Southeast Conservation Blueprint Mechanics

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ABOUT THE WATER INSTITUTE OF THE GULF

The Water Institute of the Gulf is a not-for-profit, independent research institute dedicated to advancing the understanding of coastal, deltaic, river and water resource systems, both within the Gulf Coast and around the world. This mission supports the practical application of innovative science and engineering, providing solutions that benefit society. For more information, visit www.thewaterinstitute.org.

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Preface

This report was developed by the Water Institute of the Gulf (the Institute) for the U.S. Fish and Wildlife Service (USFWS) and synthesizes information from discussions with many individuals at USFWS, Florida Fish and Wildlife Conservation Commission, Mississippi State University, and Texas Parks and Wildlife Department. It is intended to summarize the key aspects of the history, governance, and technical development of the current Southeast Conservation Blueprint which is the primary technical output of the Southeast Conservation Adaptation Strategy (SECAS).

Ecologists, social scientists, and physical scientists from the Institute participated in the discussions and contributed to the development of this report. The cross-disciplinary focus of the Institute supported synthesis of the diverse information and technical information included within the report. The Institute is focused on assisting with data collection, analysis, and synthesis to facilitate increased use of best available science within management and restoration and conservation planning, implementation, and adaptive management.

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List of Acronyms

Acronym	Term
ASMT	Adaptation Science Management Team
BCR	Bird Conservation Region
CHAT	Crucial Habitat Assessment Tool
CLIP	Critical Lands and Waters Identification Project
CLC	Cooperative Land Cover Map
CPA	Conservation Planning Atlas
CVI	Conservation Value Index
DES	Desired Ecological States
DOI	Department of the Interior
DSS	Decision Support System
EEZ	Economic Exclusion Zone
EGCP	East Gulf Coastal Plain
ESA	Endangered Species Act
FEOW	Freshwater Ecoregions Layer
FNAI	Florida Natural Areas Inventory
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GCJV	Gulf Coast Joint Venture
GCPOLCC	Gulf Coast Plains and Ozarks Landscape Conservation Commission
GIS	Geographic Information System
HUC	Hydrologic Unit Code
ISA	Integrated Science Agenda
JV	Joint Venture
LCC	Landscape Conservation Cooperative
LCD	Landscape Conservation Design
LMV	Lower Mississippi Valley
MAV	Mississippi Alluvial Valley
MSU	Mississippi State University
NLCD	National Land Cover Database
PFLCC	Peninsula Florida Landscape Conservation Cooperative
SALCC	South Atlantic Landscape Conservation Cooperative
SECAS	Southeast Conservation Adaptation Strategy
SGCN	Species of Greatest Conservation Need
SLR	Sea Level Rise
SOC	Species of Concern
SWG	State Wildlife Action Grant
SWAP	State Wildlife Action Plan
TEI	Texas Ecological Index

Acronym	Term
TNC	The Nature Conservancy
TPWD	Texas Parks and Wildlife Department
TxNDD	Texas Natural Diversity Database
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WAFWA	Western Association of Fish and Wildlife Agencies
WGA	Western Governors' Association
WGWC	Western Governors' Wildlife Council
WGCP	West Gulf Coastal Plain

SECAS Glossary

Term	Description
Blueways	Marine migratory corridors used to address connectivity in the Florida Marine Blueprint.
Critical habitat	Specific areas occupied by an Endangered Species Act (ESA) listed species that may require specialized management or protection because the areas contain ecological and/or physical features essential to conservation of the listed species. Areas considered critical habitat may refer to areas not currently occupied by a listed species but that will be needed for the species recovery.
Crucial Habitat Assessment Tool (CHAT)	A spatial map providing non-regulatory decision support to aid in landscape planning and conservation prioritization. The tool is currently managed by the Western Association of Fish and Wildlife Agencies and can be accessed at: https://www.wafwachat.org/
Crucial habitat	Areas or ecosystems characterized either by high levels of biodiversity or by the presence of resources necessary for current and ongoing health of fish and wildlife populations. This is one of the foundations of the CHAT.
Coastal and Marine Ecological Classification Standard (CMECS)	CMECS is a marine ecological systems classification scheme similar to the terrestrial National Vegetation Classification standard; CMECS is the result of an ongoing collaboration by several organizations including NatureServe, the National Oceanic and Atmospheric Administration, the U.S. Environmental Protection Agency, the U.S. Geological Survey, and the University of Rhode Island.
Condition Index	Habitat-specific numerical indices used in the Middle Southeast Blueprint to spatially evaluate the departure of current conditions from the Desired Ecological State. Condition Indices are based on a series of habitat-specific rulesets.
Conservation Assets	Defined as a set of biological and ecological features and ecological processes critical to sustaining the current and future landscape for use in the Florida Conservation Blueprint. Conservation Assets are partially derived from Priority Resources defined by the Peninsula Florida Landscape Conservation Cooperative (PFLCC) in the PFLCC Science Plan (PFLCC, date unknown). Conservation Assets are generally defined as broad ecosystem types (e.g., freshwater non-forested wetlands, hardwood forested uplands).

Term	Description
Conservation Hubs	A term used in the Middle Southeast Blueprint to refer to areas that can be used to leverage opportunities for conservation action. These areas include regions listed as conservation opportunity areas in State Wildlife Action Plans that intersect with the Middle Southeast Blueprint v3.0. *Note: hubs are defined differently for use in the South Atlantic Blueprint.
Conservation Planning Atlas (CPA)	CPAs were created by multiple Landscape Conservation Cooperatives (LCC) as part of each cooperative's Landscape Conservation Design (LCD), and provide a "searchable, science-based mapping platform" to conservation decision-makers (SALCC, 2013). CPAs serve as a platform for LCCs to create galleries to showcase collections of spatial information and supporting documentation.
Conservation Value Index (CVI)	The key ecosystem-level evaluation tool, for terrestrial and aquatic systems separately, used in the Middle Southeast Blueprint. CVIs are derived from input layers that detail conservation hubs, anchors, species, habitat condition, and risk across the region.
Cooperative Land Cover Map (CLC)	The CLC map details land cover classes across Florida at a 10 m scale, and is developed from existing federal, state, and local data sources and expert review. It is revised and updated every 6–12 months (FWC, 2019). The CLC map provides the primary structure for the Florida Conservation Blueprint, with the majority of the Conservation Assets coming directly form the CLC and then further refined for use by the Critical Lands and Waters Identification Project (CLIP).
Decision Support System (DSS)	Relied upon for the development of state-based CHATs and the region-wide CHAT. DSSs are used to compile data in a publicly accessible manner for those interested in conservation or landscape level planning.
Desired Ecological State (DES)	Used in the Middle Southeast Blueprint to identify landscape- and site-scale management targets for each ecosystem type.
Ecoregion	Areas in which ecosystems are generally similar as defined by EPA and other federal agencies, and based on the framework derived from Omernik (1987)).
Ecosystem Indicators	Clearly defined, quantifiable metrics used in the South Atlantic Blueprint to provide information that can be used to determine the health and integrity of complex ecosystems within the South Atlantic region.

Term	Description
Ecosystem Integrity Scores	The term used in South Atlantic Blueprint documentation for the resulting prioritization rank for each spatial pixel derived from the Zonation program used in the South Atlantic Blueprint 2.2 and earlier. These scores are based on analysis of individual spatial data layers that comprise each ecosystem indicator.
Endpoints	Utilized in the Middle Southeast Blueprint, Endpoints are specific and measurable outcomes developed for each priority habitat system as defined by the GCPOLCC's Integrated Science Agenda. Endpoints can refer to landscapes, species, ecosystems, or broadly defined habitat types.
Global Species Ranking System (G1 and G2 classifications)	"G" refers to the global ranking system created and used by NatureServe and Natural Heritage partner programs that facilitates quick assessment of a species' rarity based on a numerical scale between 1 (high risk of global extinction) and 5 (low risk of global extinction). A species ranked G1 is considered "critically imperiled," and G2 indicates the species is "imperiled."
Governance	In an environmental conservation context, governance refers to any institutional agreement that is designed to control "use of natural resources, ecological systems, and sinks for wastes in order to meet objectives such a sustainable use, protection of public health, and protection of valued species or places" (National Research Council, 2005).
Hydrologic Unit Codes (HUC)	A Hydrologic Unit Code (HUC) is a unique sequence of numbers or letters that identify a hydrological feature (river, lake, or area like a drainage basin / watershed / catchment). HUCs consist of two-to-eight-digit values that are based on four levels of classification. These levels span "regions" (broadest geographic area) to "units" (smallest geographic unit). For more information, visit: https://water.usgs.gov/GIS/huc.html
Landscape Conservation Cooperative (LCC)	LCCs were established by the Department of the Interior (DOI) in the early 2000s to provide science capacity and technical expertise for meeting shared natural and cultural resource priorities. LCC partnerships across the Southeast were closely involved in the development of the Southeast Blueprint v1.0 in 2016.
Landscape Conservation Design (LCD)	A core component of the LCC structure that was leveraged in the development of the Florida Conservation Blueprint. LCDs involved the development of interactive, collaborative, and holistic analytical tools, maps, and strategies to support LCC goals and goals of LCC partners. Specifically, LCDs called for the combining of geospatial data, biological information, and models.

Term	Description
USFWS Trust Species	Prioritized Trust Species are a subset of prioritized Federal Trust Species (i.e., those for which the U.S. Fish and Wildlife Service (USFWS) has legal authority under the Endangered Species Act, Migratory Bird Treaty Act, or other legislation) developed for biological planning in USFWS Strategic Habitat Conservation.
NatureServe network	A collection of state, provincial, and national member programs dedicated to collecting, managing, and disseminating biological information using a uniform methodology. The NatureServe web portal can be accessed at: https://explorer.natureserve.org/
Southeast Conservation Adaptation Strategy (SECAS)	Strategic plan to improve the health, function, and connectivity of southeastern U.S. ecosystems by at least 10% by 2060, and advanced via the use of SECAS's Southeast Conservation Blueprint (Southeast Blueprint). The Southeast Blueprint can be utilized for conservation and restoration prioritization and planning.
Southeast Conservation Blueprint (Southeast Blueprint)	The Southeast Conservation Blueprint (Southeast Blueprint)—which is the primary product of SECAS—is a spatial map developed by USFWS, the states, and a broad collaboration of partner conservation agencies and organization in the southeastern U.S. depicting areas of conservation value across the southeastern U.S. region.
Species of Concern (SOC)	Used by the USFWS, this term refers to species that may require focused conservation actions. Data on these species are held on the Protected Areas Database (PAD-US) v2.0 developed by the Department of the Interior (see *USGS Gap Analysis Project (GAP)*, 2018 for access to the data).
Species of Greatest Conservation Need (SGCN)	Species in need of conservation action as identified by State Wildlife Action Plans.
State Wildlife Action Plans (SWAPs)	State Wildlife Action Plans (SWAPs) are proactive plans developed to assess the condition of each state's wildlife and habitats, identify key threats, and outline actions needed to conserve fish and wildlife over the long term. Plans are developed in collaboration with state, federal, and private partners with participation from the public, and a congressional mandate requires that these plans be renewed every 10 years.
The Nature Conservancy's Resilient Land analysis	A data layer produced by The Nature Conservancy that displays levels of landscape resilience (Anderson et al., 2016), and is framed largely around the intersection of geomorphic setting and landscape connectivity driving areas of high biodiversity and resilient areas to consider for future biodiversity planning.

Term	Description
Thematic Ranking Mosaic	The database that supports the region-wide CHAT map. The database contains spatial information, at the one-square mile scale, for habitat prioritization rankings for the overall CHAT Rank, the terrestrial CHAT Rank, the aquatic CHAT Rank, and rankings for a host of other relevant considerations for those engaged in conservation and planning using the CHAT.
White paper	An authoritative report or formal guide used to communicate the issuing author's position or philosophy on a given subject.
Wildlife corridor	Important habitats that connect/join areas used by animal and plant species across time and space, existing within unfragmented or fragmented landscapes.
Zonation	A conservation planning framework and software, developed by the University of Helsinki, that was used in the South Atlantic Blueprint development process. This software offers multiple prioritization algorithms for a landscape. In prior versions of the South Atlantic Blueprint, the output of the Zonation analysis based on a core area zonation model was an **Ecosystem Integrity Score** for each pixel. However, the current 2020 version of the South Atlantic Blueprint no longer uses ecosystem integrity scores, but still uses Zonation to identify prioritized areas for conservation.

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Executive Summary

The Southeast Conservation Adaptation Strategy (SECAS) was formed in fall 2011 by the Southeastern Association of Fish and Wildlife Agencies (SEAFWA) in response to the "unprecedented challenges facing our natural and cultural resources, like urban growth and climate change," through coordination of "conservation partners around a common vision for sustaining natural resources in the Southeast through 2060" (SECAS, 2020). The specific goal of SECAS is to improve the health, function, and connectivity of southeastern U.S. ecosystems by at least 10 percent by 2060 with a one percent improvement in the health, function, and connectivity of southeastern ecosystems, and a one percent increase in conservation actions, every four years. To assist in the project planning and implementation strategies needed to achieve this goal, SECAS developed a dynamic data synthesis process to produce a conservation prioritization map known as the Southeast Conservation Blueprint (the Southeast Blueprint).

First released in 2016, the Southeast Blueprint has drawn from, and compiled, conservation maps from across the southeast region. It is an annually updated conservation planning map that identifies important places for conservation and restoration across the southeastern U.S. and Caribbean. The Southeast Blueprint v4.0 delineates areas of high conservation value that are most important for conservation of ecosystem health, function, and connectivity, and areas of medium conservation value that may require restoration that is "important for buffering high value areas and maintaining connectivity" (Southeast Conservation Adaptation Strategy, 2020b).

This report focuses on the subregional blueprints that include the geography of the northern Gulf of Mexico coast with a focus on the primary ecosystem types represented. The blueprints for these subregions are the Crucial Habitat Assessment Tool (CHAT): Texas (TX CHAT); the Middle Southeast Blueprint; the South Atlantic Blueprint; the Florida Conservation Blueprint; and the Florida Marine Blueprint. For each of these subregions and the overall Southeast Blueprint, this report summarizes the history and governance; geography and ecosystem; and blueprint structure and methodology. In addition, the integration of each subregional blueprint into the Southeast Blueprint is discussed, along with the identification of future data needs to continue to develop and improve each subregional blueprint and the Southeast Blueprint as a whole. At the time this report was composed, in 2020, the Southeast Blueprint v4.0 was the most up to date version, and descriptions contained within are accurate for v4.0.

The subregional blueprints compiled within the Southeast Blueprint were developed largely from a bottom-up governance framework that is based in state or regional mechanisms and high stakeholder engagement. The benefit of this approach is that local and regional conservation priorities are captured and represented in the overall Southeast Blueprint, but it presents a challenge for geographic, planning, and/or management processes that are larger than one individual subregion because of different analytical and data approaches within each subregion.

To support SECAS in reaching their 2060 goal, use of the Southeast Blueprint by multiple governance mechanisms at the federal, state, and local scales will be needed. Over the next 15 years, the largest source of restoration funding in the northern Gulf of Mexico is expected to be through Deepwater

Horizon (DWH) fines, penalties, and settlement entities. A major focus of this restoration funding is large-scale ecosystem and habitat restoration efforts which present an opportunity for engagement with, and use of, the Southeast Blueprint to inform these management and restoration planning and prioritization processes.

However, since these planning and implementation processes are either at a state or cross Gulf of Mexico scale, the different methodologies in the subregions result in conservation prioritizations that are not directly comparable across the relevant geographic area. As has been noted since the first SECAS Symposium in 2015, the central themes of the different subregional blueprints are common and drive toward the same measures of success, but use different data, targets, metrics, or priority resources. The current opportunity is to focus on common themes and measures of success, identified in this report, to develop an example blueprint that has unified data and analytical approaches at the northern Gulf of Mexico spatial extent to provide direct potential for linkage with Deepwater Horizon related large scale ecosystem restoration processes.

To assist in facilitating expanded utility of the Southeast Blueprint, a conscious effort to be inclusive of habitat and ecosystem restoration as well as conservation would be beneficial. Over the past two decades, there has been ongoing and increasing recognition of large-scale landscape change as a result not only of local stressors, such as development or transition of forest or wetland to agricultural land, but also of large-scale changes such as rising sea level and changes to rainfall and temperature patterns storm intensity. One result of this in terms of land management and conservation is an increased focus on the resilience of human communities to impacts such as flooding, land loss, and drought. This focus results in protection projects for which the use of habitat, ecosystem, or nature-based approaches can be cost effective. These approaches can have co-benefits such as support to health and function of flora and fauna resources as well as landscape connectivity. To maximize these benefits, restoration managers and planners could use synthetic data, such as the Southeast Blueprint, on the relative value of different geographic locations for supporting priority natural resources.

In conclusion, the current SECAS process of subregional analyses, engagement, and prioritization being compiled into the overall Southeast Blueprint provides an important engagement process that is highly valuable for informing conservation and land management decisions at moderate spatial scales. Programmatic, planning, and funding mechanisms that have spatial extents that cover more than one subregion currently have limited ability to utilize the Southeast Blueprint. This opportunity for engagement would be greatly enhanced if additional steps were added to 1) generate blueprints at relevant spatial scales (for example the northern Gulf of Mexico coastal region); 2) utilize uniform input data and analytical approaches; 3) facilitate comparisons with human community vulnerability; and 4) integrate key indicators of current and future potential ecosystem threats. An active engagement with funding mechanisms for habitat and landscape restoration, in addition to habitat and landscape conservation, has potential to increase overall natural resource intactness and assist SECAS in achieving their goal.

To increase the usefulness, and therefore the uptake, of the Southeast Blueprint within a broader array of land management, conservation, and restoration efforts at ecosystem and habitat scale, four key recommendations are provided:

Recommendation 1: *Develop an example cross-regional blueprint for the northern Gulf of Mexico that is consistent with the aims and goals of all spatially relevant subregional blueprints and uses one consistent set of metrics and analysis approach. This blueprint would facilitate engagement of the Southeast Blueprint in conservation and restoration planning processes that cover the northern Gulf of Mexico.*

Recommendation 2: *Communicate the utility of the Southeast Blueprint for restoration projects to increase utilization of the Southeast Blueprint in management prioritization and planning. Previously the Southeast Blueprint has been used largely in conservation planning, but there are presently large investment mechanisms for landscape-scale restoration for which the Southeast Blueprint has additional utility. In the northern Gulf of Mexico there are significant landscape-scale restoration efforts underway as a result of the settlement for DWH. Most of those restoration projects are habitat-based with explicit goals of benefiting multiple natural resource types injured by the DWH event, including avian fauna.*

Recommendation 3: *Compile an index of social data of human community resilience and vulnerability to directly overlay on the Southeast Blueprint. This effort would serve to increase utility of the Southeast Blueprint and provide an opportunity for utilization in identifying conservation and natural resource co-benefits from projects with a primary human community protection or resilience goal. Because policy and planning processes frequently focus on the needs of and opportunities for human communities, this recommendation will increase the potential for the blueprint to be utilized in decision-making processes.*

Recommendation 4: *Continue to develop synthesis of data related to threats to potential protection or restoration efforts. This would provide project and program planners with a high-level indication of project success, as well as provide context of a project footprint's surrounding area. This is especially relevant if aiming to identify areas valuable for restoration in addition to protection. (Recommendation 2).*

1.0 Introduction

The Southeast Conservation Adaptation Strategy (SECAS) is a regional conservation initiative that spans the Southeastern U.S. and Caribbean. SECAS was established in 2011 by the states of the Southeastern Association of Fish and Wildlife Agencies (SEAFWA) and includes the federal agencies of the Southeast Natural Resources Leaders Group (SENLRG), who together "expressed their intention to meet the environmental challenges of the 21st century through effective collaboration among agencies and organizations responsible for the region's natural and cultural resources—while honoring differing agency responsibilities and authorities." (personal communications, Cindy K. Dohner)

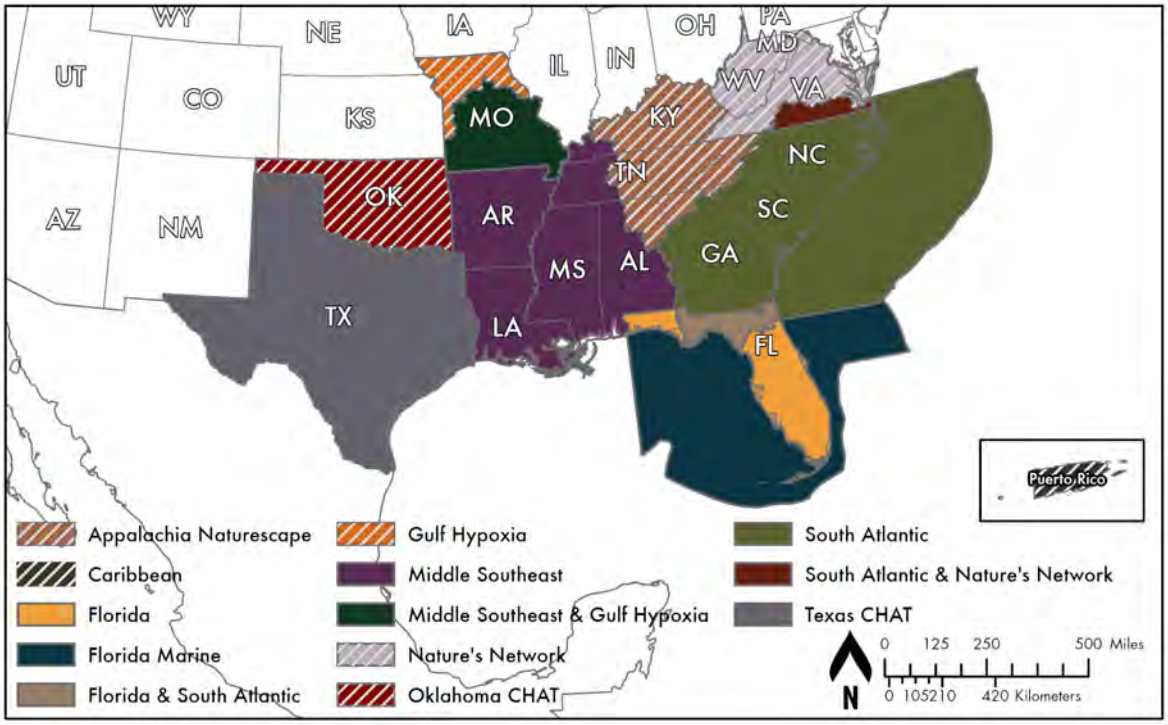
The central goal of SECAS is to improve the health, function, and connectivity of southeastern U.S. ecosystems by at least 10% by 2060, along with two near-term goals to "achieve a 1% improvement in the health, function, and connectivity of Southeastern ecosystems, as well as a corresponding 1% increase in conservation actions" every four years (Southeast Conservation Adaptation Strategy, 2020a). The long-term goals are based on a synthesis of 12 regional and subregional ecosystem assessments (e.g., Everglades Report Card, State of the South Atlantic, Chesapeake Bay Report Card, State of the Birds) and the short-term goals are used to track progress towards the long-term goals (Southeast Conservation Adaptation Strategy, 2020a).

To assist in the project planning and implementation strategies needed to achieve this goal, a dynamic data synthesis process was developed to produce a conservation prioritization map known as the Southeast Conservation Blueprint. First released in 2016, the Southeast Conservation Blueprint (the Southeast Blueprint) has drawn from, and compiled, conservation maps from across the southeast region. At the time this document was composed, in 2020, the Southeast Blueprint v4.0 was the most up to date version, and descriptions within this text are accurate for v4.0. The Southeast Blueprint integrates nine subregional inputs, each of which compile and categorize data from a large number of sources (Figure 1).

This report focuses on the subregional blueprints that include the geography of the northern Gulf of Mexico coast and have a focus on the primary ecosystem types represented along the northern Gulf of Mexico coast. The blueprints for these subregions are:

- Crucial Habitat Assessment Tool (CHAT): Texas (TX CHAT)
- The Middle Southeast Blueprint
- The South Atlantic Blueprint
- The Florida Conservation Blueprint
- The Florida Marine Blueprint

These subregional blueprints were developed variously by Landscape Conservation Cooperatives (LCCs), the western U.S. association of governors (CHAT, with only Texas and Oklahoma incorporated into the overall Southeast Blueprint), and most recently by the Florida Fish and Wildlife Conservation Commission (FWC) in partnership with U.S. Fish and Wildlife Service (USFWS). Each of these individual blueprints was developed for and by the region that it applies to. LCCs, while operating under a national initiative, each developed their own conservation mapping system largely independently of other LCCs. CHAT, meanwhile, is composed of a "mosaic" of data provided by individual participating states.



Data Source: http://secassoutheast.org/blueprint.html

Figure 1. Subregional inputs of the Southeast Blueprint v4.0. Hatch-marked regions indicate subregional blueprints not included in this report.

