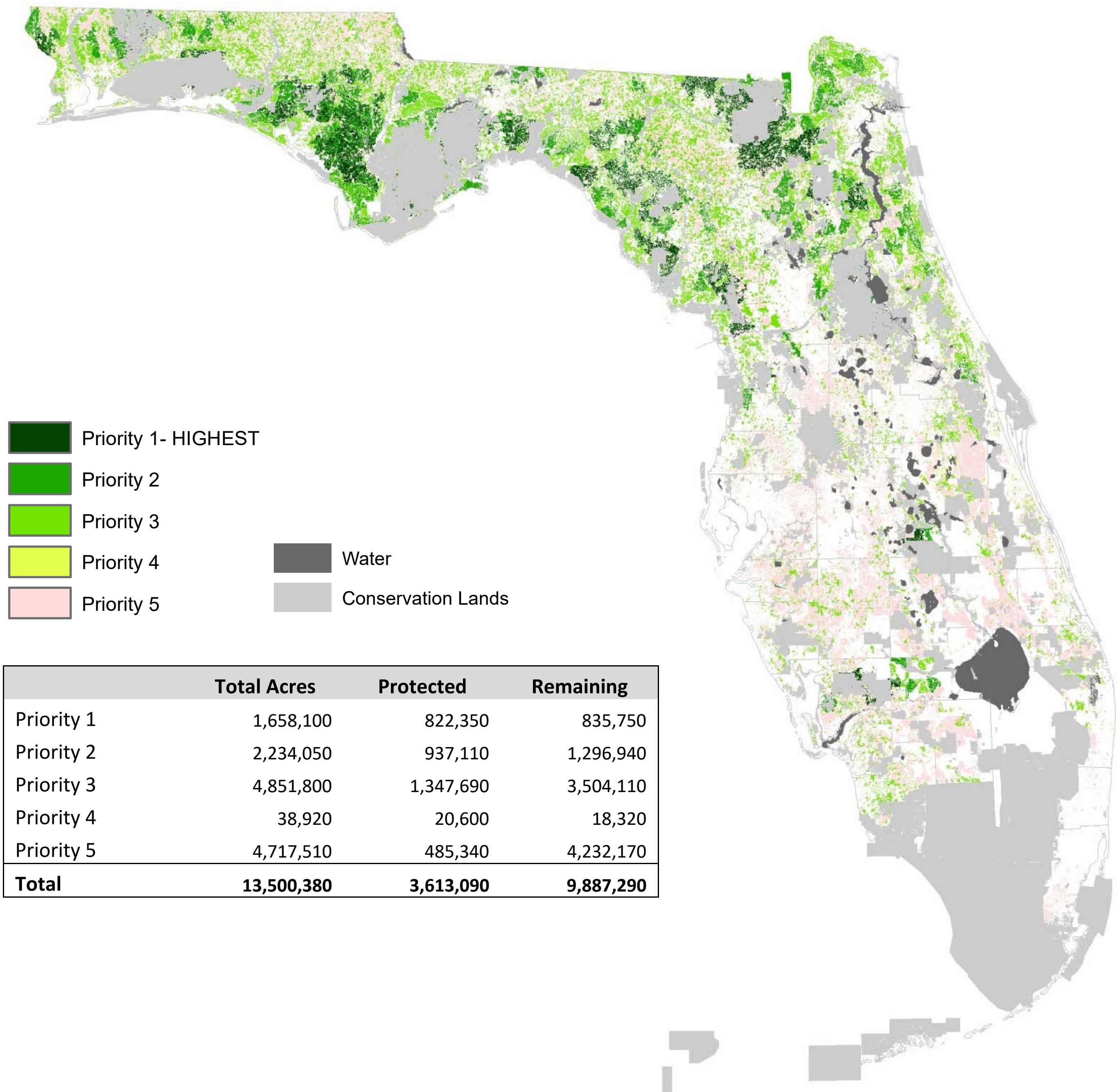
Primary Source: DEP/Office of Greenways and Trails

Description: The Recreational Trails data layer is based on land trail priorities and opportunities, including those for the Florida National Scenic Trail, identified in the Florida Greenways and Trails System Plan (2015 update). These trails are made up of existing, planned and conceptual non-motorized trails that form a connected set of linear recreational opportunities statewide. For more information: http://www.dep.state.fl.us/gwt/FGTS_Plan/default.htm.

Sustainable Forestry



	Total Acres	Protected	Remaining
Priority 1	1,658,100	822,350	835,750
Priority 2	2,234,050	937,110	1,296,940
Priority 3	4,851,800	1,347,690	3,504,110
Priority 4	38,920	20,600	18,320
Priority 5	4,717,510	485,340	4,232,170
Total	**13,500,380**	**3,613,090**	**9,887,290**

November 2018

The information displayed on this map was developed or provided to address specific performance measures of the Florida Forever program. The data may not be *appropriate* for general use and are not intended for use in a regulatory decision making process.

Primary Source: Florida Forest Service; Florida Natural Areas Inventory

Description: The Sustainable Forestry data layer identifies existing pinelands (natural and planted) and former pinelands that are potentially available for forest management. Prioritization is based on 4 criteria set by the Florida Forest Service: whether trees are natural or planted, size of tract, distance to market, and hydrology. Large tracts of natural pine on mesic soils (versus very dry or wet) that are within 50 miles of a mill receive the highest priority. Former pinelands that currently do not have trees receive the lowest priority. For more information see the Conservation Needs Assessment Technical Report: http://www.fnai.org/FlForever.cfm.