This bottom-up governance framework was integral to the development of each subregional blueprint and was incorporated into the development of SECAS as a whole. The strength of this approach is that it enables the conservation priorities developed by each individual subregion to be maintained when integrated into the Southeast Blueprint. But nuances exist within each of the underlying subregional blueprints; each subregional blueprint was developed independently of one another, using different underlying datasets, analysis methodologies, and prioritization rules based on subtly different concerns. These subregional blueprints very often utilize their own terminology for core components which can cause difficulties in overall interpretation and understanding.

Yet each blueprint has clear unifying features that are brought together in the Southeast Blueprint. In their reflections on the first SECAS Symposium, held in 2015, Hilary Morris, then of the South Atlantic Landscape Conservation Cooperative (SALCC) noted that (Morris, 2015):

> Each of the LCCs in the Southeast may be using different words and different methods, but central themes emerged over and over again… whether you call them indicators, targets, metrics, focal species, or priority resources, we're all using shared measures of success… Regardless of how you perform your connectivity analysis, we're all building an ecologically connected network with hubs and corridors.

It is these specific components—the prioritization of landscapes for conservation, and the hubs and corridors that connect them—that are brought together in the Southeast Blueprint. This report, with a

specific focus on those subregional blueprints that intersect with the northern Gulf of Mexico Coast (listed above), discusses the overall framework of SECAS and the Southeast Blueprint before examining the history, governance, structure, and methodology that underpin each subregional blueprint. This summary of the internal mechanics of the Southeast Blueprint is developed in an effort to support further understanding of the common themes and data sources that exist between the subregional blueprints.

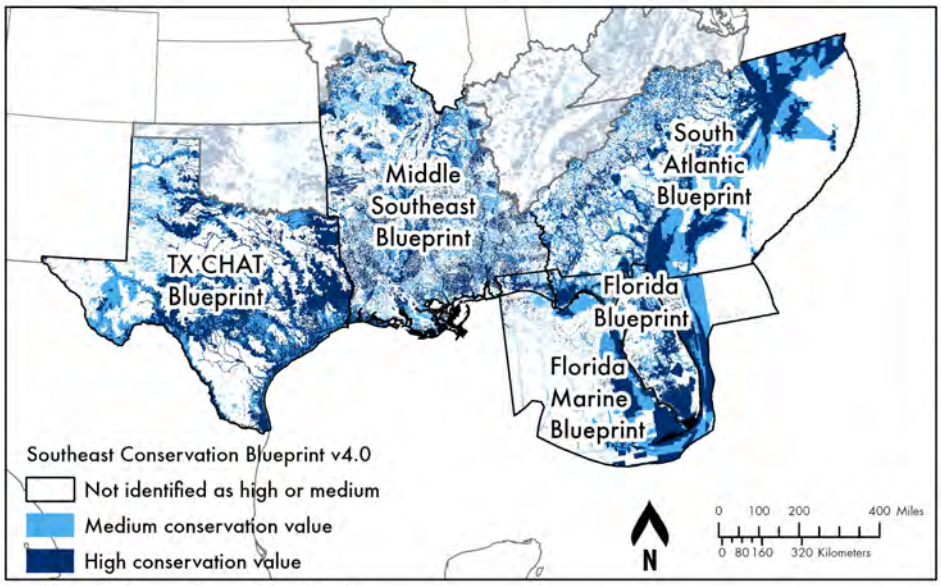
2.0 Southeast Conservation Blueprint

2.1. INTRODUCTION

The Southeast Blueprint is a dynamic conservation planning map that identifies important places for conservation and restoration across the Southeast and Caribbean. It encompasses 15 states in addition to Puerto Rico and integrates subregional conservation blueprints into a seamless visualization tool that uses best available science to delineate areas of "High" and "Medium" conservation value across the Southeast Blueprint's extent. The Southeast Blueprint is on a continuous update schedule to improve the tool's effectiveness, accuracy, and usability over time. The Southeast Blueprint was developed by SECAS in 2016 and SECAS published the Southeast Blueprint v4.0 in 2019.

The Southeast Region Conservation Planning Atlas (CPA) is the publicly accessible online interface for the Southeast Blueprint v4.0. Through the web-based portal, users can download the layers of spatial data for each region, overlay multiple layers for planning purposes, and create and export maps. Users can view the final Southeast Blueprint v4.0 as well as other layers specific to connectivity, threats, and future land use change (Southeast Conservation Adaptation Strategy, 2020a). Data layers for Southeast Blueprint v4.0 are available for download from the CPA Data Gallery on DataBasin.

The Southeast Blueprint v4.0 delineates areas of high conservation value (shown in dark blue; Figure 2) that are most important for conservation of ecosystem health, function, and connectivity, and areas of medium conservation value (shown in light blue) that may require restoration that is "important for buffering high value areas and maintaining connectivity"(Southeast Conservation Adaptation Strategy, 2020).



Data Source: http://secassoutheast.org/blueprint.html

Figure 2. Southeast Blueprint highlighting subregional blueprints of interest for the northern Gulf Coast discussed in this report.

2.2. HISTORY AND GOVERNANCE

The Southeast Blueprint was initially developed by SECAS in 2013, and the initiative continues to be responsible for all aspects of the Southeast Blueprint. SECAS brings together representatives of state and federal agencies, non-profit organizations, private businesses, tribes, and academic institutions to work toward improving the health, function, and connectivity of southeastern ecosystems.

SECAS was formed in fall 2011 by SEAFWA and USFWS who, in response to "the unprecedented challenges facing our natural and cultural resources, like urban growth and climate change," recognized the "need to rally conservation partners around a common vision for sustaining natural resources in the Southeast through 2060." The LCC Network, including the Gulf Coast Plains and Ozarks LCC (GCPOLCC) and the Peninsular Florida LCC (PFLCC) were early supporters of SECAS.

In 2012 the Southeast Natural Resources Leaders Group (SENRLG; a regional group of 13 federal agencies with responsibilities related to the conservation and management of natural resources) were asked by SEAFWA to help lead SECAS. As a result, early leadership of SECAS was composed of a partnership of SEAFWA directors and SENRLG principals, providing broad representation of state and federal agencies. Each member of the SECAS leadership elected a member of their organization to "participate in more detailed discussions and provide a complementary 'bottom-up' governance framework." At that time, SECAS' conservation science and technology planning capacity were channeled through multi-agency LCCs so as to limit the generation of bureaucracy around conservation priorities that may conflict with the aims of individual states (GCPOLCC 2012 Annual Report).

In 2013 SECAS initiated the Southeast Blueprint, putting forward a plan to develop and release the first version of a landscape-scale conservation plan by fall 2016. In 2015 the Southeast Climate Adaptation Science Center (SECASC; a partnership of academic institutions, the Department of the Interior (DOI), and the U.S. Geological Survey (USGS), based at North Carolina State University) founded the Vital Futures Project to provide support for SECAS. The Vital Futures Project was tasked with "assessing the implications of climate change and other drivers of landscape change for existing conservation goals and management objectives" (see http://secassoutheast.org/about).

The first SECAS symposium took place in fall 2015 at the SEAFWA annual meeting, during which there was significant engagement with LCCs to discuss how the SECAS framework could assist in the development of shared conservation visions among the LCCs in the Southeast.

The following year's SEAFWA annual meeting hosted a SECAS summit at which the Southeast Blueprint v1.0 was unveiled. This first version relied largely on LCCs and by utilizing common themes between the LCCs' blueprints provided the first integration of the conservation maps that had been developed by LCCs across the Southeast. The Southeast Blueprint v1.0 was finalized and released in December 2016.

In 2017 the Southeast Blueprint v2.0 was released, which integrated CHAT to extend coverage of the Southeast Blueprint. In addition, updates of LCC blueprints were included along with improved consistency across LCC boundaries. SEAFWA tasked SECAS with establishing an "overarching goal"

for SECAS, and work began on a process of identifying a key objective for the initiative along with near-term metrics by which to measure progress towards that overarching, long-term goal.

In 2018 SECAS unveiled a newly defined long-term goal for the initiative to support "a 10% or greater improvement in the health, function, and connectivity of [s]outheastern ecosystems by 2060," with near-term metrics for a 1% improvement in the health, function, and connectivity of southeastern ecosystems, supported by a 1% increase in conservation actions within the Blueprint, every four years. The Southeast Blueprint v3.0 was also released, which introduced full coverage of Texas with the integration of CHAT, and the introduction of a Hubs and Corridors layer across parts of the Southeast Blueprint's extent. Changes to the DOI's LCC structure that were initiated in 2017 took place around that time. USFWS confirmed a commitment to support the subregional blueprints to continue the pursuit of LCC goals and those of SECAS overall. As a result, when many LCCs restructured, the LCC partnerships of the southeastern U.S. and Caribbean reorganized within USFWS under the umbrella of SECAS.

In 2019, the Southeast Blueprint v4.0 was released, which included the newly developed Florida Marine Blueprint, and expanded the Hubs and Corridors layer to encompass all of Florida. SECAS also published their first update, *Recent Trends in Southeastern Ecosystems: Measuring Progress toward the Southeast Conservation Adaptation Strategy (SECAS) Goal*. See Figure 3 for a timeline of critical milestones in the development of the Southeast Conservation Blueprint.

At present, five SEAFWA directors and the southeast regional director of USFWS form the SECAS Steering Committee to provide oversight and strategic direction to the partnership. Each state agency director of SEAFWA, each SENRLG agency principal, and three conservation nonprofit organizations formally designate SECAS Points of Contact (POCs), who work collaboratively to identify priority actions, provide technical input, and focus the work of the partnership. The SECAS Coordinator and additional technical support staff, who are full-time USFWS employees, provide the technical coordination, facilitation, and communication capacity for the SECAS partnership.

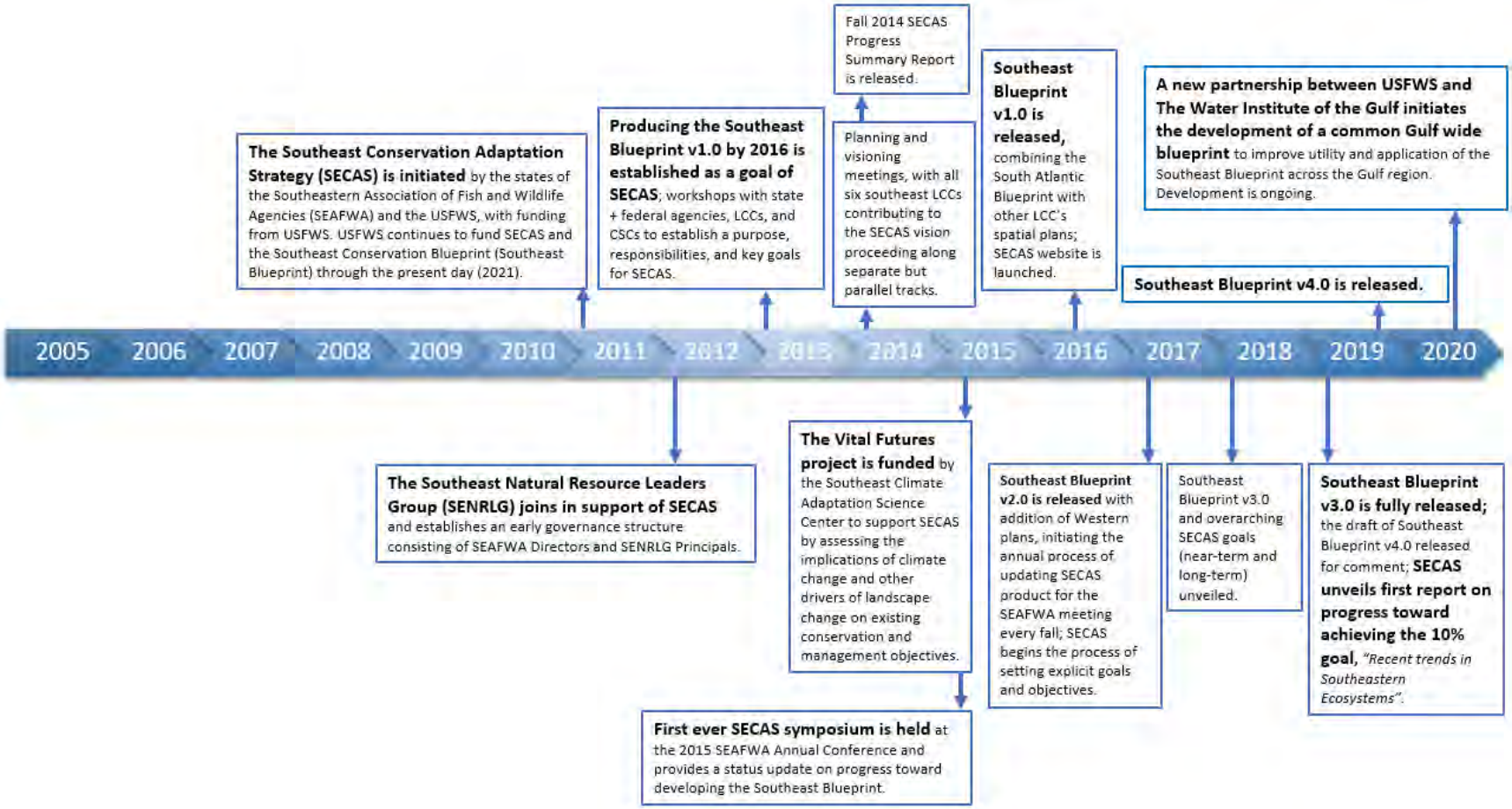


Figure 3. Summary of critical milestones in the development of the Southeast Conservation Blueprint

2.3. GEOGRAPHY AND ECOSYSTEM

The Southeast Blueprint v4.0 covers the geographic extent of SECAS: 15 Southeast states in addition to Puerto Rico, with the exception of the U.S. Virgin Islands (Southeast Conservation Adaptation Strategy, 2020a). This blueprint also extends into the marine environment with boundaries that align with the federal jurisdiction limits created when Congress passed Public Law 94-265, the Magnuson Fishery Conservation and Management Act of 1976. The federal waters encompassed by that boundary are referred to as the Exclusive Economic Zone (EEZ) and extend offshore from state waters to 200 nautical miles. Outer boundaries of the EEZ that determine the marine extent of the Southeast Blueprint off the southeastern U.S. coast vary according to areas where jurisdictional boundaries meet with the boundaries of Bermuda, the Bahamas, and Cuba.

2.4. BLUEPRINT STRUCTURE AND METHODOLOGY

The Southeast Blueprint v4.0's spatial dataset consists of four main data layers that users can download: 1) the Southeast Blueprint v4.0; 2) Hubs and Connectors; 3) Input Areas; and 4) SECAS Boundary (Southeast Conservation Adaptation Strategy, 2019a). The Southeast Blueprint v4.0 and the Hubs and Connectors layers incorporate spatial data related to conservation prioritization from the following plans (Input Areas):

- The Crucial Habitat Assessment Tool (CHAT; for the states of Texas and Oklahoma; see Section 3.0)
- The Middle Southeast Blueprint (see Section 4.0)
- The South Atlantic Conservation Blueprint v2.2 (see Section 5.0)
- The Florida Conservation Blueprint v1.3 (see Section 6.0)
- The Florida Marine Blueprint v1.0 (see Section 7.0)
- The North Atlantic Nature's Network Conservation Design
- The Gulf Hypoxia Precision Conservation Blueprint v1.5; Conservation and Watershed Interests (2016) layer
- The Caribbean Landscape Conservation Design
- The Appalachian NatureScape Design (Phase II) used in combination with portions of The Nature Conservancy's Resilient and Connected Landscapes "Prioritized Network" layer

Users can also download threats and land-use change datasets curated to overlay the full spatial extent of the Southeast Blueprint. These datasets include information for southeast floodplain inundation frequency, mean high water inundation, projected urban growth (using the SLEUTH model), sea level rise inundation scenarios (for 1, 2, 3, 4, 5, and 6 feet [ft]), and solar energy suitability. While available for viewing with the Southeast Blueprint, these data layers do not directly inform conservation prioritization in the Southeast Blueprint (SECAS, 2019). See Sections 2.4.2 and 2.5 for information regarding ongoing development of these data layers and the incorporation of threats such as sea level rise and urbanization into the Southeast Blueprint.

The Hubs and Connectors data layer for the Southeast Blueprint v4.0 takes input from the South Atlantic Blueprint v2.2 hubs and corridors (which represent connectors) layer, the Florida Blueprint v1.3 hubs and connectors, and the Appalachian NatureScape design (Phase II) layer (see the Southeast Blueprint v4.0

[2019a] for more information). Work is ongoing to include hubs and corridors from other subregions into future Southeast Blueprint updates.

The Input Areas data layer depicts the spatial extent of all subregion inputs utilized in the Southeast Blueprint v4.0. This layer was first created to cover the full extent of all subregional inputs in the Southeast Blueprint, and was then refined to match the boundary of SECAS (Southeast Conservation Adaptation Strategy, 2019a)[1]. The input areas are translated into high and medium conservation values by region in the Southeast Blueprint v4.0 according to rules outlined in Table 1.

One primary goal in development of the Southeast Blueprint was to improve consistency across the blueprint, therefore each subregional output is reclassified when incorporated into the Southeast Blueprint v4.0 in order to achieve equivalent proportions of areas ranked at high vs. medium conservation value across input subregional areas. Inputs from each subregion are adjusted so as approximately 30% of inputs are classified as high conservation value, and approximately 20% of inputs are classified as medium conservation value (see Southeast Conservation Adaptation Strategy, 2019a for full documentation). The reclassification schemes applied to the subregional blueprints that intersect with the northern Gulf are shown in Table 1.

Table 1. Summary of methods for translating outputs from subregional blueprints into Southeast Blueprint classes (Southeast Conservation Adaptation Strategy, 2019a).

Subregional Blueprint	Original Subregion Blueprint Output Classification	Classification in the Southeast Blueprint v4.0
Florida Conservation Blueprint v1.3	Priority 1	High
	Priority 2	Medium
South Atlantic Blueprint v2.2	Highest and High	High
	Medium and Corridors	Medium
Crucial Habitat Assessment Tool (CHAT) (Texas)	All CHAT Rank 1; a subset of CHAT Rank 2 with high terrestrial and aquatic scores (aquatic 2 & terrestrial 2, aquatic 2 & terrestrial 3, or aquatic 3 & terrestrial 2)	High
	Remainder of CHAT Rank 2 with lower terrestrial and aquatic scores	Medium
Middle Southeast Blueprint	High CV (1)	High
	Moderate CV (2)	Medium
Florida Marine Blueprint v1.0	Priority 1 and 2	High
	Priority 3	Medium

[1] In order to distinguish between Oklahoma and Texas CHAT inputs into the Southeast Blueprint v4.0, a separate state spatial area (the 2015 Tiger line version of U.S. county boundaries) was used to assign each hexagon to either Oklahoma or Texas.

The Southeast Blueprint v4.0 has three key integration rules regarding how the subregional blueprints are aggregated:

1. Application of the conversion rules outlined above (Table 1) to attain 30% high conservation to 20% medium conservation value across each subregion.
2. In areas where subregions overlap, input is only used from a subregional blueprint if the subregion input data in question has documented application to conservation planning.
3. In areas where subregions overlap but there are no known applications of any of the overlapping subregion inputs for conservation planning, only "the most well-established input" is included.

To map the input layers, each input was resampled at a uniform 30 m cell size so that the resulting Southeast Blueprint v4.0 was displayed in a uniform grid. Mapping steps are provided in further detail in the Southeast Blueprint v4.0 Development Process (2019a).

In places not already covered by the above plans, the Appalachian NatureScape and The Nature Conservancy's (TNC) Resilient and Connected Landscapes—Prioritized Network data layers are used. For more information regarding TNC Resilient and Connected Landscapes see Section 2.4.1, for information regarding the Appalachian NatureScape data (which does not intersect with the northern Gulf of Mexico coast) see the Southeast Blueprint v4.0 Development Process (2019a).

2.4.1. The Nature Conservancy Resilient and Connected Landscapes

The Nature Conservancy (TNC) Resilient and Connected Landscapes—Prioritized Network data map is used in the Southeast Blueprint v4.0 to provide data in areas where gaps exist between or within subregional blueprints. The TNC Resilient and Connected Landscapes map displays levels of landscape resilience, for which resilience is described as an area's capacity to "maintain species diversity and ecological function as the climate changes (The Nature Conservancy, 2020). This data layer is derived from TNC's Resilient Land analysis (Anderson et al., 2016). The Resilient Land analysis is framed around impacts of climate change and the intersection of physical settings (geology, underlying bedrock, soil, topography) and landscape connectivity (e.g., relief, wetland connectivity and patchiness). These components—climate change, physical settings, and landscape connectivity—are considered in the TNC Resilient Land analysis as drivers in the creation of areas of high biodiversity and resilient areas to consider for future biodiversity planning. The foundation of these data is the correlation between species diversity and geomorphic diversity (Anderson & Ferree, 2010; Lawler et al., 2015), the relationship between microclimates and species resilience (Albano, 2015), and resilience in microclimates linked with habitat connectivity (see Anderson et al., 2016 and refs. therein). The "final resilience score" is a spatial output of resilience scores across the region, which is the primary output of TNC's Resilient Land Analysis. These spatial resilience scores communicate how resilient a given area is overall to threats posed by climate change based on landscape diversity and local connectedness (Southeast Conservation Adaptation Strategy, 2020a). Other sub-layers of TNC's Resilient Land data layers that can be viewed within the Southeast Blueprint v4.0 include spatial maps of "landscape diversity" and "underrepresented settings," which are those not commonly used in conservation planning, for instance in accounting for differences in elevation, and comparing similar landscape settings such as elevation.

2.4.2. Threat Assessments

Threat projections related to urban growth for the Southeast Blueprint v4.0 CPA gallery can be viewed as separate data layers developed using the SLEUTH urban growth model (Zhou et al., 2019). In addition, users can also access a solar energy suitability layer developed as the output of the Energy Zones Mapping Tool (a utility-scale photovoltaic model that predicts suitability of areas for solar energy development across the region; EISPC, 2013 and online at: https://ezmt.anl.gov/). Southeast Blueprint v4.0 developers recommend NOAA's sea level rise inundation data (https://coast.noaa.gov/slr/) to assess threats from sea-level rise, and users can visualize each projected scenario from within the Southeast Blueprint v4.0 CPA gallery. Due to the bottom-up development structure of the Southeast Blueprint, the approaches used by subregions to address threats of urban growth and sea level rise vary considerably. The South Atlantic Blueprint uses a threat category to increase conservation prioritization, the Middle Southeast Blueprint meanwhile uses a threat category to reduce conservation prioritization. In Texas CHAT, threats such as sea level rise and urbanization are used in calculation and ranking of conservation prioritization. This inconsistency is a known issue with the Southeast Blueprint v4.0, and is listed in Southeast Blueprint v4.0 documentation (Southeast Conservation Adaptation Strategy, 2019a).

2.5. ONGOING MONITORING AND DEVELOPMENT

The Southeast Blueprint v4.0 companion guide assists individuals and organizations who wish to use the blueprint for planning purposes (Southeast Conservation Adaptation Strategy, 2020a). Users that intend to plan within the South Atlantic subregion of the Southeast Blueprint v4.0 are directed to the South Atlantic companion guide; however, the most recent update to the South Atlantic blueprint and the most recent companion documentation (South Atlantic Conservation Blueprint, 2020) refer to the iteration of the South Atlantic Blueprint that will be incorporated into the Southeast Blueprint 2020 (see Section 5.0 for more information on the South Atlantic Blueprint).

Users can view connectivity (Hubs and Corridors) separately from the overall Southeast Blueprint via the v4.0 CPA; connectivity layers are based on inputs from the Florida Conservation Blueprint's connectivity layer in addition to input from the South Atlantic subregion (Section 5.0) and the Appalachian subregion (not discussed here). At present, the Hubs and Corridors layer does not extend throughout the Southeast region due to limited data availability.

Work to develop threat assessments for the Southeast Blueprint is ongoing. Future plans include the incorporation of additional data layers and visualization tools into the Southeast Blueprint CPA. These layers include the U.S. Forest Service's Water Supply Stress Index, which estimates increases in water quantity based on longleaf pine leaf area (shifting in response to fire regimes) in the South Atlantic region, as well as the incorporation of a dataset that will support estimation of the impacts of conservation on water quality, using water models such as the Soil and Water Assessment Tool (Southeast Conservation Adaptation Strategy, 2020a). Additionally, a layer has been developed through a collaboration between state, federal, and local partners which provides habitat suitability maps for at-risk herpetofauna species in the longleaf pine ecosystem. This data layer intersects with much of the southeast region and has the potential to be integrated into the Southeast Blueprint.

2.6. KEY CONTACTS AND RESOURCES

Contacts

Todd Hopkins, Coastal Resilience Coordinator; U.S. Fish and Wildlife Service
todd_hopkins@fws.gov

Resources

SECAS Website
Southeast Blueprint v4.0 on DataBasin
Individual State Point of Contacts for SECAS

3.0 Crucial Habitat Assessment Tool (CHAT)

3.1. INTRODUCTION

The Crucial Habitat Assessment Tool (CHAT) is a collaboratively developed map of conservation values that is maintained and updated by the Western Association of Fish and Wildlife Agencies (WAFWA). CHAT encompasses 15 states of the western U.S. in addition to Alaska (State Wildlife Agencies of the Western United States., 2020), representing a large area with diverse ecosystems and governance. The function of CHAT is to provide a single, connected, and consistent framework for the ranking and visualization of conservation data across the western states to serve as a decision support system for conservation planning.

The CHAT interface is the region-wide CHAT, which is a publicly accessible GIS map provided on WAFWA's website (named there as the "West-wide CHAT map," but presented in documentation as the "region-wide CHAT"), that provides prioritization ranking data detailed at a one square mile hexagon scale across the entire CHAT domain. The primary data for each hexagon is a CHAT Rank, which delineates priority areas for conservation, or, "crucial habitats" (Western Association of Fish & Wildlife Agencies, 2020). When users click on any hexagon within the CHAT map, they are given access to a table of the underlying data rankings of CHAT, which comprise what is termed a "Thematic Ranking Mosaic." The Thematic Rankings Mosaic is a database that includes—at a consistent resolution of one-square mile hexagons—an overall CHAT Rank, a terrestrial CHAT Rank, an aquatic CHAT Rank, in addition to rankings for other relevant concerns for those engaged in conservation and planning including landscape connectivity, condition, and the presence or absence of Species of Concern (SOC).

The Southeast Blueprint's coverage of Texas and Oklahoma is derived entirely from CHAT. As Oklahoma does not intersect with the northern Gulf Coast and is not discussed in this report, this section first discusses CHAT as a whole, before describing the Texas contribution to CHAT that is utilized in the Southeast Blueprint area of interest for this report.

3.2. HISTORY AND GOVERNANCE

CHAT was initially developed as a project of the Western Governors' Association (WGA; see Figure 4 for a summary of major timeline milestones in the development of the CHAT). The WGA is a nonpartisan organization of governors representing 19 states of the western U.S. and three U.S.-flag Pacific Island States; the organization conducts a range of initiatives that focus on environmental protection, natural resources, and the economy.

In 2007, WGA approved a policy resolution, *Protecting Wildlife Migration Corridors and Crucial Habitat in the West*, which called on western U.S. member states of WGA to collaborate with stakeholders to identify crucial wildlife habitats and key wildlife corridors across the West, and to make recommendations regarding policy options and tools for preservation of those landscapes. The WGA established six working groups to represent science, energy, land use, oil and gas, climate change, and transportation. Each of these working groups developed their own set of recommendations as to how to implement the policy resolutions. These recommendations were compiled in a 2008 report, *Wildlife Corridors Initiative* (Western Governors' Association, 2008).

This report laid the groundwork for the development of CHAT. Specifically, the WGA Science Committee envisioned (Western Governors' Association, 2008):

> [T]he creation of a geographic information system [GIS]-based spatially-explicit Decision Support System that builds upon existing information and programs, but is improved by a commitment to invest in the information base by filling data gaps, bringing consistency across the West to the mapped data of crucial habitats and important wildlife corridors, increasing integration of that information into decision processes, promoting research on adaptive resource management, and creating sustainable funding.

The report called for the establishment of a governing council, the Western Governors' Wildlife Council (WGWC; initially named the Western Wildlife Habitat Council in the 2008 report), and WGA invited each of its governors to appoint one member to the WGWC, with the mandate that this appointee be a state employee and policy expert in a field related to the Wildlife Corridors Initiative (Western Governors' Association, 2008). The WGWC was charged with overseeing the development and implementation of the recommendations laid out in the report, beginning with four priority actions:

1. Coordinate and assist in development of a Decision Support System (DSS) within each state to assist in identifying wildlife corridors and crucial habitats while supporting research into the threats that climate change poses to conservation.
2. Establish policies to ensure that information from this process is used in planning and decision-making processes.
3. Ensure that states use this information to avoid, minimize or mitigate impact to sensitive areas.
4. Seek funding from state and federal partners.

In 2009, WGWC drafted a "White Paper" that provided the following definitions for crucial habitats and important wildlife corridors, which remain central to the CHAT framework (Western Governor's Wildlife Council, 2009):

> *Crucial habitats* are places containing the resources, including food, water, cover, shelter and "important wildlife corridors," that are necessary for the survival and reproduction of aquatic and terrestrial wildlife and to prevent unacceptable declines, or facilitate future recovery of wildlife populations, or are important ecological systems with high biological diversity value.
>
> *Important Wildlife Corridors* are crucial habitats that provide connectivity over different time scales (including seasonal or longer) among areas used by animal and plant species. Wildlife corridors can exist within unfragmented landscapes or join naturally or artificially fragmented habitats and serve to maintain or increase essential genetic and demographic connection of aquatic and terrestrial populations.

Additionally, the 2009 White Paper outlined how individual states would develop DSSs to compile information, assure data quality and make the resulting data, models, and analyses available to those interested in planning conservation actions or examining climate adaptation strategies. States were

directed to utilize landscape-level mapping of crucial wildlife habitat and important wildlife corridors such that the maps could be coordinated across the states represented by the WGA. In 2010 regional pilots were launched with support from a Department of Energy grant.

In 2011, based on the lessons learned from those regional pilots, WGA established a plan to develop a region-wide CHAT to encompass the full spatial extent of the 16 WGA states participating in the initiative. This region-wide CHAT was planned as a publicly accessible GIS conservation tool, and WGA documented that plan in a 2013 update to the White Paper, *Western Wildlife Crucial Habitat Assessment Tool (CHAT): Vision, Definitions and Guidance for State Systems and Regional Viewer* (Western Governor's Wildlife Council, 2013). This finalized draft of the White Paper was intended to facilitate coordination with federal land management agencies that seek to use landscape-level wildlife data in their planning processes; this document served as a guide for an ongoing relationship between the WGA and federal agencies (i.e., USFWS, the Bureau of Land Management, the U.S. Forest Service, and others) in an effort to establish a regionally consistent tool. That document formalized the WGA's development process for CHAT in its integrated, region-wide form, and defined the goal of the program "to provide a public, user friendly online tool with consistent and region-wide information on crucial habitats for fish and wildlife, for all interested parties to use and assess landscapes and connectivity while better informing land use decisions" (Western Governor's Wildlife Council, 2013).

While CHAT's region-wide emphasis provides a consistent framework for the entire region, individual states are assured a degree of autonomy while participating in the initiative. States select the data sources for inputs, do not have to provide information for all data types, and generate their own rulesets to calculate priority rankings.

In December 2013, the WGA launched the region-wide CHAT and continued to manage the initiative through 2014. In April 2015, WGA transferred full responsibility for CHAT to WAFWA. WAFWA is an advocacy group that supports and promotes "collaborative, proactive, science-based fish and wildlife conservation across the west," whose members are composed of state- and territory-based fisheries and wildlife agencies from across the western U.S. and connected regions of Canada, that work closely with federal agencies such as USFWS (WAFWA, 2018). WAFWA continues to maintain and update CHAT with the use of state-submitted data.

Texas Parks and Wildlife Department (TPWD) is responsible for collecting, compiling, ranking, and submitting data that pertains to the state of Texas to WAFWA for inclusion in the region-wide CHAT. More information about this data and process can be found in Section 3.4.

As of 2020, Texas has not developed a state-specific presentation of CHAT, and the compiled data is viewable only through WAFWA's region-wide CHAT (Western Association of Fish & Wildlife Agencies, 2020). TPWD does however provide publicly accessible online GIS maps (TPWD, 2020b) of much of its conservation data, including many of the state-specific data inputs that are utilized in CHAT.

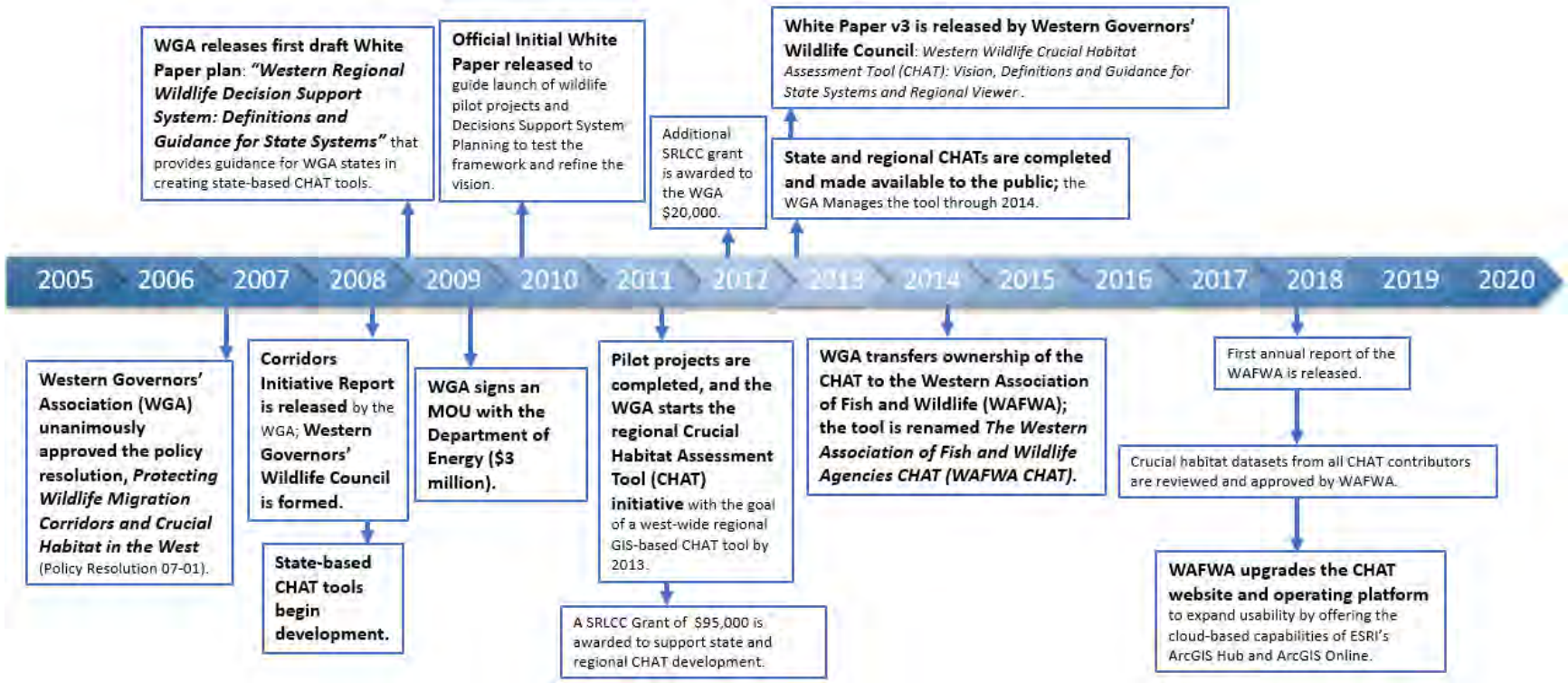


Figure 4. Summary of critical milestones in the development of CHAT.

3.3. GEOGRAPHY AND ECOSYSTEM

The region-wide CHAT spans 16 states and the Southern Great Plains subgeography (Figure 5). This comprises a vast array of ecosystem types. The ecosystems of Texas, based on NatureServe classifications are described in Appendix A, and span warm temperate forest and woodland to salt marsh. The Texas CHAT input to the Southeast Blueprint covers the geographic extent of the state of Texas.

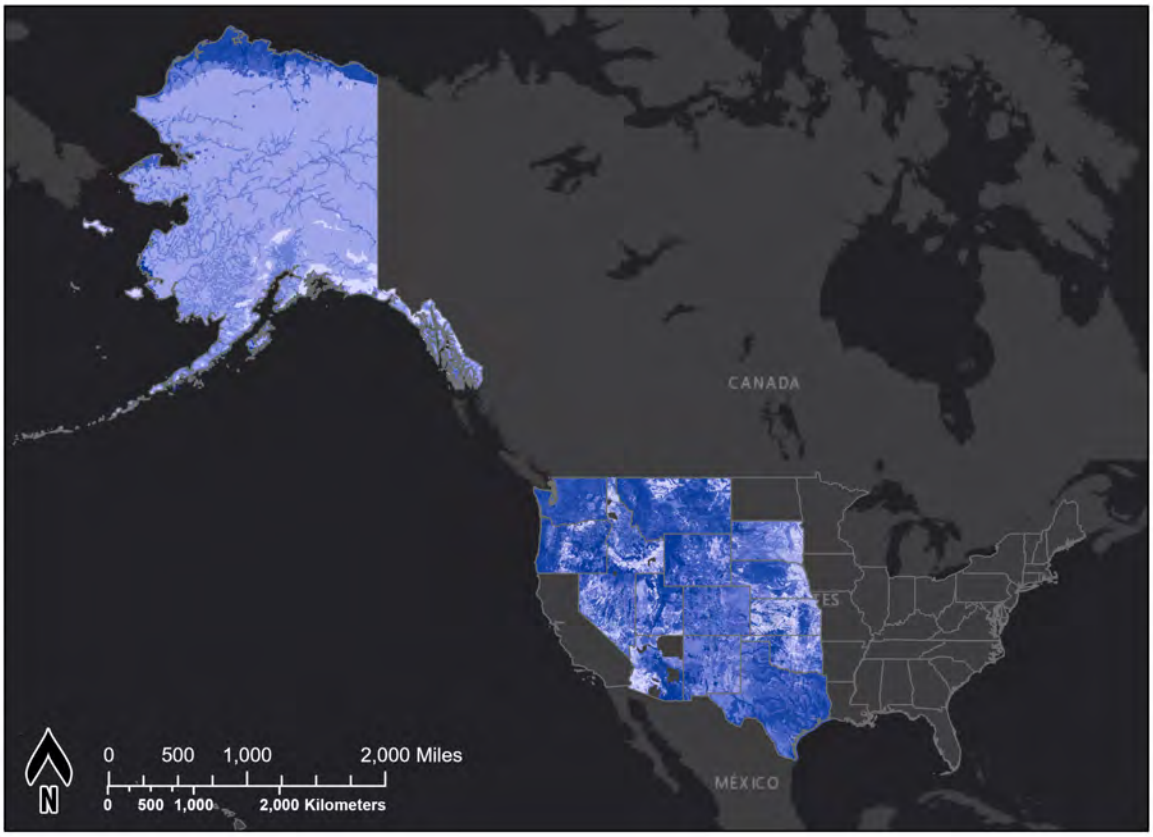


Figure 5. Full extent of the region-wide CHAT domain.

CHAT is centered around the idea of *crucial habitat* defined for species and habitats of interest to fish and wildlife management agencies within the western states. “Crucial habitat describes places that are expected to contain the resources necessary for continued health of fish and wildlife populations or important ecological systems expected to provide high value for a diversity of fish and wildlife” (State Wildlife Agencies of the Western United States., 2020).

3.4. BLUEPRINT STRUCTURE AND METHODOLOGY

Although this report is focused on inputs related to the Gulf coast (e.g., the Texas component of the CHAT), in order to understand the structure and methodology of Texas CHAT it is helpful to understand the overall framework of the region-wide CHAT for context. Below the mechanics of the region-wide tool are discussed, followed by a discussion of the specific structure and methodology used by Texas.

CHAT is composed of a collection of data types that together provide for the calculation of a prioritized rank of crucial habitat and habitats of interest to the western states' fish and wildlife management agencies. The WGA White Paper provides guidance to states on what crucial habitat and important wildlife corridors are and how to categorize them in a broad sense (e.g., Category 1: "Aquatic or terrestrial habitats, including wildlife corridors, that are rare or fragile and are essential to achieving and/or maintaining wildlife species viability or exceptional diversity…and is therefore considered irreplaceable"; Category 2: "Habitat, including wildlife corridors, which is limiting to a fish or wildlife community, population, or metapopulation…Restoration or replacement is difficult, or may be possible only in the very long term"; Category 3: "Habitat…that contributes significantly to the maintenance of fish or wildlife communities, populations, or metapopulations"). In the White Paper, the WGA provides further guidance as to what types of data are of value in the identification of crucial habitat; these data layers are considered by WGA to be the "foundation of any crucial habitat layers and which states commit to including, as a minimum, in their systems." Data types that are not essential but that could add to the value of crucial habitat are also listed; these additional categories can be optionally included by individual states. The following categories are those listed as essential data types for states to provide for inclusion in the CHAT (State Wildlife Agencies of the Western United States., 2020):

1) Habitat for SOC (terrestrial and/or aquatic): Specifically related to species of greatest conservation need (SGCN) identified by State Wildlife Action Plans (SWAPs) or other assessments (e.g., occurrence data of Federally or state-listed threatened/endangered species, or key habitat boundaries related to species with special protective rankings or that are characterized by high biodiversity).
2) Native and unfragmented habitat: Large, contiguous areas of undisturbed, natural habitat with low urban influence identified by natural vegetation classification habitat maps, ecological systems of concern, priority habitats identified by SWAPs, and others.
3) Riparian and wetland habitat: Unique environments that support high animals and plant diversity based on data related to natural springs, National Wetlands Inventory, and others.
4) Connectivity or linkage areas (wildlife corridors): Areas specifically denoted as important for wildlife habitat connectivity (i.e., major animal movement corridors or landscape connectivity zones).
5) Quality habitat for species of importance: "May include game or sportfish species especially if habitat needs are not already covered by mapping [SOC]" (State Wildlife Agencies of the Western United States., 2020).

For information regarding optional data categories, see Table 2, and the WGA White Paper for full documentation (Western Governor's Wildlife Council, 2013).

Once states collect and compile the data, each state is tasked with developing their own relative, six-level prioritization scheme with which they assign a ranking to each individual one square mile hexagon cell for "crucial habitat." The region-wide CHAT stipulates that each state's prioritization scheme must be ranked from 1 to 6, where 1 represents areas 'most crucial' (areas that most closely meet the definition of crucial habitat) and 6 represents 'least crucial' areas (areas that least closely meet the definition of crucial

habitat) based on mutually agreed-upon definitions. Rankings of zero (0) represent areas with no available data (State Wildlife Agencies of the Western United States., 2020). This data is compiled for aquatic and terrestrial ecosystems separately using stat-based rules to provide terrestrial and aquatic CHAT Ranks, which are then subject to a final "Roll-Up" ruleset that is used to create the overall CHAT Rank for any given hexagon (at a 1 square mile scale) across the entire CHAT spatial domain. The WGA provided guidance on how the final CHAT rankings could be calculated (using weighted sum or categorical methods), but provided states with the freedom determine their own methodologies, noting that there is "no 'one size fits all' approach…to accommodate state priorities" (Western Governor's Wildlife Council, 2013).

Lastly, the WGA White Paper acknowledges that challenges exist in terms of regional compatibility as states may not necessarily map the same information for the same species, and states can categorize and rank crucial habitat differently based on each state's authority over its own fish and wildlife management. The WGA acknowledges that discrepancies will exist in CHAT rankings between states, particularly at state boundaries, that prevent CHAT from being a seamless map of crucial habitat (Western Governor's Wildlife Council, 2013). To develop a consistent map, WGA hosted regional workshops in 2012 and 2013 to assist states with developing an initial set of common processes, data attributes, and scale. The current CHAT prioritization rules developed by each state can be viewed in the CHAT Thematic Rankings document (State Wildlife Agencies of the Western United States., 2020).

3.4.1. CHAT Rankings and the Thematic Ranking Mosaic

Each state's collection of data, including aquatic, terrestrial, and overall CHAT Ranks, is aggregated into a single region-wide database called a "Thematic Ranking Mosaic" (Table 2). The key metric within the CHAT Thematic Ranking Mosaic is the CHAT Rank, which is a relative measure of crucial habitat. The CHAT Rank is derived from the terrestrial CHAT Rank and the aquatic CHAT Rank, which are provided on a 1–6 scale, with 1 indicating that the hexagon is composed of the "most crucial" habitats and 6 indicating that the hexagon is composed of lands that are classified as "least crucial." In addition to the primary CHAT Rank data, all states are asked to provide additional data related to a range of conservation concerns within in their state (Table 2, rows 4–13). For each state, a single state agency is responsible, in coordination with the WAFWA state representative (who is also any employee of state wildlife agency) for that state's submission to the region-wide CHAT. In this way, they are responsible for selecting the data used as inputs for CHAT in their state, determining how the Thematic Ranking Mosaic attributes are to be ranked based on that data, and determining the overall CHAT ranking of each cell (see State Wildlife Agencies of the Western United States., 2020 for a list of each category in full detail). If states do not supply data for a given category, that category is left blank in the public-facing CHAT map for a given spatial hexagon. For hexagons that cross state boundaries, the lesser of the two values is used to denote rank for that hexagon (State Wildlife Agencies of the Western United States., 2020).

Table 2. CHAT Thematic Ranking Data Types. The first three data types highlighted in blue are required inputs to the CHAT Thematic Rankings Mosaic, whereas the other data types are optional inputs that states can include for aggregation into the top three rank calculations.

Thematic Ranking Data Type	Description
Overall CHAT Rank	Integrated measure of the below categories as determined by each state's prioritization and aggregation rules (aka "Roll-Up" rules).
Terrestrial CHAT Rank	Final ranking of how crucial a given cell is to terrestrial wildlife and/or wildlife habitat as determined by state wildlife agency personnel and their ranking of individual terrestrial thematic inputs.
Aquatic CHAT Rank	Final ranking of how crucial a cell is to aquatic wildlife and/or wildlife habitat as determined by state wildlife agency personnel and their ranking of individual aquatic thematic inputs.
SOC	Species of specific conservation importance at the state or national level. Most states define this list using SWAP SGCN and NatureServe conservation status rankings, and other criteria as determined by individual states. a. Terrestrial SOC: Species of state/national conservation importance that occur on land. b. Aquatic SOC: Species of state/national conservation importance that occur in aquatic environments (freshwater, estuarine, and coastal marine).
Landscape Condition	An overall measure of land cover impacted by human activities derived from model outputs of Intact Habitat Blocks and Important Connectivity Zones identified by the NatureServe Landscape Condition Model. a. Landscape Condition – Raw: This measure (a score from 0 to 1) is derived from the NatureServe Landscape Condition model to indicate how natural (un-impacted) an area is. This score is based on a model of impact decay rates for areas near different infrastructure types (i.e., cropland is included as an impact, so cells surrounding cropland are ranked according to the model based on distance away from that impact). b. Large Natural Areas: A product of the NatureServe Landscape Condition Model, here represented as "Large Intact Blocks" of native habitat that are relatively intact or have low levels of anthropogenic impact. c. Natural Vegetation Communities: Spatial data representing natural vegetations communities of conservation concern (as determined by individual states or the Ecological Systems of Concern map produced from the WGA Landscape Integrity Workgroup). d. Landscape Connectivity: Landscape connectivity or permeability as defined by state-specific connectivity mapping or as derived from the linear landscape paths for core habitats (data derived from the WGA Landscape Integrity Workgroup).

Thematic Ranking Data Type	Description
Landscape Condition Summary	An overall aggregated measure of landscape integrity data layers and condition (see Section 3.4.2 for further detail).
Freshwater Integrity	Measure of freshwater habitat condition (for many states this typically includes landscape variables and land use variables known to impact aquatic ecosystems).
Riparian and Wetland Habitat Distribution	"Unique and/or sensitive environments" that function to support animal and plant diversity.
Wildlife Corridors	Species-specific analyses of connectivity including important movement areas.
Species of Economic and/or Recreational Importance	Habitat needs of terrestrial game species (especially if those habitats are not covered in mapping "Species of Concern").
Aquatic Species of Economic and/or Recreational Importance	Habitat needs of sportfish (particularly if those habitats are not covered in mapping "Species of Concern").
Lesser Prairie Chicken Habitat Ranking	Landscape ranking within the range of the lesser prairie chicken.

When viewing and utilizing the public facing WAFWA CHAT map, the overall CHAT Rank is displayed, with hexagons ranked as 1, or "most crucial habitats" shown in dark blue, and hexagons ranked as 6, or "least crucial habitats" shown in white (Figure 6). Other metrics included in the Thematic Ranking Mosaic are similarly ranked on a 1-6 scale by each individual state. These additional metrics (detailed in full in Table 2) may inform the CHAT Rank but are represented only in tabular format on the CHAT map.

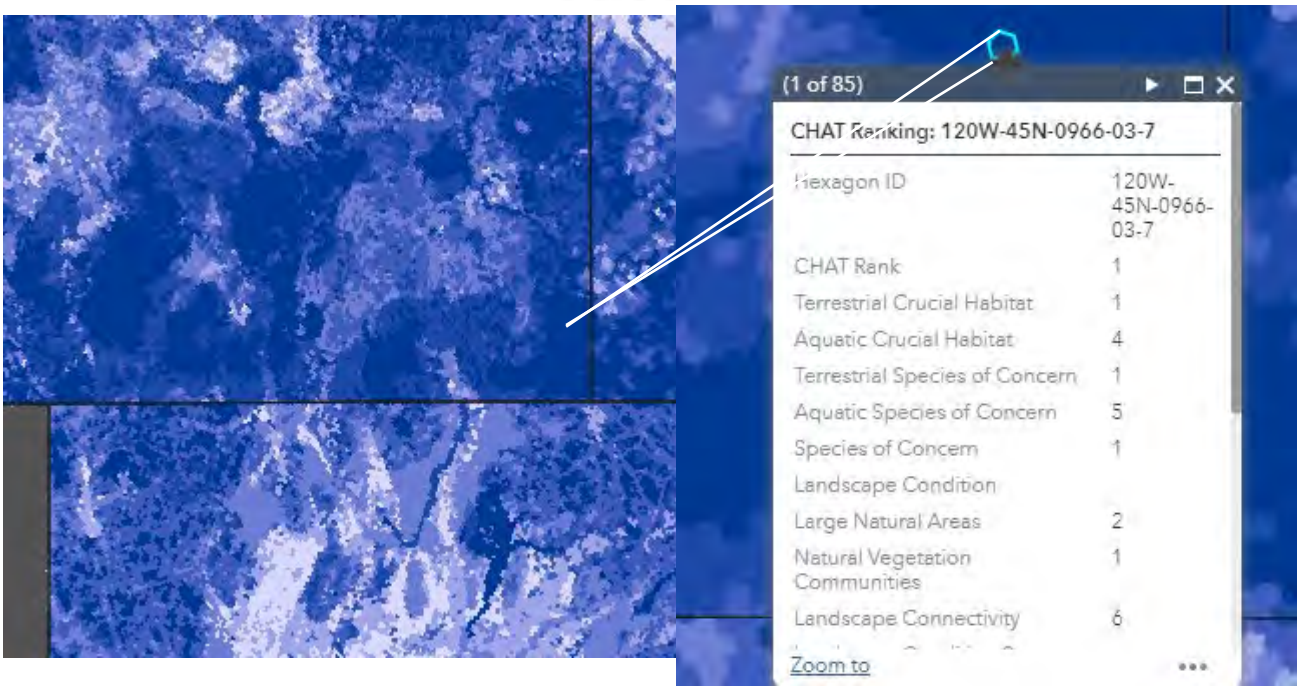


Figure 6. Presentation of CHAT Thematic Rankings on wafwachat.org. One square mile hexagon level data show in tabular format.

States are responsible for determining their own state-specific "Roll-Up Rules," which are the "method of combining, or aggregating, several different data inputs into a final score or ranking" (State Wildlife Agencies of the Western United States., 2020). These rules can be additive (weighted sum) whereby input data layers are weighted by importance relative to another, or categorical (non-mathematical) which use a set of rules to combine input data layers for each hexagon. Roll-Up Rules, or aggregation rules, are submitted for the overall CHAT Rank as well as for terrestrial SOC, aquatic SOC, and any other data category a state chooses to supply. See the CHAT Thematic Rankings document (2020) for how each state aggregates their CHAT data categories into the overall CHAT Rank. The CHAT Thematic Rankings document does not provide aggregation details, these details can be found in Table 3–5 of this report.

3.4.2. Texas CHAT Core Data Layers

In Texas, TPWD has selected datasets from a range of state and federal agencies to satisfy the suggested five data types for inclusion in the region-wide CHAT. These datasets are both terrestrial and aquatic in focus, largely related to state and federally listed priority species and their spatial occurrence. These datasets are summarized in Figure 7 and discussed in the following sections.

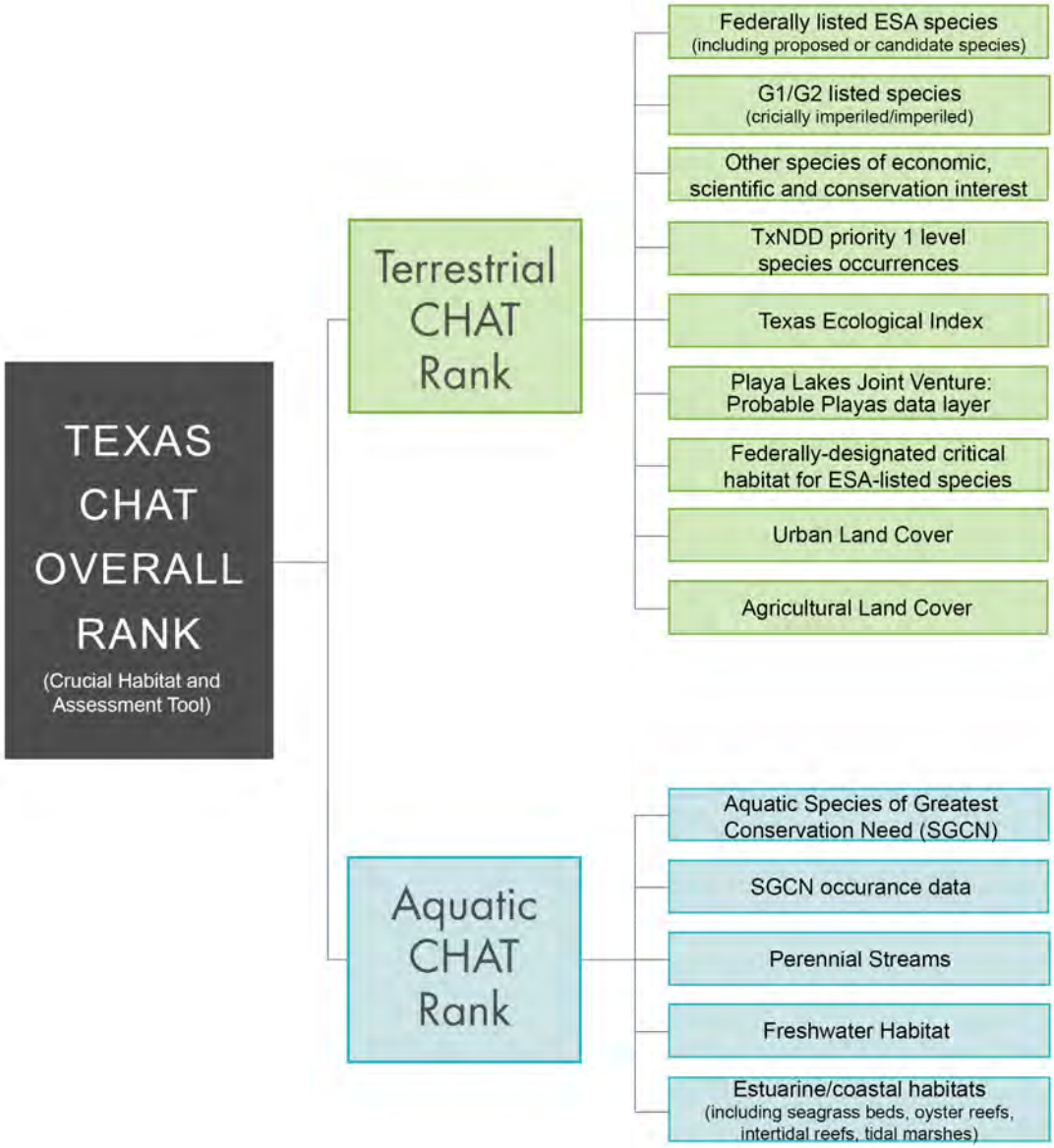


Figure 7. Texas CHAT data inputs.

3.4.2.1. Terrestrial Data

Terrestrial data types used by the Texas CHAT are listed in the terrestrial CHAT ruleset documentation (TPWD, 2018). The terrestrial Texas CHAT is largely focused on ESA-listed species that occur in Texas as well as species ranked as G1 or G2 (critically imperiled or imperiled). G-ranked species lists are derived from G1/G2 species records curated by NatureServe and the National Heritage Program. In addition, “other selected species of scientific, economic, and conservation interest as determined by TPWD personnel” are included in Texas CHAT, but documentation regarding specifics of those species is limited (TPWD, 2018).

Datasets for federally designated “Critical Habitats” for ESA-listed species are derived from the USFWS Critical Habitat for Threatened and Endangered Species Dataset (USFWS, 2020a). This dataset was created in 1999 by USFWS and updates are made on a continuous basis by USFWS. The database is composed of spatial data that includes habitats considered essential to conservation of ESA-listed species; this information is required when proposing a species for listing as threatened or endangered under the ESA. Areas designated as Critical Habitat may refer to areas not currently occupied by the species, but that will be needed for a given species’ recovery (USFWS, 2020a).

The Texas Natural Diversity Database (TxNDD) is another component of the terrestrial species dataset (Wildlife Diversity Program, 2019). The TxNDD database was established in 1983 as a member program in the NatureServe network. The TxNDD consists of areas where a species, a native plant community, or an animal aggregation (termed an “Element” in the TxNDD documentation) is known to occur, and therefore the area has higher conservation value. Data inputs to the TxNDD include information on Element Occurrences (EOs), describing where an Element has been observed, who observed it and when, and how many of the Element have been observed. Data for the TxNDD database is derived from a variety of sources including other conservation organizations, consulting firms, TxNDD personnel, and published articles/reports/herbaria. All information is coded to the NatureServe classification standard (Wildlife Diversity Program, 2019).

Spatial land use/land cover data for agriculture and urban land cover classifications for the Texas CHAT are derived from the Texas Ecological Mapping Systems (EMS) project (Elliott et al., 2014). The EMS project was developed in 2014 as a component of the Ecological Systems Classification and Mapping Project, which was conducted by the TPWD in cooperation with private, state, and federal partners (funded by the TPWD, the USFWS, and the Great Plains LCC), in support of the Texas Comprehensive Wildlife Conservation Strategy for the TPWD. The goal of the EMS project is to provide high resolution spatial data for conservation planning and management (Elliott et al., 2014). The EMS project describes systems, subsystems, and vegetation types for Texas, linking vegetation and ecosystem classes explicitly to the NatureServe Terrestrial Ecological Systems classification (Elliott, 2014; NatureServe, 2009).

The terrestrial CHAT inputs also rely on modelled priority species habitat areas derived from the TPWD Ecological Index (TEI) model, which is an offshoot of the EMS project (Elliott et al., 2014; personal communications, Duane German, TPWD). The TEI model is based on data layers developed from the EMS project, and it functions as a habitat suitability model for priority species (both aquatic and terrestrial). The model uses probability of species occurrence (based on species occurrence data and known ranges) and a ranking of habitat suitability of a given habitat type for a particular species, combined into an ecological index to represent potential habitat by species across the state (TPWD, 2020a; Duane German TPWD, personal communication). Information is limited regarding the development of the TEI model.

Other land use and land type data layers used in the Texas terrestrial CHAT are derived from the Probable Playas dataset developed by the Playa Lakes Joint Venture. The Probable Playas v5.0 data layer, developed in 2019, details spatial data within the Playa Lakes Joint Venture Region related to playas: “[S]hallow, depressional wetlands that are generally round and small in size” which are characterized by

highly variable wet-dry cycles and diverse plant communities (PLJV, 2019). This dataset identifies playas via a compilation of multiple data sources: The Soil Survey Geographic database (a highly detailed soil data for states across the U.S.); the National Wetlands Inventory (a database of the abundance, characteristics and distribution of U.S. wetlands); the National Hydrography Dataset (surface waters of the U.S.); Landsat Thematic Mapper imagery; National Agriculture Imagery Program imagery (aerial imagery during the agricultural growing season); and hand-delineation on aerial maps of select lands managed by TNC (PLJV, 2019).

The prioritization rules that TPWD use to delineate terrestrial CHAT rankings for the state of Texas are given in
Table 3, but at this time there is no publicly available supporting documentation on the scientific basis of these rulesets.

Table 3. Texas CHAT Terrestrial Crucial Habitat Rank Ruleset; reproduced from (TPWD, 2018)

CHAT Rank	Terrestrial Prioritization Rules
CHAT 1	IF hexagon intersects a Texas Natural Diversity Database (TxNDD) record of a Federally Listed T/E species (including proposed and candidate species) OR hexagons that intersect a federally designated critical habitat for T/E species OR hexagons that intersect a TxNDD record of a G1/G2 species and other selected species of scientific, economic, and conservation interest as determined by TPWD personnel.
CHAT 2	IF hexagon intersects a TxNDD record of any non-Priority Level 1 species tracked in the database OR hexagons with a weighted average top 3% score from based TPWD Ecological Index model OR hexagon intersects a priority 1 species TxNDD occurrences not meeting CHAT 1 standards of age and/or accuracy OR hexagons that intersect Playa Lakes Joint Venture Probable Playas layer that are less than 50% agriculture or urban land cover per the Texas EMS data.
CHAT 3	IF hexagons with a weighted average score in the top 4-9 percent of all scores from Texas Ecological Index data OR hexagons with less than 50% urban or agriculture land cover per TPWD EMS intersecting TPWD modeled priority 1 species habitats

CHAT Rank	Terrestrial Prioritization Rules
	OR hexagons with less than 50% Urban land cover and greater than 50% agricultural land cover per TPWD EMS data intersecting the Playa Lakes Joint Venture Probable Playas layer.
CHAT 4	IF hexagons with a weighted average score in the top 10-20 percent of all scores from Texas Ecological Index data OR hexagons with greater than 50% urban or agriculture land cover per TPWD EMS intersecting TPWD modeled priority 1 species habitats OR hexagons with less than 50% urban or agriculture land cover per TPWD EMS data intersecting TPWD modeled all other species not mapped at level 3 habitats
CHAT 5	Every hexagon not category 1-4 and less than 50% urban land cover per the Texas EMS data.
CHAT 6	All hexagons that are high-density urban (greater than or equal to 50% urban per Texas EMS data) that do not rank CHAT 1-2.

3.4.2.2. Aquatic Data

Aquatic data types used by the Texas CHAT are listed in the aquatic CHAT ruleset documentation (TPWD, date unknown). Similar to the terrestrial CHAT input data layers, the aquatic data is focused on priority species (specifically SGCN) and the habitats that support them.

SGCN occurrence data is derived from multiple datasets including: The University of Texas at Austin Natural History Collections, the TPWD Natural Diversity Database, and the TPWD Inland Fisheries and Coastal Fisheries division.

To add habitat occurrences for those SGCNs, habitat data is drawn from spatial datasets developed by the Texas Commission on Environmental Quality (perennial streams); the TPWD Coastal Fisheries Division (estuarine/coastal habitat data); and the Texas Native Fish Conservation Areas Network and the TPWD-annotated U.S. Geological Survey (USGS) Springs of Texas (priority freshwater habitats known to support aquatic SGCN).

Lastly, migration pathways for highly migratory coastal SGCN were inferred from the locations of passes between the Gulf of Mexico and Texas bays (Duane German TPWD, personal communication). However, the data source is not clearly identified in the aquatic Texas CHAT ranking documentation.

The prioritization rules that the TPWD uses to delineate aquatic CHAT Ranks for the state of Texas are shown in Table 4.

Table 4. Texas CHAT Aquatic Crucial Habitat Rank Ruleset

CHAT Rank	Aquatic Prioritization Rules
CHAT 1	IF hexagon intersects perennial streams and estuarine/coastal habitats with known occurrences of aquatic SGCN.
CHAT 2	IF hexagon intersects priority freshwater or estuarine/coastal habitats known to support aquatic SGCN.
CHAT 3	IF hexagon intersects HUC 12 that intersects perennial streams within the native ranges of freshwater fish SGCN OR hexagon intersects a migration pathway for a highly migratory coastal SGCN.
CHAT 4	IF hexagon intersects with all other perennial or intermittent streams or coastal waters not contained in Priority Levels 1-3.
CHAT 5	IF all other areas of the state not contained in Priority Levels 1-4.
CHAT 6	Nothing.

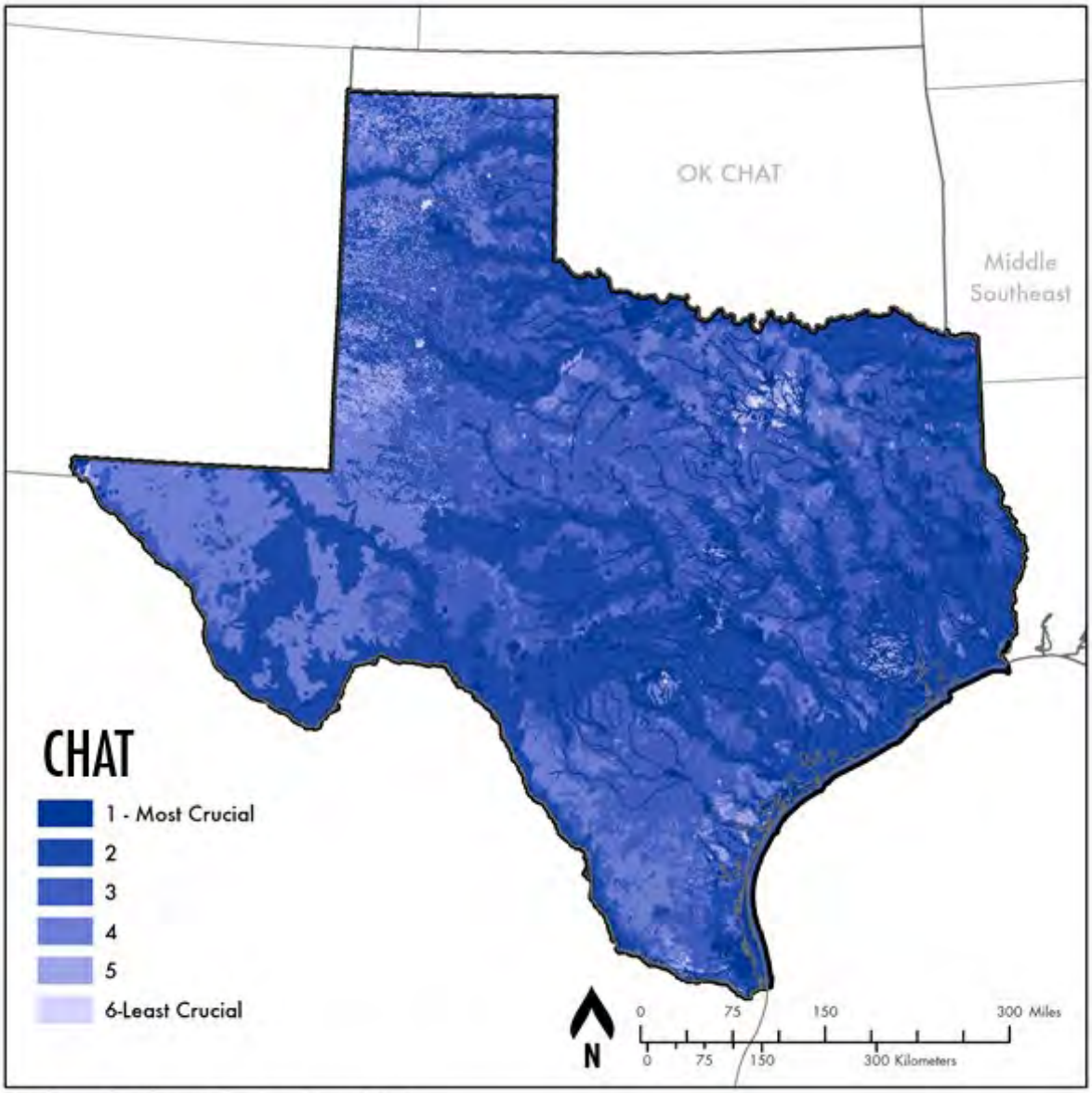
3.4.3. Texas CHAT Aggregation Rules

Texas provides data and accompanying aggregation rules for terrestrial and aquatic crucial habitat CHAT Ranks, as well as an overall CHAT Rank ruleset, which produce ranks from 1 ("most crucial" or highest priority) to 6 ("least crucial" or lowest priority). The terrestrial and aquatic rules are shown in Table 3 and Table 4, respectively. These two rankings are then aggregated together using an additional "Roll-up" ruleset (Table 5) to create a single overall CHAT Rank on the 1–6, highest to lowest priority scale in a framework grid at the 1 square mile hexagon level. Taken together, CHAT rankings reflect the relative probability that a high-priority species or habitat exists in a given area.

Table 5. Texas CHAT Roll-Up (Aggregation) Rules for Integration of Terrestrial and Aquatic CHAT Rankings into a Single Layer of CHAT Priority Rankings

CHAT Rank	CHAT Rollup Rules
CHAT 1	IF Aquatic SOC =1 OR Terrestrial SOC = 1
CHAT 2	IF Aquatic SOC = 2 AND Terrestrial SOC 1-6 OR Terrestrial SOC =2 AND not classified in CHAT 1
CHAT 3	IF Aquatic SOC = 3 and Terrestrial SOC 1-6 OR Terrestrial SOC = 3 AND not classified in CHAT 1 or 2
CHAT 4	IF Aquatic SOC = 3 and Terrestrial SOC = 6 OR Aquatic SOC = 4 OR Terrestrial SOC = 4 AND not classified in CHAT 1, 2, or 3

CHAT Rank	CHAT Rollup Rules
CHAT 5	IF Aquatic SOC = 3 and Terrestrial SOC = 6 OR Aquatic SOC = 5 OR Terrestrial SOC = 5 AND not classified in CHAT 1-4
CHAT 6	IF Terrestrial SOC = 6 AND not classified in CHAT 1-5



Data Source: http://secassoutheast.org/blueprint.html

Figure 8. Texas CHAT data as represented in the region-wide WAFWA CHAT.

3.4.4. Integration into the Southeast Conservation Blueprint

Data used as input to the Southeast Blueprint v4.0 from the region-wide CHAT consists of the outputs from Oklahoma (not covered in this report) and Texas. Delineation between hexagons at the border of Texas and Oklahoma were separated when integrating the inputs into the Southeast Blueprint v4.0 (see Section 2.4 for more information). For Texas, areas with a combined CHAT Rank of 1 are defined as "high conservation value" in the Southeast Blueprint, as well as a subset of CHAT 2 rank with high terrestrial and aquatic scores. The remainder of the CHAT Rank of 2 with lower terrestrial and aquatic scores is classified as "medium conservation value" in the Southeast Blueprint (Southeast Conservation Adaptation Strategy, 2019b). See Section 2.4 for a summary of how data from this subregion were integrated into the Southeast Blueprint v4.0.

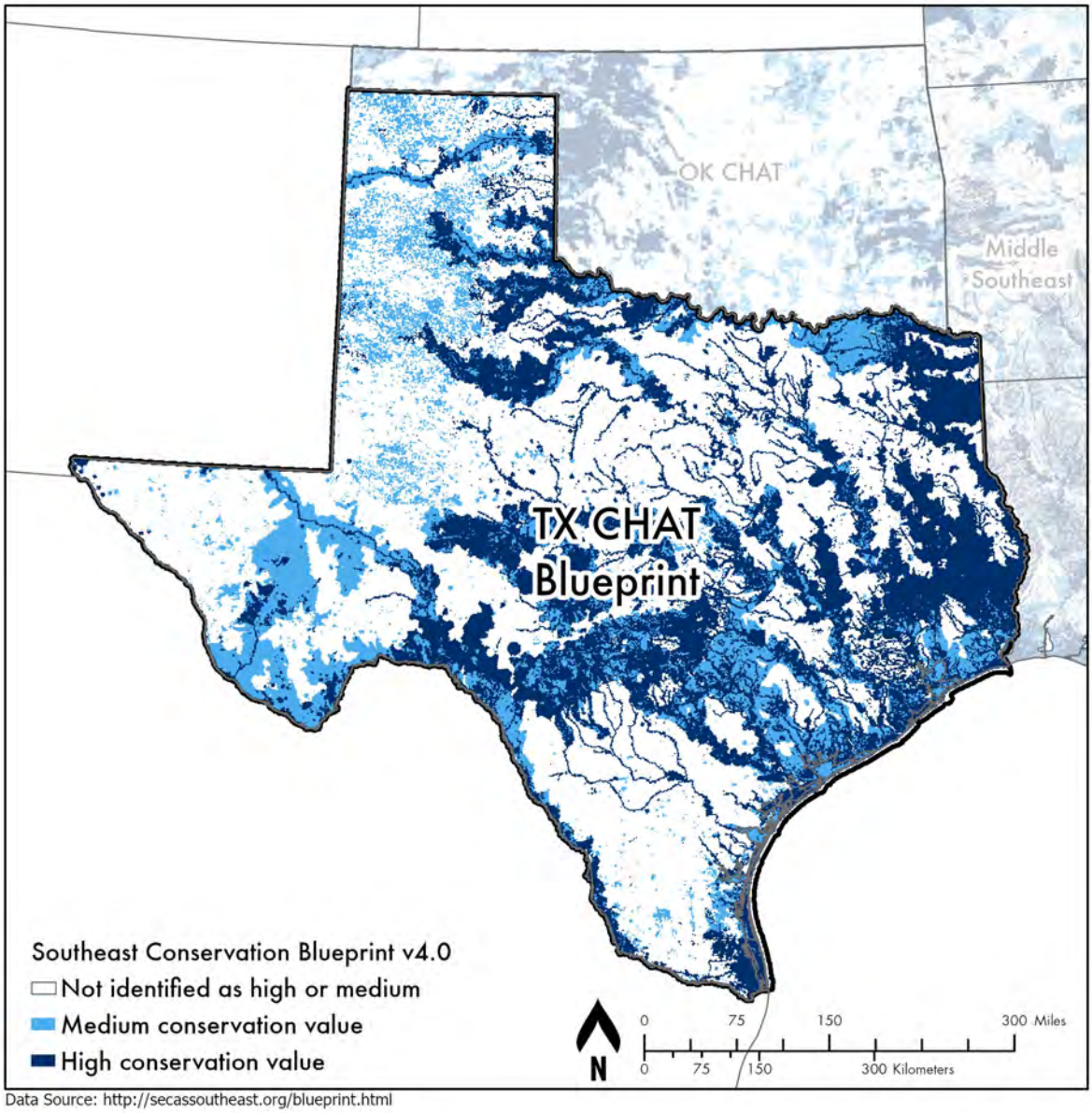


Figure 9. The Southeast Blueprint v4.0, area shown uses input from Texas CHAT.

3.4.5. Schematic Overview of Blueprint Mechanics

Figure 10 illustrates simplified process steps related to how data are configured within the CHAT and prioritized into data submitted to the Southeast Blueprint.

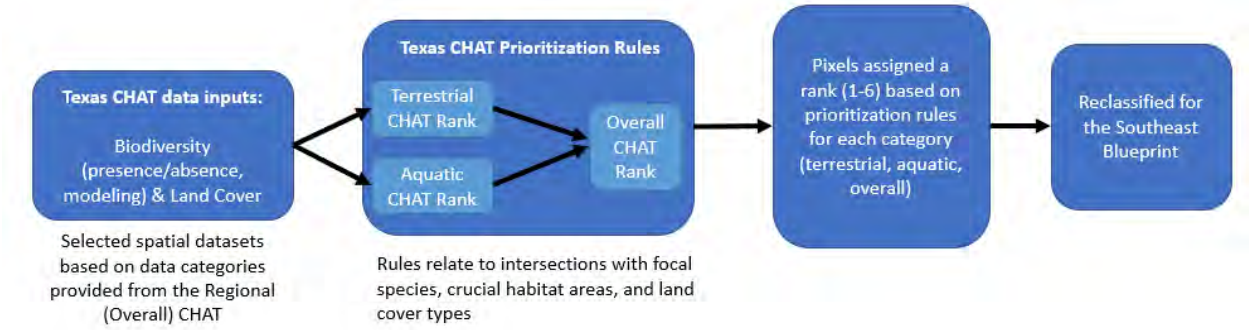


Figure 10. Simplified process schematic of Texas CHAT and its integration into the Southeast Blueprint.

3.5. ONGOING MONITORING AND DEVELOPMENT

WAFWA continues to maintain CHAT, and all original participating states continue to contribute to the region-wide map, which is viewable on WAFWA's website. WAFWA has continued WGA's original mission for CHAT, presenting the conservation map as a "non-regulatory, decision support system of state fish and wildlife agency priorities" (Western Association of Fish & Wildlife Agencies, 2020).

CHAT documentation suggests that datasets are "expected to be updated regularly" (State Wildlife Agencies of the Western United States., 2020), but states set their own update frequency. As of 2020, the most recent data update by Texas to the region-wide CHAT occurred in July 2018 (State Wildlife Agencies of the Western United States., 2020).

3.6. KEY CONTACTS AND RESOURCES

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- Duane German, Landscape Ecology Program Manager, Texas Parks and Wildlife Department
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- Chanda Pettie, WAFWA CHAT Coordinator
  Chanda.Pettie@wafwa.org

Resources

- CHAT, viewable through WAFWA's data portal: wafwachat.org

- Texas Parks and Wildlife Department Geographic Information Systems: Interactive online conservation maps: tpwd.texas.gov

4.0 Middle Southeast Blueprint

4.1. INTRODUCTION

The Middle Southeast Blueprint is a mapped integrated set of data layers for conservation that encompasses 180 million acres of terrestrial and aquatic ecosystems spanning the entire states of Arkansas, Louisiana, and Mississippi, in addition to portions of nine other states (Missouri, Oklahoma, Texas, Florida, Alabama, Georgia, Tennessee, Kentucky, and Illinois; Figure 15)[2]. The Middle Southeast Blueprint was initially developed as the Gulf Coastal Plains and Ozarks Landscape Conservation (GCPOLCC) Cooperative Conservation Blueprint in 2016 by GCPOLCC to support their mission to "define a shared vision for sustainable natural and cultural resources in the face of a changing climate and other threats; design strategies to achieve that vision; and deliver results on the ground through leadership, partnerships, contributed resources, evaluation and refinement over time" (GCPOLCC, 2017b). The blueprint's key data layers represent an aquatic Conservation Value Index (CVI), delineated at the HUC4 watershed scale, and a terrestrial CVI delineated by groupings of one or more EPA Level III Ecoregions. These CVIs are derived from input layers that detail conservation hubs, anchors, species, habitat condition and risk across the region.

In 2017, GPCOLCC was reorganized by USFWS, and the GCPOLCC Conservation Blueprint was renamed the Middle Southeast Blueprint. The most recent version, the Middle Southeast Blueprint 3.0, was released in 2019 (Middle Southeast Blueprint, 2020). The Middle Southeast Blueprint's aquatic and terrestrial CVI layers are aggregated into a single CVI layer for inclusion in the Southeast Blueprint. More information on this integration can be found in Sections 2.0 and 4.4.3 of this report.

4.2. HISTORY AND GOVERNANCE

The Middle Southeast Blueprint was developed as the central initiative of the GCPOLCC, one of 22 LCCs established by the Department of the Interior (DOI) in 2010 which operated until 2017 LCCs were first discussed in the USFWS Climate Report (USFWS, 2010) as the second of seven "Bold Commitments," which stated an intent to: "Establish Landscape Conservation Cooperatives that enable members of the conservation community to plan, design and deliver conservation in ways that integrate local, State, Tribal, regional, national, and international efforts, and resources, with our 150 million-acre National Wildlife Refuge System playing a role in ensuring habitat connectivity and conserving key landscape and populations of fish and wildlife". (GCPOLCC, 2011; see Figure 11 for a timeline of key milestones in the development of the Middle Southeast Blueprint). LCCs were also integral to the development of the South Atlantic Conservation Blueprint, and the Florida Conservation Blueprint.

[2] While an area of eastern Texas is included within the boundary of the Middle Southeast Blueprint, the Southeast Blueprint v4.0 does not utilize the Middle Southeast Blueprint in its coverage of Texas. Instead, all data for Texas in the Southeast Blueprint v4.0 is from Texas CHAT (Section 3.0).

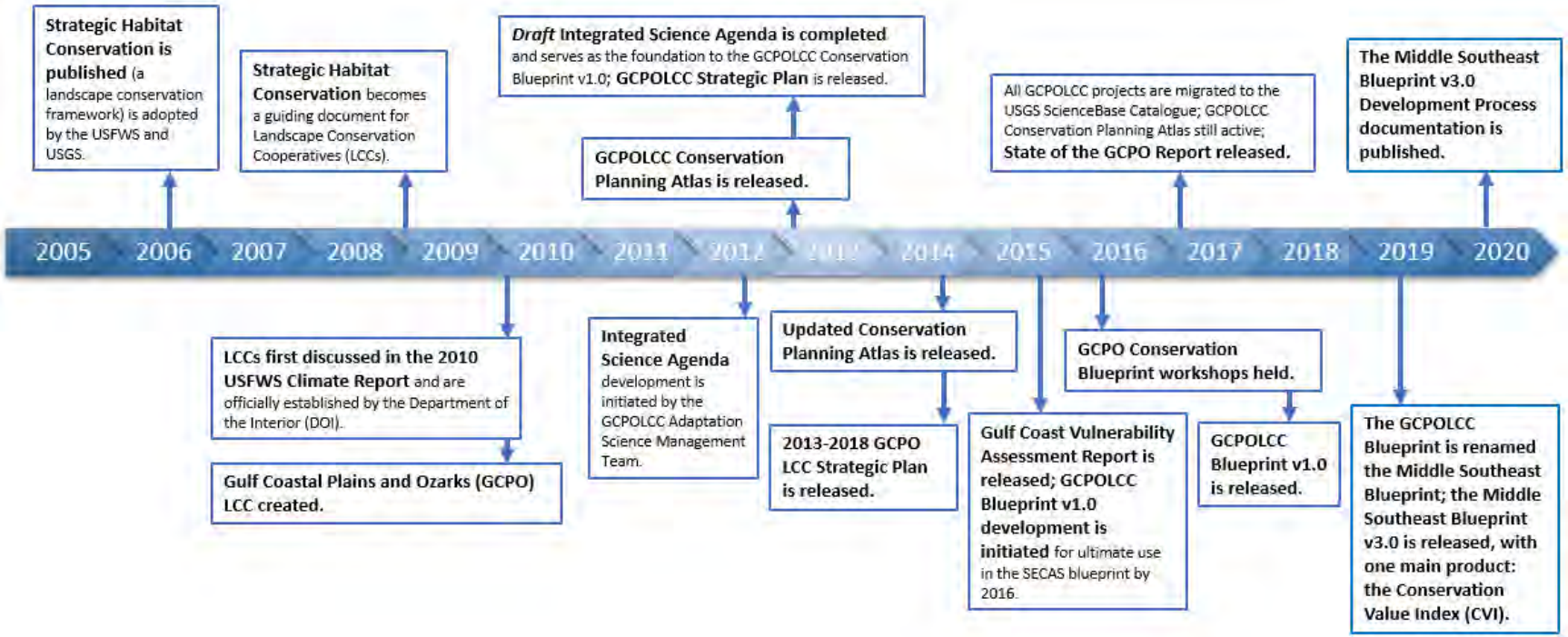


Figure 11. Summary of critical milestones in the development of the Middle Southeast Blueprint (formerly the GCPOLCC Blueprint).

GCPOLCC comprised a partnership of 26 organizations, including 10 state agencies as well as representatives from USGS and USFWS, and was overseen by a Steering Committee formed of representatives from those organizations. The GCPOLCC also partnered with four Joint Ventures in the region: The Lower Mississippi Valley (LMVJV), East Gulf Coastal Plain (EGCP), Gulf Coast (GC) and Central Hardwood (CH) Joint Ventures (see USFWS, 2009 for information on the agencies that form the collective members of these organizations). These Joint Ventures were established between 1986 and 2008 as "collaborative, regional partnerships of government agencies, NGOs, corporations, tribes and individuals that conserve habitat for the benefit of priority bird species, other wildlife, and people" (USFWS, 2020b).

In 2010–2011 the GCPOLCC launched a suite of initial projects to support their mission. Two of these projects were key foundational steps in the development of the Middle Southeast Blueprint. The first was the development of a USFWS-supported Conservation Planning Atlas (CPA), and the second an expansion and update of land cover classification for the GPCOLCC within in NatureServe's Ecological Systems (Comer & Schulz, 2007; GCPOLCC, 2011; NatureServe, 2009). The land cover classification updates were conducted in partnership with Mississippi State University Geosystems Research Institute, LMVJV, North Carolina State University (NC State), TPWD, USFWS, USGS, and other state, federal and non-governmental organizations. At that time, the GCPOLCC also outlined their support, along with the support of other LCCs in the southeastern U.S., for a collaborative effort lead by the Southeastern Association of Fish and Wildlife Agencies to develop a comprehensive Southeast Conservation Adaptation Strategy (SECAS).

The GCPOLCC Steering Committee additionally established a charter for the formation of an Adaptation Science Management Team (ASMT) composed of scientists and natural resource managers. The ASMT provided a forum for "coordination and communication" on technical matters among GCPOLCC's many partners to provide a balance between scientific rigor and operational reality in the development and implementation of GCPOLCC projects.

The ASMT served as the nexus of science and management for the GCPOLCC, tasked with the "development and implementation of a Conservation Adaptation Strategy in support of sustaining trust resources in light of current and anticipated stressors" within the GCPOLCC geography (GCPOLCC, 2012). Specifically, the ASMT was to 1) identify technical challenges in achieving the GCPOLCC mission, address those challenges and provide recommendations; 2) provide a framework for a regional Conservation Adaptation Strategy; 3) develop a strategy for soliciting science needs to inform the strategy; 4) develop and implement a process for prioritizing science needs and addressing uncertainties; 5) identify additional science capacities within the GCPOLCC and leverage those for the Conservation Adaptation Strategy; and 6) organize committees and teams to achieve the purpose of GCPOLCC (GCPOLCC, 2012).

In 2012 GCPOLCC, with the assistance of their ASMT, initiated development of an Integrated Science Agenda (ISA) that laid out the overarching framework for a regional Conservation Adaptation Strategy. The 2013 draft ISA, v4, outlined ASMT's progress with a clear structure for establishing "broadly defined habitats" across the five subgeographies in the GCPOLCC. Within each broadly defined habitat

type, ASMT worked to define Desired Ecological States (DES; management ideals for ecosystem condition) to provide targets for conservation actions (GCPOLCC & GCPOLCC, 2013). Targeted ecological assessments were conducted for each broadly defined habitat identified as the major habitat type by subregion within the GCPOLCC (see Section 4.3 for the geographies of each subregion). More information is provided regarding broadly defined habitats and DES in Section 4.4.1.

In 2014, the GCPOLCC relaunched their CPA with an improved interface, data organization, and a targeted outreach strategy (GCPOLCC, 2015). Data additions in the 2014 relaunch included the addition of natural glades in Missouri, inclusion of habitat suitability indices for alligator gar, addition of an urban growth model for the southeast U.S. (SLEUTH), new coastal marsh classification by salinity for Texas, Louisiana, Mississippi, and Alabama, inclusion of an updated 2011 National Land Cover Database (NLCD), and the addition of many other baseline datasets (GCPOLCC, 2015). In the following year development of the GCPOLCC Conservation Blueprint was initiated with the intent for it to be integrated into the Southeast Blueprint on its release. The core team behind the development of the GCPOLCC Conservation Blueprint was composed of ASMT, GPCOLCC's Partnership Advisory Council, leaders of SWAPs in partner states, and staff of the National Wildlife Refuge System Inventory and Monitoring Program.

The first iteration of the GCPOLCC Conservation Blueprint v1.0 was developed to provide data for four key areas (GCPOLCC, 2017a):

- A baseline assessment of habitat condition via the ISA, Ecological Assessments, and the Condition Index.
- Action Opportunity maps that categorize and rank actions required to achieve DES for a particular habitat in a specific region in the GCPOLCC geographic area (see Section 4.3 for those delineations).
- Watershed Rank maps for each habitat system that rank the relative quality of landscapes based on the amount (length or area) of habitat and the proportion of habitat in good condition (i.e., at or near DES).
- An Integrated Watershed Rank map that combines terrestrial and aquatic landscape assessments to provide a relative assessment of the ability of individual watersheds to sustain natural resources.

The GCPOLCC Conservation Blueprint design underwent an extensive review process with input solicited from GCPOLCC partners through a series of workshops and webinars. In 2016, the GPCOLCC Blueprint v1.0 was released. The following year LCCs in the southeastern U.S. (including GCPOLCC) were reorganized within the USFWS so as to continue work that is integral to the development of the Southeast Blueprint. In 2019, the GCPOLCC Conservation Blueprint was renamed the Middle Southeast Blueprint v3.0 and was released and integrated into the Southeast Blueprint v4.0.

4.3. GEOGRAPHY AND ECOSYSTEM

LCC metadata describes the geographic boundaries of LCCs across the network as being derived from: 1) the Bird Conservation Region (BCR) data layer that delineates "ecologically distinct regions in North America with similar bird communities, habitats, and resource management issues" in similar aerial

extent as Joint Ventures regions (NABCI, 1998); and 2) the Freshwater Ecoregions layer (FEOW), a freshwater ecoregion map built to provide a global delineation of freshwater biodiversity, using boundaries to separate each unit, which are based largely on watershed locations (FEOW, 2019). The purpose of this union was to use the linework and attributes from the FEOW layer to divide some BCRs to accommodate high priority aquatic areas.

The Middle Southeast (formerly GCPOLCC) Blueprint covers the entire states of Arkansas, Louisiana, and Mississippi as well as parts of nine additional states. The geographic boundary of the Middle Southeast Blueprint is aligned with the boundary of the former GCPOLCC with expanded coverage to encompass coastal Louisiana and integrate several active project areas north of the original GCPOLCC blueprint boundary (David Jones-Farrand USFWS, personal communication).

The geographic boundary for the GCPOLCC, which delineated the footprint of the GCPOLCC Conservation Blueprint, is derived from the BCR boundaries described above. BCRs were first developed in the late 1990s by a partnership between the United States, Mexico, and Canada. The USFWS created the original BCR geospatial layer (Arc/INFO format) in 1999 with assistance from Bird Studies Canada, which continues to be the authority on the master BCR file (Bird Studies Canada, 2012). The delineation from the BCR applies to the Middle Southeast Blueprint boundary except for the Gulf Coastal Area which was defined on the west by the Mississippi Alluvial Valley (MAV) boundary and on the north with the Gulf Coast Joint Venture/Southern Coastal Plain Omernik Level III Ecoregion (GCPOLCC, 2020).

The Middle Southeast Blueprint spans five major subgeographies (smaller subdivisions of the whole Middle Southeast Blueprint spatial extent): 1) The Ozark Highlands (OZHI), 2) West Gulf Coastal Plain (WGCP), 3) East Gulf Coastal Plain (EGCP), 4) Mississippi Alluvial Valley (MAV), and 5) Gulf Coastal Area (GC) (GCPOLCC, 2017c). These distinct subgeographies share many characteristics, driving their inclusion in a single LCC, but significant differences exist related to their ecology (defined by USFWS **Trust species**), history, culture, and economics (see USFWS, 2009 for a detailed breakdown of these elements as well as conservation needs by subgeography developed by the GCPOLCC).

The Middle Southeast Blueprint spans multiple states, but those that intersect with the Gulf Coast include Texas, Louisiana, Mississippi, and Alabama, each with a range of ecosystem types including warm temperate forests and woodlands, as well as temperate grasslands and shrublands (Appendix). See Section 4.4.1.1 for details regarding how priority habitats were defined for this region.

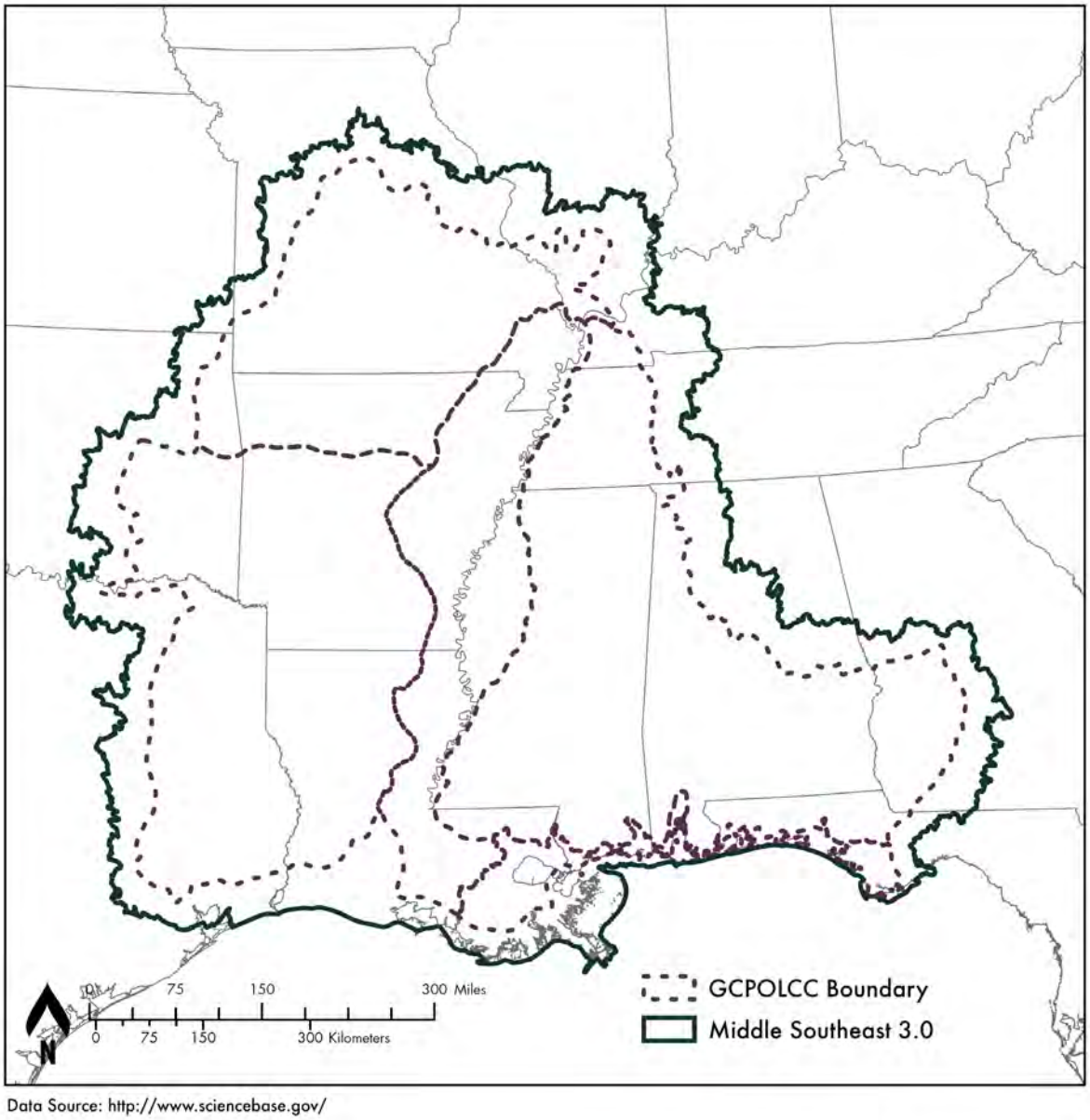


Figure 12. Middle Southeast Blueprint v3.0 boundary. Former boundary of the GCPOLCC Blueprint and its subgeographies are noted with dashed lines.

4.4. BLUEPRINT STRUCTURE AND METHODOLOGY

The Middle Southeast Blueprint v3.0 is based on several inputs linked into a hierarchical decision-making framework (for detailed information, see the 2020 Middle Southeast v3.0 development process documentation). The inputs—aquatic and terrestrial—include protected lands, areas of high value for partners and stakeholders (conservation hubs), habitat condition, species distribution, and risk of future change. The main product of the Middle Southeast Blueprint v3.0 is the Conservation Value Index (CVI),

combined for terrestrial and aquatic habitats, which serves as the subregional input into the Southeast Blueprint v4.0.

The CVI layer produced in 2019 for the Middle Southeast Blueprint is based on a framework that is "a major departure from the original Gulf Coastal Plains and Ozarks (GCPO) Blueprint and needs to be vetted through workshops and partner review", which was a well-established process used by LCCs and emphasized as one of the Guiding Principles in the LCC charter (LCC National Council Final Charter, 2013; USFWS, 2019). The elements of this index and methodology are described in detail in the rulesets for the original GCPOLCC Blueprint v1.0 documentation (GCPOLCC, 2017a).

Importantly, the methodology used to calculate habitat-specific indices for risk (originally based on ecosystem stressors), species (originally based on a subset of SGCN identified in SWAPs and identified in the ISA), and conservation hubs (originally termed "collaboration indices") were revised between blueprint versions (GCPOLCC, 2017a; Middle Southeast Blueprint, 2020). Action Opportunity Ranks, which are spatial datasets that indicate importance of a particular site or the need for a specific action (e.g., protection) and originally operated in parallel with the habitat-specific CVIs, were not carried over from the GCPOLCC Blueprint v1.0 to the Middle Southeast Blueprint v3.0 (GCPOLCC, 2017a). The inputs used in the Middle Southeast Blueprint v3.0 are outlined below, along with the methodology used to rank conservation priorities in the final Middle Southeast Blueprint v3.0.

4.4.1. Core Data Layers

The Middle Southeast Blueprint calculates separate terrestrial and aquatic Conservation Indices for Hubs, Species, and Habitat, and an additional conservation index provides data for terrestrial Network Anchors (i.e., protected lands). A single Risk layer is applied to both terrestrial and aquatic ecosystems (Middle Southeast Blueprint, 2020).

The structure of each index and its scoring is fully explained (with the exception of Habitat) in the *Middle Southeast Blueprint 3.0 Development Process* (Middle Southeast Blueprint, 2020) and is summarized below. Part of the hierarchical decision-making (or "decision tree") framework for the Habitat Condition index was carried over from the GCPOLCC Blueprint v1.0 and is explained in greater detail due to the complex derivation of this index's components. However, full documentation on how these components are scored is not available. These indices are compiled as inputs to generate CVIs at a 30 m scale across the Middle Southeast domain; this process is explained in Section 4.4.3.

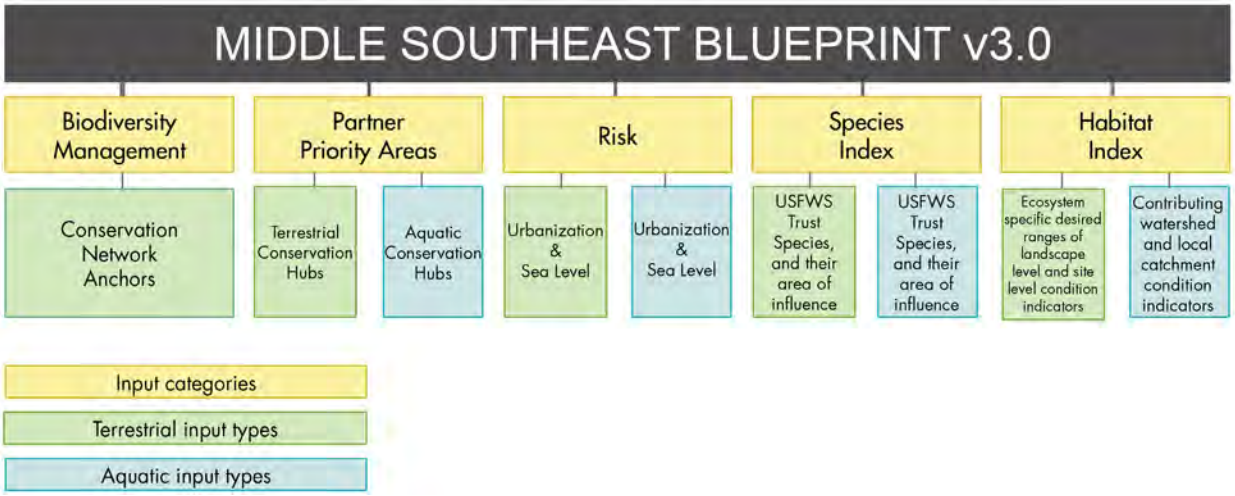


Figure 13. Input categories for the Middle Southeast Blueprint v3.0

4.4.1.1. Habitat

Habitat Condition Indices are an important component of both the current Middle Southeast Blueprint v3.0 as well as the original GCPOLCC Blueprint v1.0, and are firmly rooted in the GCPOLCC's ISA (GCPOLCC & GCPOLCC, 2013). The ISA describes a series of "Broadly Defined Habitats" developed by NatureServe and the USFWS as a habitat framework for the GCPOLCC region (GCPOLCC, 2017a; GCPOLCC & GCPOLCC, 2013). These Broadly Defined Habitats include: 1) beaches and dunes; 2) bogs, ferns, and seeps; 3) cave, karst, and springs; 4) estuarine systems; 5) forested wetlands; 6) freshwater aquatic; 7) freshwater transitional; 8) grasslands; 9) marine; 10) open pine woodlands and savannas; 11) scrub-shrub; and 12) upland hardwoods and montane conifers. This habitat delineation system was adopted due to its broad applicability for both aquatic and terrestrial systems, its limited subset of habitat types which are universally recognizable, and the relative ease with which this system could be mapped based on other classification systems (GCPOLCC & GCPOLCC, 2013).

The GCPOLCC summarized this list into a smaller set of priority systems described for each subgeography of the GPCOLCC (GCPOLCC & GCPOLCC, 2013). See Figure 12. Middle Southeast Blueprint v3.0 boundary. Former boundary of the GCPOLCC Blueprint and its subgeographies are noted with dashed lines. for delineations of each subgeography. Priority systems include Grasslands, Medium/Low-Gradient Streams and Rivers (Freshwater Aquatic), and Open Pine Woodlands & Savannas (Open Pine) in the East and West GCP subgeographies (WGCP and EGCP); Tidal Marsh (Estuarine) and Beaches and Dunes in the GC subgeography; Forested Wetlands and Mainstem Big Rivers in the MAV subgeography; and Upland Hardwoods & Montane Conifers (Upland Hardwoods) and High Gradient Streams and Rivers (Upland Streams and Rivers, Freshwater Aquatic) in the IH (OZHI) subgeography.

The GCPOLCC initially drafted a set of specific and measurable outcomes (termed "Endpoints") for each priority system listed above in the GCPOLCC's ISA, noting a few changes in how these systems were labelled in the documentation (GCPOLCC & GCPOLCC, 2013): 1) mainstem "Big River" systems; 2) forested wetlands; 3) open pine woodland and savanna; 4) grassland-prairie-savanna; 5) medium/low-

gradient streams and rivers; 6) upland hardwoods; 7) high gradient streams and rivers; 8) beaches and dunes; and 9) tidal marsh. The Endpoints were developed to reflect DES for the GCPOLCC priority systems (GCPOLCC & GCPOLCC, 2013). Desired conditions for terrestrial habitat reflect three primary landscape attributes: amount (length or area), configuration at landscape scale (patch size, connectivity, and other landscape metrics), and condition at site/stand scale (structure and composition); for aquatic habitats, the primary landscape attributes include those similar to terrestrial: Amount (length or area), configuration (length related to patch size, connectivity, and other landscape-scale metrics), and conditions (reach, related to water quantity, water quality, and structure). Temporal considerations (e.g., successional stage, fire regime) were also included for terrestrial habitat types, and "timing, frequency, and rate of change" were key attributes for flow related to aquatic habitat types. DESs were developed to create a framework to support fish and wildlife within the bounds of the LCC (GCPOLCC & GCPOLCC, 2013).

The GCPOLCC ASMT delved further into a subset of those priority habitats in an Ecological Assessment Project, producing "Ecological Assessments" that addressed the following questions (GCPOLCC, 2015):

1) How much habitat is in a DES [defined by the ISA]?
2) How much more [habitat] is needed [to restore ecosystems to health]?
3) Where is the habitat already in the DES and where are opportunities to manage for these conditions?
4) What are the key data gaps for which the LCC can support data acquisition?

That effort by ASMT yielded a final collection of habitat Endpoints (GCPOLCC, 2017a). To evaluate these Endpoints spatially, the ASMT reframed those Endpoints and ecological evaluations into habitat-specific numerical indices. Thus, habitat-specific Endpoints were combined into a series of habitat-specific Condition Indices using a series of habitat-specific rulesets; these rulesets were designed to apply a consistent method in processing spatial data to produce each index.

During the development of the Condition Indices caveats were established by the GCPOLCC:

1) Not all habitat Endpoints are mappable at larger scales (landscape or regional).
2) The index assigns quantitative thresholds when Endpoints are qualitative (serving as hypotheses when data is limited, e.g., an Endpoint of restored natural hydrology may not be known for a specific area due to a lack of information, but an Endpoint could be assigned based on best available science to serve as a potential quantitative Endpoint).

The index scores are based on restoration capacity ("a mechanism for scoring lands that are restorable but currently under a different land use"), and integrate elements of the cost (effort, time, and money) required to reach the DES (GCPOLCC, 2017a). Terrestrial habitats are evaluated at the pixel level (30 m spatial area) and aquatic habitats utilize both pixels and line segments for assessment. These habitats are evaluated using the following decision-making framework:

Is the location (pixel or line) mapped as one of the identified focal habitats?

i. If "no", and the area is terrestrial, then the location is scored on whether it is appropriate to restore that location to the same classification as its surrounding systems (e.g., if a location is identified as crop land, then what is the possibility that it might be

converted to bottomland hardwoods if the surrounding systems are bottomland hardwoods).

ii. If "yes", then the scoring first looks at Endpoints related to configuration (i.e., landscape-level metrics), then condition (i.e., site-level metrics).

This framework addresses relative cost of conservation whereby parcels of land that are "out-of-condition" (see point i, above) within a matrix of undisturbed habitat may be considered "lower-hanging fruit" with respect to ease of conservation action versus sites already "in-condition" within a broader matrix of disturbed landscapes (GCPOLCC, 2017a).

The rulesets for deriving each habitat-specific Condition Index for the GCPOLCC Blueprint v1.0 are outlined in the v1.0 (2017a) ruleset documentation and are summarized in Appendix C. Habitats included in the GCPOLCC Blueprint v1.0 and the Middle Southeast Blueprint v3.0 are based on the list of priority habitats (derived from the original GCPOLCC list of Broadly Defined Habitats) outlined above and include 1) upland streams and rivers; 2) upland hardwoods (forest); 3) upland hardwoods (woodland); medium/low-gradient streams and rivers; 4) forested wetlands; 5) open pine; 6) grassland; 7) mainstem big rivers; and 8) tidal marsh habitats. The original habitat index ranked habitat condition from 0 (unavailable for conservation) to 17–37 (maintain habitat value, or at DES). Certain variables were weighted higher than others depending on the habitat type and based on whether they were considered more important for planning or for improved data quality. "The basic interpretation of Condition Index value is that sites with lower scores will cost more (effort, time, & money) to restore the site into the DES than those sites with higher scores" (GCPOLCC, 2017a).

The habitat types used in the Middle Southeast Blueprint v3.0 are the same as for the GCPOLCC Blueprint v1.0. However, habitat condition in the Middle Southeast Blueprint v3.0 ranges from 0 (unrestorable non-habitat) to 14 (habitat in fragmented landscapes) for terrestrial systems, and from 0 (uplands/non-habitat) to 12 (good local conditions in relatively undisturbed/intact watersheds) for aquatic systems using a similar hierarchical decision making framework as the GCPOLCC Blueprint v1.0 (Middle Southeast Blueprint, 2020). This difference in scale suggests that the habitat condition indices calculation methodology and/or ranking scheme were updated, although documentation on this change has not yet been identified.

Both the aquatic and terrestrial habitat condition index values were then grouped into the five classes (0–4) described in Table 6.

Table 6. The five classes of conservation value derived from grouping Conservation Index values.

Conservation Value	Terrestrial Parameters	Aquatic Parameters
0	Unrestorable non-habitat (CI = 0)	Uplands (CI = 0)
1	Restorable non-habitat (CI = 1)	Very Poor Watershed and Local Conditions (CI = 1)

Conservation Value	Terrestrial Parameters	Aquatic Parameters
2	Restorable habitat and nearby restorable non-habitat in highly fragmented landscapes (CI = 2-5)	Poor Watershed Conditions with relatively good Local Conditions (CI = 2-3)
3	Habitat in fragmented landscapes (CI = 6-11)	Watersheds with some disturbances (CI = 4-9)
4	Habitat in unfragmented landscape (CI = 12-14)	Intact Aquatic Networks (CI = 10-12)

4.4.1.2. Conservation Network Anchors

Conservation Network Anchors are calculated only for terrestrial areas and are defined as "public or private lands managed for biodiversity (G1 – Critically Imperiled or G2 – Imperiled designation)". These are limited to those areas that are specifically managed for the conservation of SOC and are extracted from the Protected Areas Database (PAD-US) v2.0 developed by the DOI (see *USGS Gap Analysis Project (GAP)*, 2018 for access to the data). In the Conservation Network Anchor Layer, each 30 m pixel is given a binary score whereby:

- 0 = Not an anchor (not managed for biodiversity)
- 1 = Anchor (managed for biodiversity)

4.4.1.3. Conservation Hubs

Conservation Hubs are defined for terrestrial and aquatic areas separately as "areas of leverage opportunities for conservation action." These hubs are created by overlaying data layers that represent "partner priority areas," which are designated focal areas of organizations who work on conservation of terrestrial or aquatic resources (e.g., JVs, USFS, National Park System, USFWS, Southeast Aquatic Resource Partnership, among many others; see *Middle Southeast Blueprint*, 2020 for a full list of partners). These areas include regions listed as "conservation opportunity areas" in SWAPs that intersect with the Middle Southeast Blueprint v3.0. Data layers are stacked to form a continuous layer, and each 30 m pixel is classified as:

- 0 = No known designations
- 1 = 1 priority designation
- 2 = >1 priority designation

4.4.1.4. Species Index

The Species Index is focused on terrestrial (including amphibians) and aquatic species defined by the USFWS Trust Species list (a list of 398 species) and their Area of Influence (AOI) Spatial range maps for each species are determined from the USFWS' Information for Planning and Consultation system. Species Indices are derived for both aquatic and terrestrial CVIs separately. The ranges are stacked, integrated into a continuous layer, and summarized in 5-mile hexagons. Each 5-mile hexagon is then classified as:

- 0 = Terrestrial: Non-habitat (urban areas and reservoirs), Aquatic: N/A
- 1 = No suspected presence of these Trust Species
- 2 = 0-90th percentile of hexagons for occurrence of these Trust Species

- 3 = Top 10% of hexagons for occurrence of these Trust Species

4.4.1.5. Risk

The Risk Index is based strictly on risk of land use change as a result of urbanization or sea level rise (SLR). Urbanization risk is calculated and classified based on past change, derived from the National Land Cover Database 2001 to 2016, and expected future change derived from the Southeast SLEUTH model. SLR is derived from the "USGS Marsh Migration Model" (USGS ScienceBase, 2019) and is included in future change expectations with urbanization as an either/or (i.e., risk of urbanization or SLR), where appropriate. Risk is classified into 5 classes:

0 = Non-habitat (urban areas & reservoirs)
1 = High Risk (Past = declines in habitat; Future = declines in habitat)
2 = Moderate Risk (Past = stable or increasing habitat; Future = declines in habitat)
3 = Low Risk (Past = declines in habitat; Future = stable habitat)
4 = Very Low Risk (Past = stable or increasing habitat; Future = stable habitat)

All terrestrial and aquatic index input layers are available for download on ScienceBase.

4.4.2. Integration of Core Data Layers into Conservation Value Index Layers

The values determined for each of the five inputs are combined into "barcodes." These barcodes are five-digit values that summarize the classes for each 30 m pixel, presented in order of Anchor, Hub, Species, Habitat, and Risk, e.g., 24431 for terrestrial systems, and a four-digit value of Hub, Species, Habitat and Risk for aquatic systems. These barcodes are then classified using a set of rules shown in Table 7.

Table 7. Derivation of conservation classes used in the Middle Southeast Blueprint v3.0 based on categorization rules for barcode values.

Conservation Class	Categorization Rules
Primary Node	IF Hub = 3, Species Index = 3, Habitat Index > 2, Risk Index >2
Secondary Node	IF Hub >1, Species Index = 3, Habitat Index >2, Risk Index >2
Primary Matrix	Areas that could meet Node class definitions, but have Risk Index < 3, OR Risk Index > 2 and Habitat Index > 2 with SI = 1 or Hub = 0
Secondary Matrix	Areas that could meet Primary Matrix definition but have Risk Index < 3
Tertiary Matrix	All other combinations.

The barcode conservation classes are then assigned a rank. Terrestrial barcodes have 288 possible configurations, and aquatic barcodes have 144 possible configurations. A barcode with a value of 0 would represent a non-habitat, while a ranking of 1 would be the lowest possible conservation ranking, and a terrestrial ranking of 288 or aquatic ranking of 144 would represent the highest possible conservation rankings.

These barcode rankings are then organized in descending rank order within their applicable conservation classes to create the CVI. Each CVI score for every terrestrial and aquatic 30 m pixel is standardized relative to the other scores within its planning unit. For terrestrial systems, the planning units are roughly

delineated as a single or multiple combined EPA Level III Ecoregions, and for aquatic systems the planning units are delineated as HUC4 watersheds (both shown in Figure 14).

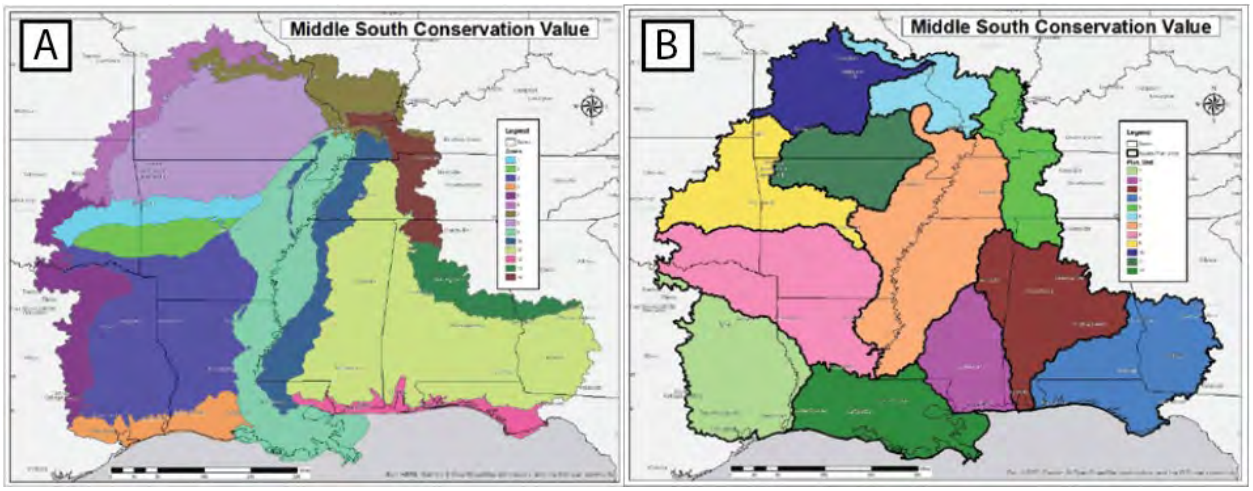


Figure 14. Delineated planning units, terrestrial and aquatic, for the Middle Southeast Blueprint. A) Terrestrial planning unites delineated at the single or multiple Omernick Level III Ecoregion scale (EPA). B) Aquatic planning units at the single or multiple HUC4 basin scale (NHD+). Source: Modified from David Jones-Farrand USFWS, personal communication.

Across the Middle Southeast domain, the top 30% of standardized CVIs are classified as “high,” conservation value the following 20% are classified as “moderate,” and the bottom 50% are classified as “low.” When integrated into the Southeast Conservation Blueprint, the Middle Southeast Blueprint’s high value category is classified as “high conservation value” and the moderate value is classified as “medium conservation value.”

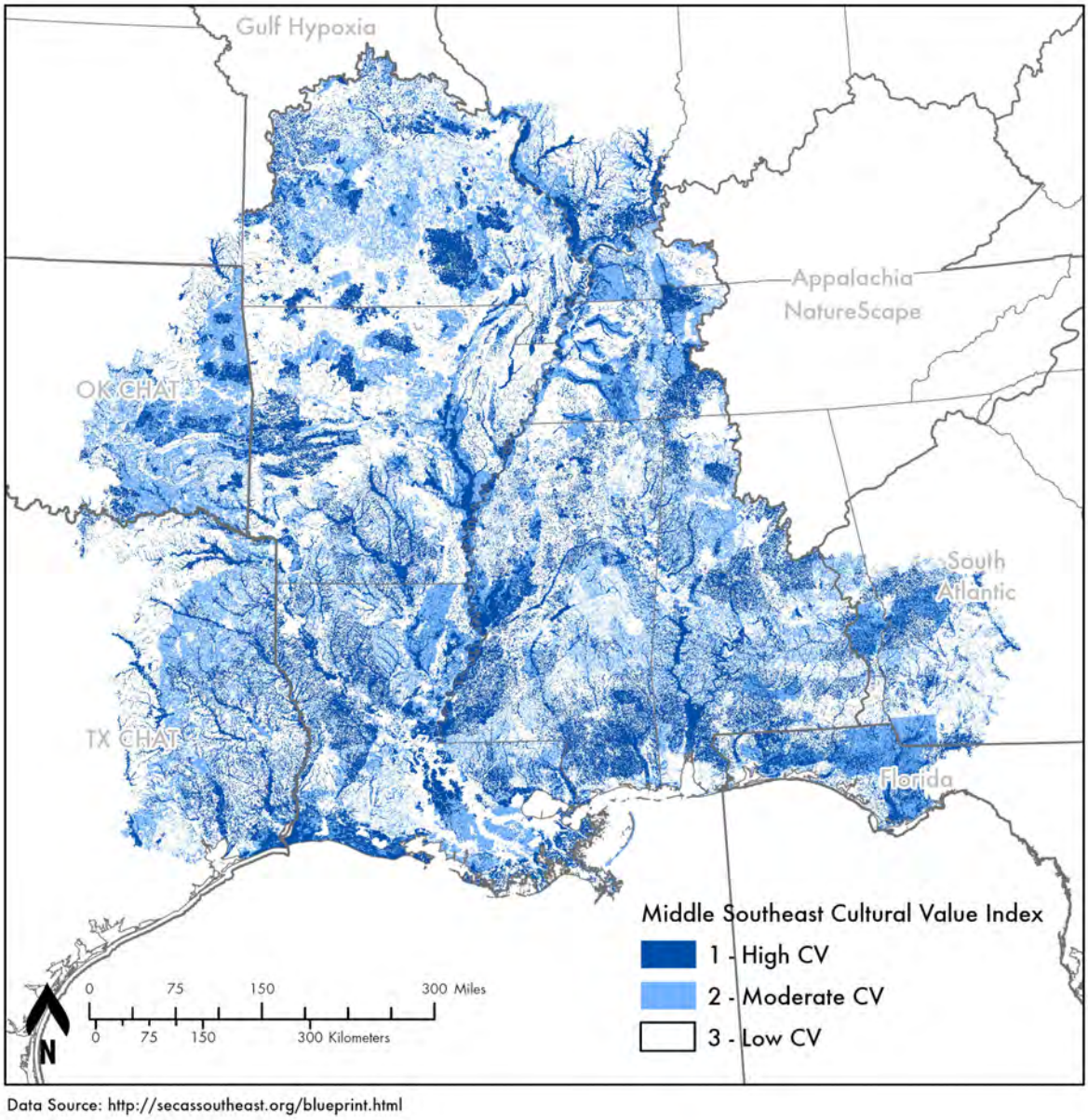


Figure 15. Middle Southeast Blueprint v3.0.

4.4.3. Integration into the Southeast Conservation Blueprint

The Conservation Value Index, combined for terrestrial and aquatic habitats as described above, is the input for this region into the Southeast Blueprint v4.0. See Section 2.4 for a summary of how data from this subregion were integrated into the Southeast Blueprint v4.0.

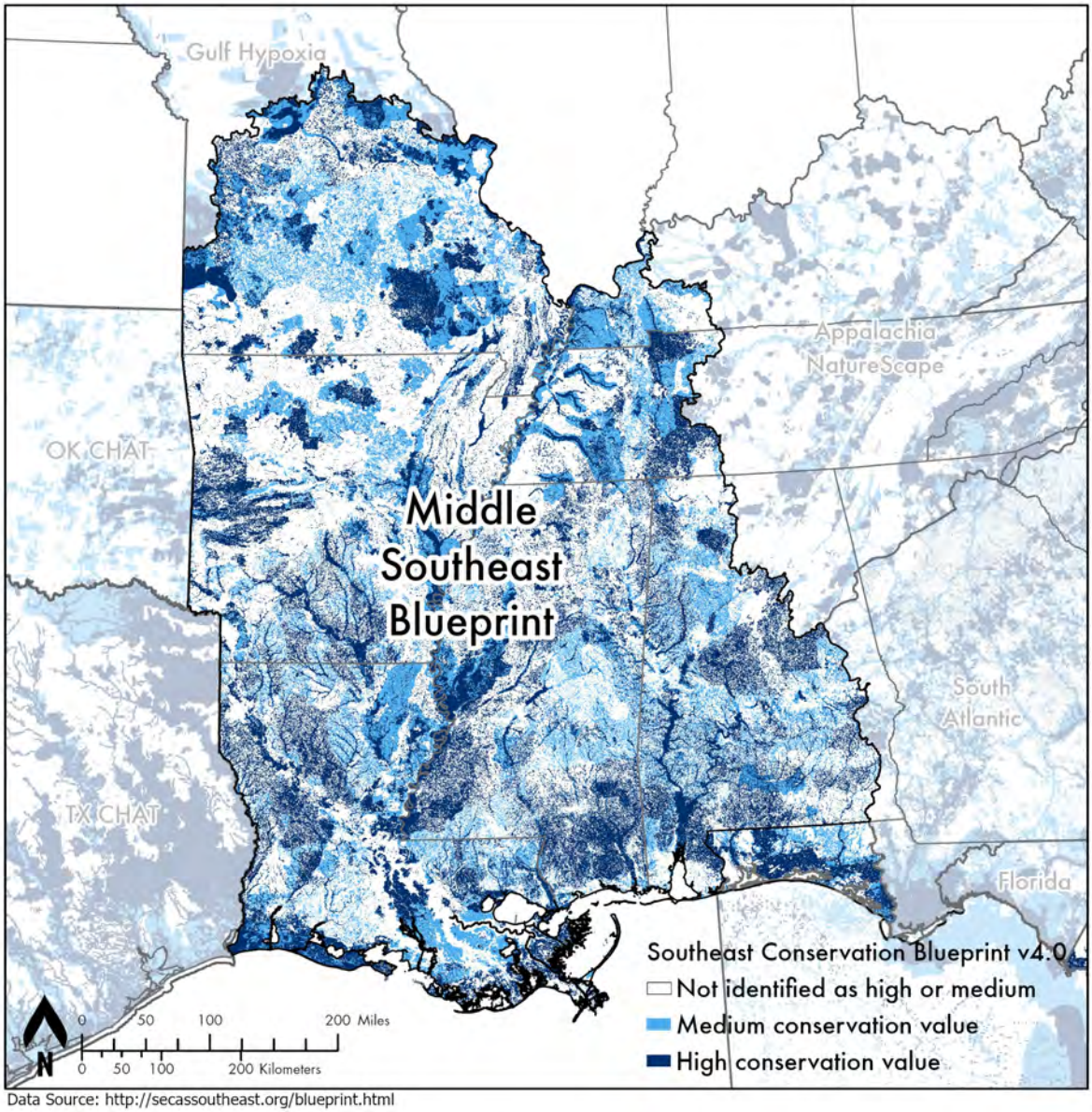


Figure 16. The Middle Southeast Blueprint as used in the Southeast Conservation Blueprint.

4.4.4. Schematic Overview of Blueprint Mechanics

Figure 17 represents a simplified schematic of the Middle Southeast v3.0 mechanics and ultimate input of data into the Southeast Blueprint.

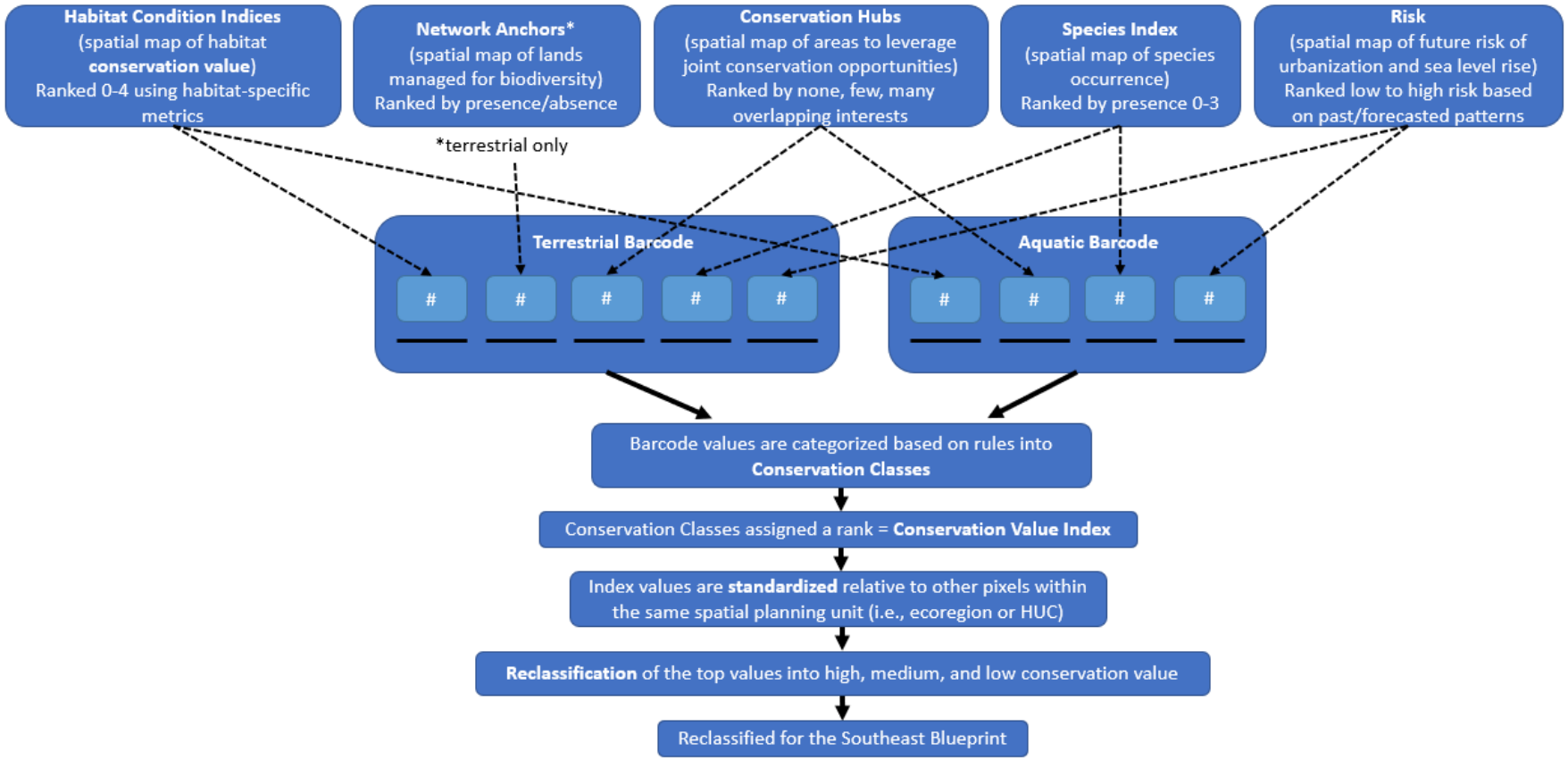


Figure 17. Simplified process schematic of the Middle Southeast Blueprint v3.0and integration into the Southeast Blueprint.

4.5. ONGOING MONITORING AND DEVELOPMENT

Management of the Middle Southeast Blueprint is currently coordinated by USFWS, who also maintain the online publication of the Middle Southeast Blueprint and its input maps. A small-scale update is expected in 2020, while efforts are primarily focused on a more significant update for FY 2021 that will improve habitat mapping along the Gulf Coast and support improved coverage of this area in the Southeast Blueprint.

4.6. KEY CONTACTS AND RESOURCES

- Contacts:

  David Jones-Farrand, Science Coordinator, USFWS
  David_Jones-Farrand@fws.gov

  - Yvonne Allen, Aquatic Habitat Analyst, USFWS
  - yvonne_allen@fws.gov
  -
- Resources

  Middle Southeast Blueprint v3.0:
  https://www.sciencebase.gov/catalog/item/5daa394ae4b09fd3b0c9cf53

  Conservation Value Index Layer:
  https://www.sciencebase.gov/catalog/item/5dc5040ee4b069579758510b

5.0 South Atlantic Blueprint

5.1. INTRODUCTION

The South Atlantic Blueprint is a data-driven spatial representation of priority conservation areas across the southeastern U.S. This conservation map was created by the South Atlantic Landscape Conservation Commission (SALCC) to fulfill their mission to facilitate "conservation actions that sustain natural and cultural resources" (South Atlantic Landscape Conservation Cooperative, 2016). The South Atlantic Blueprint encompasses 89 million acres of terrestrial and aquatic ecosystems in seven states along the southeastern U.S. from southern Virginia to northern Florida and the Florida Panhandle. West to east, the South Atlantic extends from the Blue Ridge Mountains to 200 miles offshore, the extent of the U.S. Exclusive Economic Zone (EEZ). Within this area, the South Atlantic Blueprint identifies priority areas for conservation based on a system of ecosystem indicators and connectivity analyses that were collaboratively developed by SALCC partners.

5.2. HISTORY AND GOVERNANCE

The SALCC was founded in 2010 when the DOI initiated the nationwide LCC program. Since 2017 the SALCC has continued to operate in a restructured form with support from USFWS under the umbrella of SECAS (see Figure 18 for a timeline of South Atlantic Blueprint development). SALCC is composed of "up to 800 individuals from federal agencies, regional organizations, states, tribes, nonprofits, universities and other groups." These organizations include USFWS, USGS, and NOAA, as well as the Atlantic Coast Joint Venture and TNC. The Florida Fish and Wildlife Conservation Commission (FWC) served on the Steering Committee of the SALCC in addition sitting on the Steering Committee of the Peninsular Florida Landscape Conservation Commission (PFLCC, see Section 6.0), with whom SALCC has overlapping boundaries.

The overarching goal of the SALCC partnership is to work to develop initiatives that create "a landscape that sustains the nation's natural and cultural resources for future generations" (South Atlantic Landscape Conservation Cooperative, 2017). In 2012, SALCC defined a mission to create a shared blueprint for landscape conservation actions that support this goal (SALCC, 2013). The following year, SALCC conducted large workshops (200 participants from 58 organizations) to work on development of the South Atlantic Blueprint. The plan for the South Atlantic Blueprint was to "look fifty years into the future and depict the places and actions needed to meet [SALCC's] natural and cultural resource objectives in the face of future change" (SALCC, 2013). Through these workshops, SALCC defined a set of natural and cultural resource indicators to "serve as shared measures of success for partners to evaluate the condition of the region's ecosystems" and help determine the actions needed to meet SALCC's conservation objectives (South Atlantic Landscape Conservation Cooperative, 2017).

In 2013, the SALCC, in chorus with the GCPOLCC, launched a Conservation Planning Atlas (CPA). These CPAs were created by multiple LCCs as part of each cooperative's Landscape Conservation Design, and provide a "searchable, science-based mapping platform" to conservation decision-makers. (SALCC, 2013).

In 2014 SALCC launched the first version of the South Atlantic Blueprint 1.0, which was a qualitative tool created from a combination of existing regional and state plans and input from workshop participants. The following year a new version (2.0) was released which was entirely based on geospatial data.[3] This version defined priority areas for conservation according to ecosystem indicator condition and a connectivity analysis (South Atlantic Landscape Conservation Cooperative, 2017).

Two subsequent updates (2.1 and 2.2; 2.2 is currently used in the Southeast Blueprint v4.0) provided updated data and improvements for the South Atlantic Blueprint's indicators. The most recent version of the South Atlantic Blueprint (South Atlantic Blueprint 2020) was released in August 2020, incorporating methodological improvements, finer spatial resolution, and improved indicators. Details on the South Atlantic Blueprint 2020 are provided in Section 5.4 (South Atlantic Conservation Blueprint, 2020).

[3] The South Atlantic Blueprint versions are denoted with numbers only, and do not use "v" or "version." That convention is followed in this report as latest release (version) of the South Atlantic Blueprint is named the "South Atlantic Blueprint 2020" rather than the South Atlantic Blueprint 3.0.

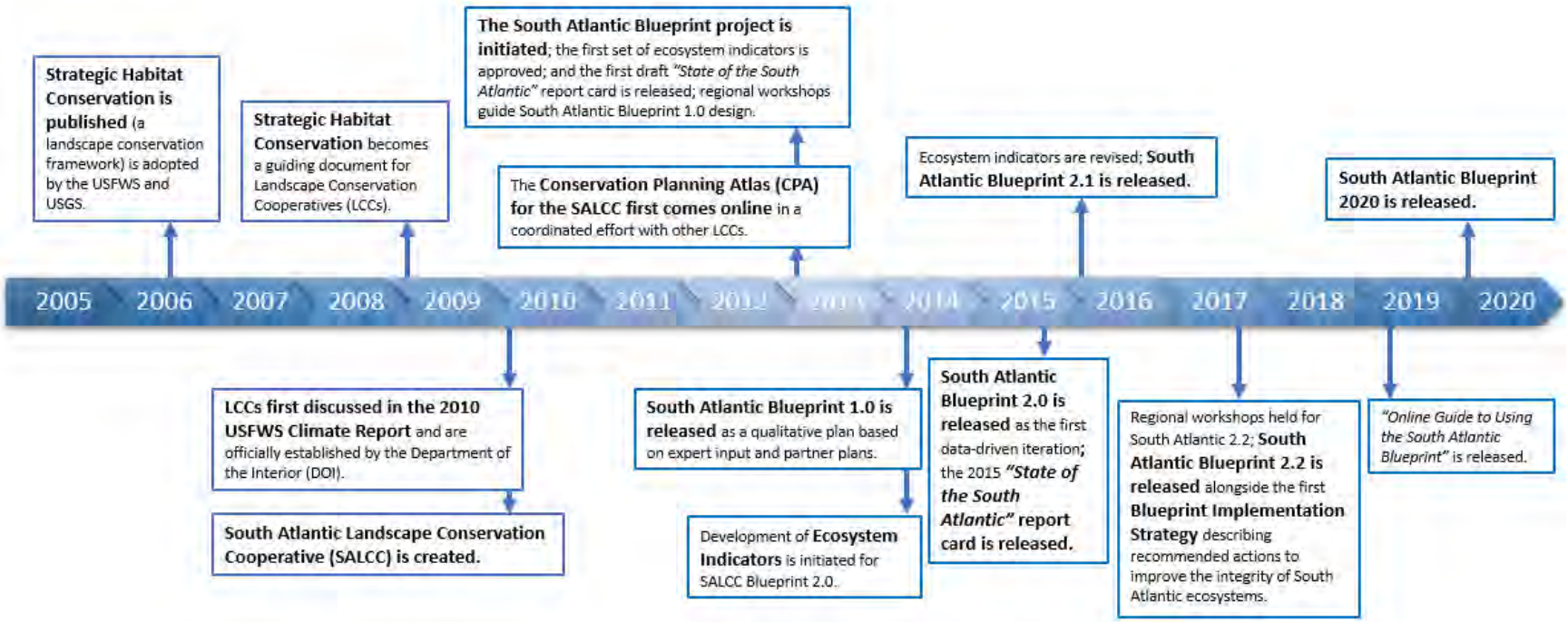
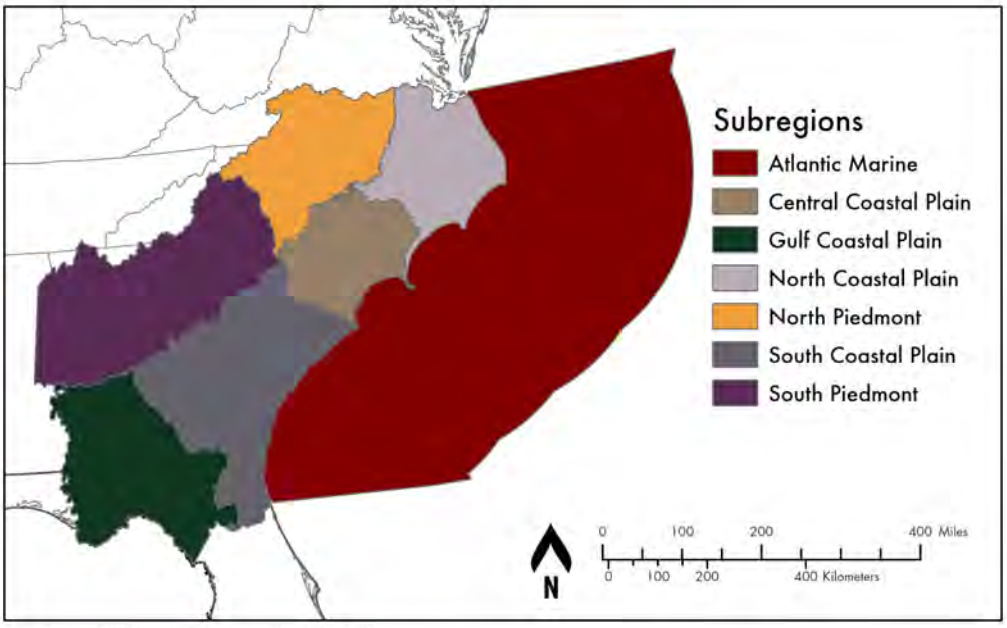


Figure 18. Summary of critical milestones in the development of the South Atlantic Blueprint.

5.3. GEOGRAPHY AND ECOSYSTEM

The geographic area covered by the South Atlantic Blueprint spans seven states in the southeastern U.S., from southern Virginia to northern Florida and extends from around 150 miles inland to 200 miles offshore to the boundary of the U.S. EEZ. The boundary of the South Atlantic Blueprint follows the delineation of the SALCC, part of the LCC network described in Section 4.3. The ecosystems of the SALCC are diverse, including barrier islands, lagoons, marshes, and wetlands along the seaward edge of the coastal plains up to the inland forested transitional zone between the Appalachian Mountains, and the coastal plain (SALCC et al., 2012).

The South Atlantic Conservation Blueprint operates within seven subregions based upon EPA Level III ecoregions (Omernik, 1987) and watershed boundaries (Figure 19). Ecoregions were used to define the boundary between the Piedmont and the Coastal Plain, and watershed boundaries further subdivide the area. The Marine subregion encompasses areas of the South Atlantic Blueprint extent not covered by ecoregion or watershed boundary, resulting in seven broad subregions: North Piedmont, South Piedmont, North Coastal Plain, Central Coastal Plain, South Coastal Plain, Gulf Coastal Plain, and Marine (South Atlantic Conservation Blueprint, 2020). The area of the Gulf Coastal Plain that intersects with Florida is the location of an overlap between the SALCC and the PFLCC, and subsequently between the South Atlantic Blueprint and the Florida Conversation Blueprint.



Data Source: http://secassoutheast.org/blueprint.html

Figure 19. The seven subdivisions of the South Atlantic Conservation Blueprint. (South Atlantic Conservation Blueprint, 2020)

5.4. BLUEPRINT STRUCTURE AND METHODOLOGY

The South Atlantic Blueprint 2.2 is utilized in the Southeast Blueprint v4.0. However, at the time of writing, the South Atlantic Blueprint 2020 has been released and will ultimately replace 2.2 version (South Atlantic Conservation Blueprint, 2020) in the Southeast Blueprint. The South Atlantic Blueprint 2020 has some key differences to the South Atlantic Blueprint 2.2. Full documentation of the South Atlantic Blueprint 2.2 can be found in SALCC's *Blueprint 2.2 Development Process* (South Atlantic Landscape Conservation Cooperative, 2017). The text below provides a summary description for the South Atlantic Blueprint 2020, with full documentation available in *South Atlantic Blueprint Development Process 2020*; references to relevant sections of that document are provided throughout.

The South Atlantic Conservation Blueprint (2020) is structured around ecosystem indicators. These indicators are clearly defined metrics that are selected to provide information that can be used to determine the health and integrity of complex ecosystems across the South Atlantic region. Individual layers are created for each of these indicators, and then those indicator layers are processed through a software program that assigns priority rankings, or Ecosystem Integrity Scores, to each pixel. The resulting map of priority ranked pixels is then subject to a connectivity analysis that identifies areas of high ecosystem integrity or protected areas (hubs), in addition to corridors, to create a final South Atlantic Blueprint layer that shows areas of high conservation value and the corridors that connect them, with rankings assigned for "highest," "high," and "medium" conservation priorities. More information on the steps in this process is provided in Section 5.4.4.

5.4.1. Indicators

SALCC identified the need for ecosystem indicators early in the development of the South Atlantic Blueprint, to help "simplify the modeling and monitoring" of complex ecosystems (SALCC, 2012). In 2012 SALCC defined these indicators, which are mapped to create the South Atlantic Blueprint, as well as their associated targets, goals, and objectives to aid in the identification of indicators and the prioritization of conservation actions. These definitions are reproduced below (SALCC, 2012):

> Goal: A desired conservation outcome that is difficult to measure (e.g., Ecological Integrity of rivers and streams).
> Indicator: A metric that is designed to inform us easily and quickly about the conditions of a system (e.g., miles of fishable and swimmable streams; used to measure progress towards a goal).
> Target: A measurable end point for an indicator (e.g., maintain total miles of fishable and swimmable streams). Used to measure whether an indicator has reached the desired level.
> Objectives: The three components above feed into the creation of a conservation objective. An example objective within this framework would be to "maximize integrity of freshwater aquatic systems (goal) – % unimpaired waterbody segments as defined in EPA 303d list (indicator) – Reduce the number of impaired waterbodies by 10% (target)."

Indicator objectives (combining goals, indicators, and targets) are used outside of the South Atlantic Blueprint tool by the SALCC in development of ecosystem health reports (i.e., *The State of the South Atlantic* report card).

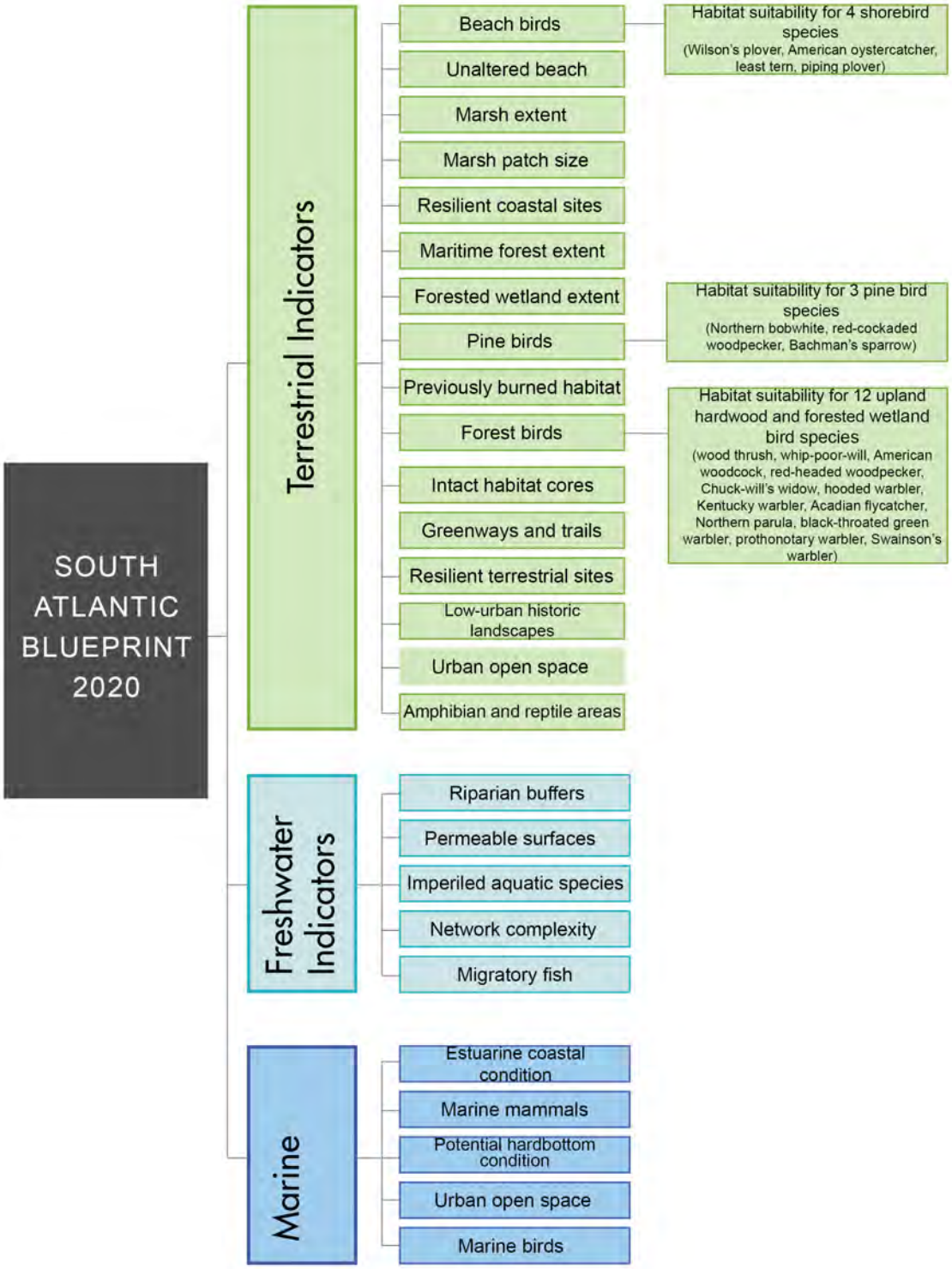

SOUTH ATLANTIC BLUEPRINT 2020
Terrestrial Indicators
Beach birds
Habitat suitability for 4 shorebird species (Wilson's plover, American oystercatcher, least tern, piping plover)
Unaltered beach
Marsh extent
Marsh patch size
Resilient coastal sites
Maritime forest extent
Forested wetland extent
Pine birds
Habitat suitability for 3 pine bird species (Northern bobwhite, red-cockaded woodpecker, Bachman's sparrow)
Previously burned habitat
Forest birds
Habitat suitability for 12 upland hardwood and forested wetland bird species (wood thrush, whip-poor-will, American woodcock, red-headed woodpecker, Chuck-will's widow, hooded warbler, Kentucky warbler, Acadian flycatcher, Northern parula, black-throated green warbler, prothonotary warbler, Swainson's warbler)
Intact habitat cores
Greenways and trails
Resilient terrestrial sites
Low-urban historic landscapes
Urban open space
Amphibian and reptile areas
Freshwater Indicators
Riparian buffers
Permeable surfaces
Imperiled aquatic species
Network complexity
Migratory fish
Marine
Estuarine coastal condition
Marine mammals
Potential hardbottom condition
Urban open space
Marine birds

Figure 20. South Atlantic Blueprint 2020 Indicators, the layers for these indicators are compiled and subject to a connectivity analysis to create the final blueprint.

Indicators are grouped into Terrestrial, Freshwater, and Marine categories and represent a diverse array of spatial data related to biodiversity (focal species occurrence data, both observed and modelled), landscape condition (reflecting the presence of key ecosystem types), and locations with high cultural value (historic places intersected with focal species). While some indicators may represent a single ecosystem (e.g., maritime forest extent), others may represent multiple ecosystems. See Appendix E for a list of indicators as they relate to interpreting priorities within the South Atlantic Blueprint 2020 (see South Atlantic Conservation Blueprint, 2020 for full documentation).

In the South Atlantic Blueprint 2020, each indicator for a given ecosystem is mapped at 30 m resolution with data compiled from multiple sources to ensure coverage across the entire extent of the South Atlantic Blueprint. The layers for all indicators are then aggregated before areas with inherently low or null conservation values, specifically reservoirs and highly developed areas, are removed from the map. Developed areas that score highly for urban space or low-urban historic landscape indicators are retained.

Full documentation of each indicator, including reasons for selection, input data, mapping steps and final indicator values is available in the *South Atlantic Blueprint Development Process 2020*.

5.4.2. Ecosystem Mapping

Previous versions of the South Atlantic Blueprint (up to and including 2.2, as used in the Southeast Blueprint v4.0) categorized small groups of indicators by ecosystem type, spanning maritime forest, beach and dune, estuarine, forested wetland, freshwater marsh, pine and prairie, upland hardwood, and marine (South Atlantic Conservation Blueprint, 2020). These ecosystem classifications are broad, and the specific classification scheme used is not explicit in the documentation; however, many categories are based on NatureServe classifications (NatureServe, 2009). The South Atlantic Blueprint 2020 groups indicators as terrestrial, marine, and freshwater to move away from a habitat approach to one in which the indicators are the primary focus, integrating ecosystem presence directly into the list of indicators. For instance, under the “Terrestrial” grouping, there is an indicator for “unaltered beach.” This “unaltered beach” focuses in on a key detail of the condition of an ecosystem, the lack of anthropogenic alteration, rather than the ecosystem itself.

To that end, ecosystem mapping is still required to constrain the spatial extent of indicators so they can be represented correctly in the South Atlantic Blueprint. Ecosystem maps were created for previous versions of the South Atlantic Blueprint, and some of these are still utilized in the current Blueprint. For instance, for the “unaltered beach” indicator, the previously developed 2.1 ecosystem map for “beach and dune” is applied in the mapping process. Not all indicators, however, use the previous South Atlantic Blueprint ecosystem maps. Full documentation regarding the creation of the South Atlantic Blueprint ecosystem maps is available in Appendix A of *South Atlantic Blueprint Development Process 2020*, and details regarding the specific data used to map each indicator can be found in that same document.

5.4.3. Zonation and the South Atlantic Blueprint

The aggregated indicator layers (aside from estuarine coastal condition, discussed further in this section) are then used as an input to Zonation. Zonation is a "conservation planning framework and software that produces a hierarchical prioritization of the landscape," that was developed by the University of Helsinki. Zonation "ranks the pixels… according to the current condition of the indicators, using a modeling approach that tries to conserve high-value representations of all indicators collectively" (South Atlantic Conservation Blueprint, 2020).

Zonation's ranking process is conducted by terrestrial ("inland") subregion for the South Atlantic Blueprint (see Section 5.3 for subregion boundaries; for open water estuaries and marine areas, see later in this section). Weights are assigned to South Atlantic Blueprint indicators in Zonation to ensure that "spatially limited indicators were not all prioritized, outdated indicator data has less influence, [and] indicators were prioritized consistently across subregions" to promote consistency in the final prioritization ranking. This was done because when equal weights were applied, small areas with a greater number of indicators were more highly prioritized (i.e., maritime forest, beach birds, freshwater aquatic indicators). Therefore, weights of those indicators were reduced to add finer resolution to priority areas rather than prioritizing the entire area of an indicator in the Blueprint. A complete list of the Zonation weighting for every South Atlantic Blueprint 2020 indicator is available on pp. 74-78 of the South Atlantic Blueprint Development Process 2020, along with the program controls implemented when Zonation was run (e.g., removal rule, boundary length penalty, warp factor, and edge removal).

The Zonation output produces a single value for each pixel based on the percent of the input area ranked from highest priority to lowest priority according to the indicators, values ranging from close to 0 to 1. Output pixels that are characterized by values between 0.9 and 1 represent the "best" 10% of the input area. These values were then converted to reflect the percent of the whole subregion. This adjustment was made for the 2020 South Atlantic analysis due to the earlier step that removed reservoirs and urban areas prior to running Zonation which made it important to recalculate this proportion on the reduced area extent. To do this, Zonation outputs were rescaled using a linear scale with the goal to "have the top 10% of each subregion score 'highest priority,' the next 5% score 'high priority,' and the next 20% score 'medium priority.'" This is explicitly explained in finer detail in the South Atlantic 2020 Blueprint documentation, pp. 73 (South Atlantic Conservation Blueprint, 2020). This rebalancing step produces values equivalent to those that that would be obtained if Zonation had been run using reservoirs and urban areas that were given very low indicator scores. Development is ongoing to produce more accurate indicators for the areas removed (reservoirs, urban areas), therefore this step may not be needed in future South Atlantic Blueprints.

For the inland portion of the blueprint the Zonation output value for each subgeography is mosaiced across the entire South Atlantic Blueprint domain as a single layer in which each inland pixel has a value between 0 and 100. In versions 2.2 and earlier of the South Atlantic Blueprint, when mapping was based on ecosystems, these outputs were termed Ecosystem Indicator Scores. As the nature of the indicators has changed, this term is no longer used. In the marine portion, the marine ecosystem integrity layer is mosaiced with the open water estuarine ecosystem score layer. This mosaiced marine layer was then reclassified in ArcGIS to generate 100 classes, with 1 representing the class of pixels with the lowest

integrity score, and 100 representing the class of pixels with the highest (pp 88-89, South Atlantic Conservation Blueprint, 2020).

For open water estuaries, the estuarine coastal condition marine indicator is the only indicator that applies to these areas. As such it is not necessary to assign priority rankings through Zonation. Instead, the developers used the ArcGIS Slice function to replicate the process that was conducted in Zonation to bin indicator values from the coastal condition indicator into 100 equal area classes, each covering roughly the same amount of area (1% of the open water estuaries). This provided scores from 0-100 for this layer to use alongside the Zonation outputs that are ranked on a similar scale. For the rest of the marine indicators, please see the 2020 blueprint documentation for parameters used for Zonation and adjusted indicator weights.

5.4.4. Connectivity Analysis and the Integration of Outputs

Once the Zonation output values are rebalanced and mosaiced (see Section 5.4.3), a connectivity analysis is conducted to delineate hubs and corridors. To identify inland hubs and corridors, the South Atlantic Blueprint 2020 utilizes areas in the top 10% of values in conjunction with data from TNC's Resilient Land Project, and the TNC Secured Lands Database. Potential hubs identified from all three sources are combined and contiguous areas are retained. All areas over 5,000 acres are classified as hubs. Inland corridors are identified with the use of this newly created hubs layer, with additional input from TNC's Resilient Land project so as to include corridors that connect with areas outside of the South Atlantic Blueprint extent. Marine hubs and connectors are identified using the South Atlantic Blueprint 2.2 integrity scores in combination with the estuarine water ecosystem map from the South Atlantic Blueprint 2.1. Marine hubs are composed of contiguous areas over 2,000 ha in the top 10% of Zonation output values. For full documentation of the Connectivity Analysis for the South Atlantic Blueprint 2020, see pp. 81-85 of South Atlantic Blueprint Development Process 2020.

Areas with high Zonation output values, along with hubs and corridors are retained and comprise the South Atlantic Blueprint 2020. The South Atlantic Blueprint 2020 presents conservation data in the following categories (South Atlantic Conservation Blueprint, 2020):

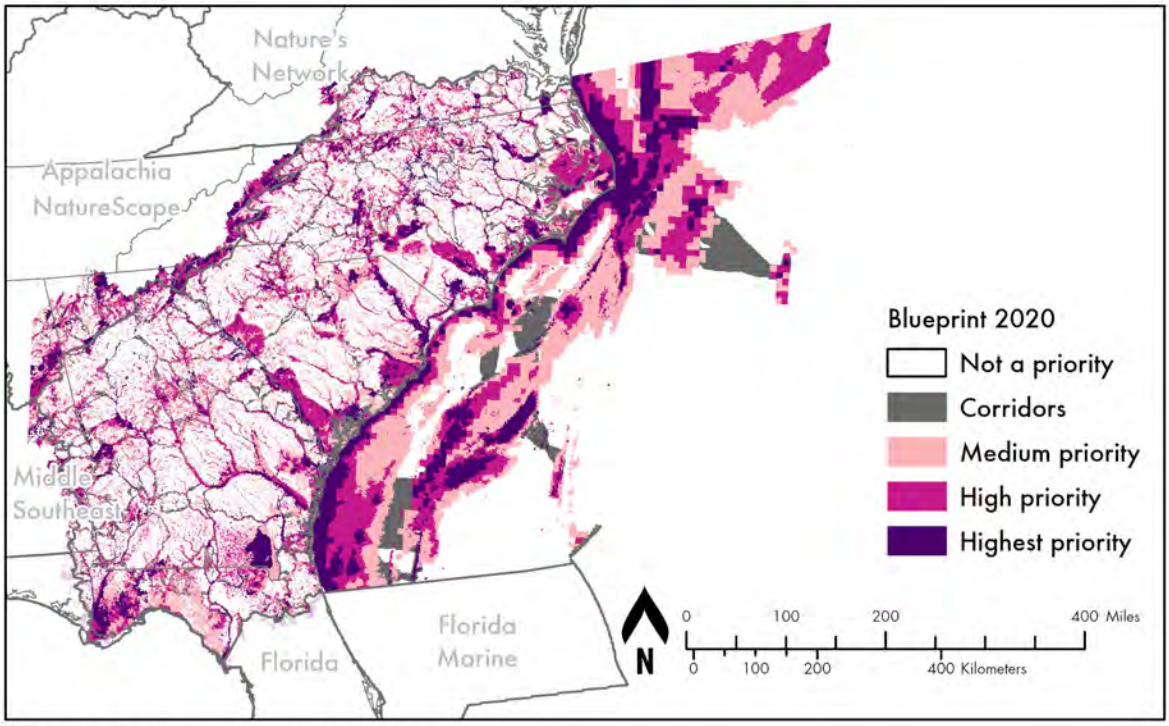
Highest priority for shared action: The most important areas for natural and cultural resources based on indicator condition. This class covers 10% of the South Atlantic geography.

High priority for shared action: Important areas for natural and cultural resources based on indicator condition. This class covers an additional 15% of the South Atlantic geography; together, the highest and high priority categories cover 25%.

Medium priority for shared action: Above-average areas for natural and cultural resources based on indicator condition, capturing potential restoration opportunities. This class covers 20% of the South Atlantic geography; together, the highest, high, and medium priority categories cover 45%.

Corridors: Connections between large patches of highest priority areas and secured lands, optimized for efficiency and indicator condition in a least cost path analysis. This category covers an additional 5% of the South Atlantic geography; in total, the Blueprint covers 50%.

Inland waterbodies: Lakes, reservoirs, and ponds (which are not included in the South Atlantic Blueprint 2.2 priorities).



Data Source: http://secassoutheast.org/blueprint.html

Figure 21. The South Atlantic Blueprint 2020.

5.4.5. Integration into the Southeast Conservation Blueprint

The areas that are highest and high priority for shared action are categorized in the Southeast Blueprint as "high conservation value" and the medium priority for shared action areas and corridors are categorized as "medium conservation value." See Section 2.4 below for a summary of how data from this subregion were integrated into the Southeast Blueprint v4.0.

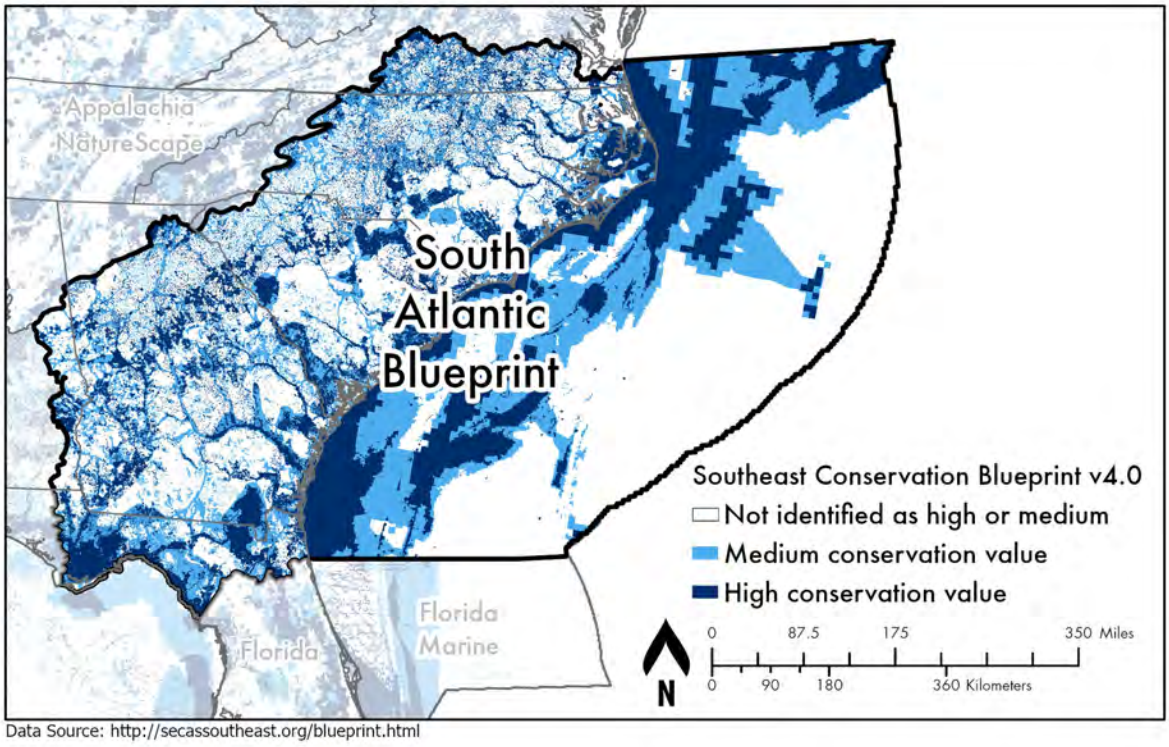


Figure 22. The South Atlantic Blueprint 2.2 as used in the Southeast Blueprint v4.0. The South Atlantic Blueprint 2020 has been published, but is not yet integrated into the Southeast Conservation Blueprint.

5.4.6. Schematic Overview of Blueprint Mechanics

Figure 23 illustrates a simplified overview of the mechanics of the South Atlantic 2020 blueprint including how data are processed and integrated into the Southeast Blueprint.

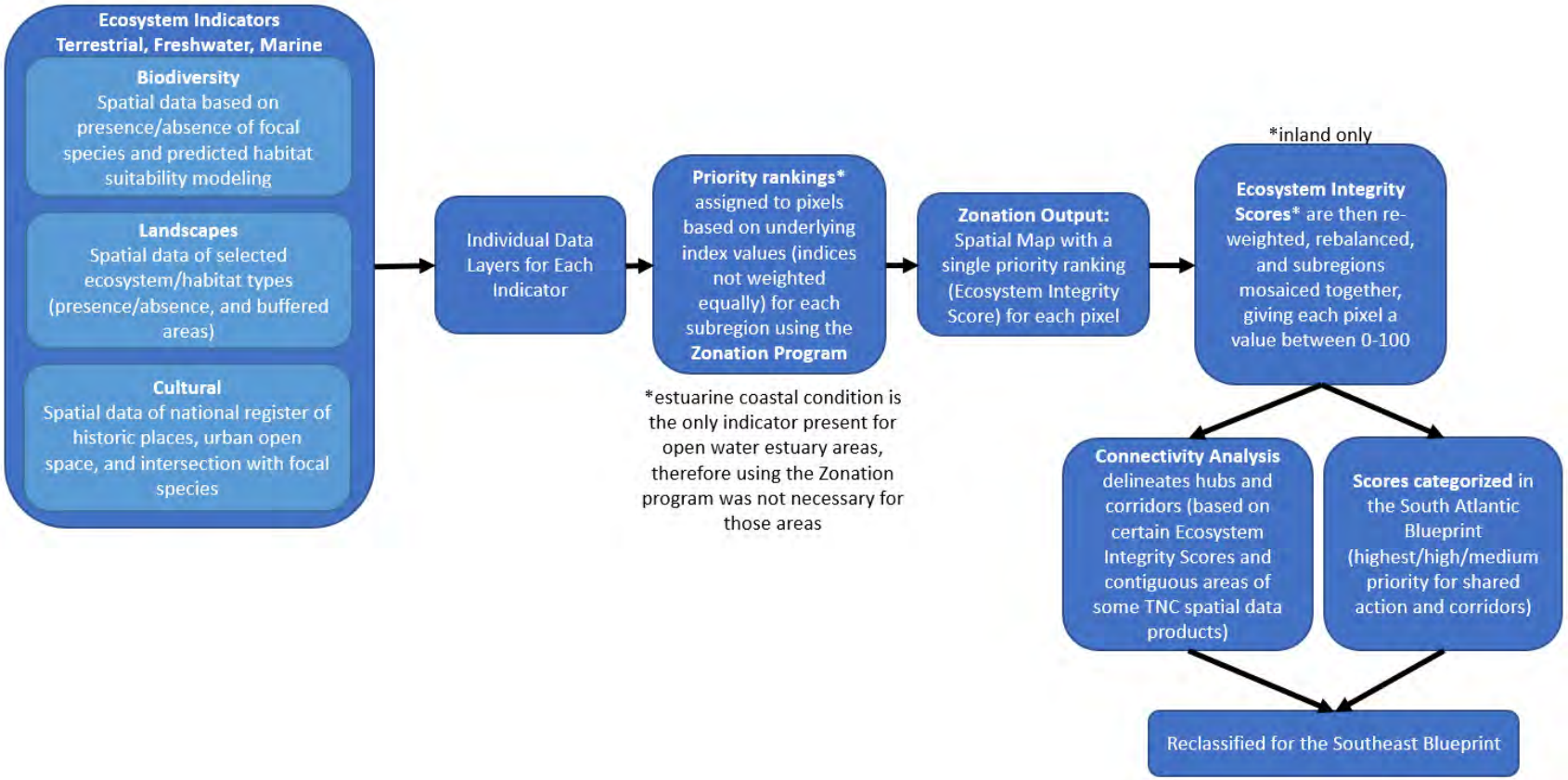


Figure 23. Simplified process schematic of the South Atlantic Blueprint 2020 and integration into the Southeast Blueprint. Ecosystem Integrity Scores was used to describe the output from Zonation in the South Atlantic Blueprint 2.2 and earlier, this term has been retired due to changes in the indicator structure for the South Atlantic Blueprint 2020.

5.5. ONGOING MONITORING AND DEVELOPMENT

There is continual refinement of indicators based on the results of testing, validation, and feedback from the conservation community. SALCC maintains a detailed list of the South Atlantic Blueprint's "Known Issues" on their website. The next update of the South Atlantic Blueprint is expected in fall of 2021.

There are future plans for the incorporation of sea-level rise and urbanization threats in the South Atlantic Blueprint, a proposed method for incorporating this information would be accomplished by overlaying the Blueprint on NOAA's sea-level rise inundation model and the SLEUTH urban growth model with probabilities shown for change by 2060 to maintain consistency with the Southeast Blueprint (South Atlantic Conservation Blueprint, 2020).

5.6. KEY CONTACTS AND RESOURCES

Contacts

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Resources

SALCC Website
SALCC CPA
South Atlantic Conservation Blueprint 2020 on Databasin

6.0 Florida Conservation Blueprint

6.1. INTRODUCTION

The Florida Conservation Blueprint is a conservation planning map that encompasses terrestrial and aquatic ecosystems within Florida's state boundaries (Figure 27). Development of the Florida Conservation Blueprint was initially led by the Peninsular Florida Landscape Conservation Cooperative (PFLCC) with a goal to "increase the efficiency and effectiveness of aligned, collaborative and consistent conservation actions in Florida by the USFWS, the FWC, and other partners [of PFLCC]" (FWC, 2018). To meet this goal, the Florida Conservation Blueprint identifies a network of connected, intact, and resilient areas that include conservation assets to represent important habitats for key species across the state. In addition, indicators for each conservation asset have been developed that can be used to track progress towards conservation goals.

6.2. HISTORY AND GOVERNANCE

The Florida Conservation Blueprint was developed by the PFLCC and is currently maintained and updated by the FWC and USFWS working together cooperatively (see Section 6.2.2 for more information on the origin of the PFLCC). It incorporates two previously established datasets—the Critical Lands and Waters Identification Project (CLIP), and the Cooperative Land Cover Map (CLC) —and builds on the work of a diverse array of conservation initiatives in Florida that date back to 2005, outlined below.

6.2.1. Prior to the PFLCC

In 2001, Congress required states and territories to submit a comprehensive wildlife conservation strategy to a U.S. Fish and Wildlife Service by October 1, 2005, in order to continue qualifying for State Wildlife Grant funds. In 2005, states were expected to submit SWAPS to a National Advisory Acceptance Team for review and approval as a condition for the distribution of funds through the State and Tribal Wildlife Grants Program (AFWA, n.d.) . These SWAPs serve as actionable, state-specific guides to support nationwide conservation of fish and wildlife (AWFA, 2020). The FWC, who manage the state's fisheries and wildlife, led the development of the SWAP for Florida.

In the same year, the Florida legislature established The Century Commission for Sustainable Florida. This commission was comprised of 15 stakeholders representing local governments, school boards, developers, agriculture, the environmental community, and the business community. Collectively these stakeholders were tasked with developing a collective vision for Florida that looked 25 and 50 years into the future, and making recommendations to the Florida governor and legislature as to how to realize that vision (*Century Commission for a Sustainable Florida Act*, 2009; Oetting et al., 2012). One of the commission's recommendations was for the identification of Florida lands and waters that are critical to conservation of natural resources. In response to this recommendation, the CLIP formed in 2006 as a partnership between FWC, the Florida Natural Areas Inventory (FNAI) and the University of Florida Center of Landscape Conservation. This partnership, in collaboration with experts from state and federal agencies, water management districts, NGOs and the private sector, developed CLIP as a GIS database to identify statewide conservation priorities for natural resources. In 2008 the first iteration of this database, CLIP v1.0, was released (Oetting et al., 2016a).

In 2007, FWC began the development of the Florida Cooperative Conservation Blueprint (not to be confused with the Florida Conservation Blueprint that was integrated into the Southeast Blueprint). The Florida Cooperative Conservation Blueprint built upon CLIP. This Cooperative Conservation Blueprint sought to develop unified conservation priorities across a broad and diverse group of stakeholders; to develop a set of voluntary incentives to support conservation priorities on privately held lands; and to serve as a core element of implementing Florida's SWAP (FWC, 2010; Oetting et al., 2016b). Recognizing the synergies between CLIP and the Florida Cooperative Conservation Blueprint, FWC funded the development of CLIP v2.0 in 2011 for utilization of CLIP within the Florida Cooperative Conservation Blueprint (FWC, 2013). The PFLCC provided support for the CLIP 3.0 and 4.0 updates.

In 2008, a Florida State Wildlife Grants (SWG) program funded project was initiated by FNAI to collaboratively develop the Cooperative Land Cover Map. The goal was to create a map that incorporated the strengths of various existing GIS data including land use, land cover, natural community, and other habitat data sets, targeting revisions to the Strategy's priority habitats, including scrub and sandhill. In 2011, a follow-up project was initiated by FWC, through SWG funding, to update the CLC statewide across all land cover/land uses, for use by FWC and its conservation partners to meet the needs for implementation of the SWAP.

In 2010, a regional pilot of FWC's Florida Cooperative Conservation Blueprint was launched in south-central and southwest Florida. The pilot focused on the development of incentive-based conservation landscape planning and consisted of two primary initiatives. The first of these initiatives identified priority conservation areas and mapped corridors. The second initiative looked to identify existing conservation initiatives, as well as alternative funding strategies for the protection of these priority lands. 7.0

Lastly, in 2008, the same year CLIP v1.0 was launched for use in the Florida Cooperative Conservation Blueprint, USFWS and USGS worked with urban planners from Massachusetts Institute of Technology (now GeoAdaptive, Inc.) to develop models for a range of scenarios in south Florida, including climate change, urbanization, and conservation funding. Those initial scenarios were completed in late 2012 to support CLIP and the PFLCC while extending the scenarios beyond the LCC boundaries to encompass the entire state of Florida (Vargas et al., 2014). Scenario modeling included five "Drivers of Change": Human population growth, urbanization/development, financial resources for conservation, conservation strategies, and climate change/sea level rise.

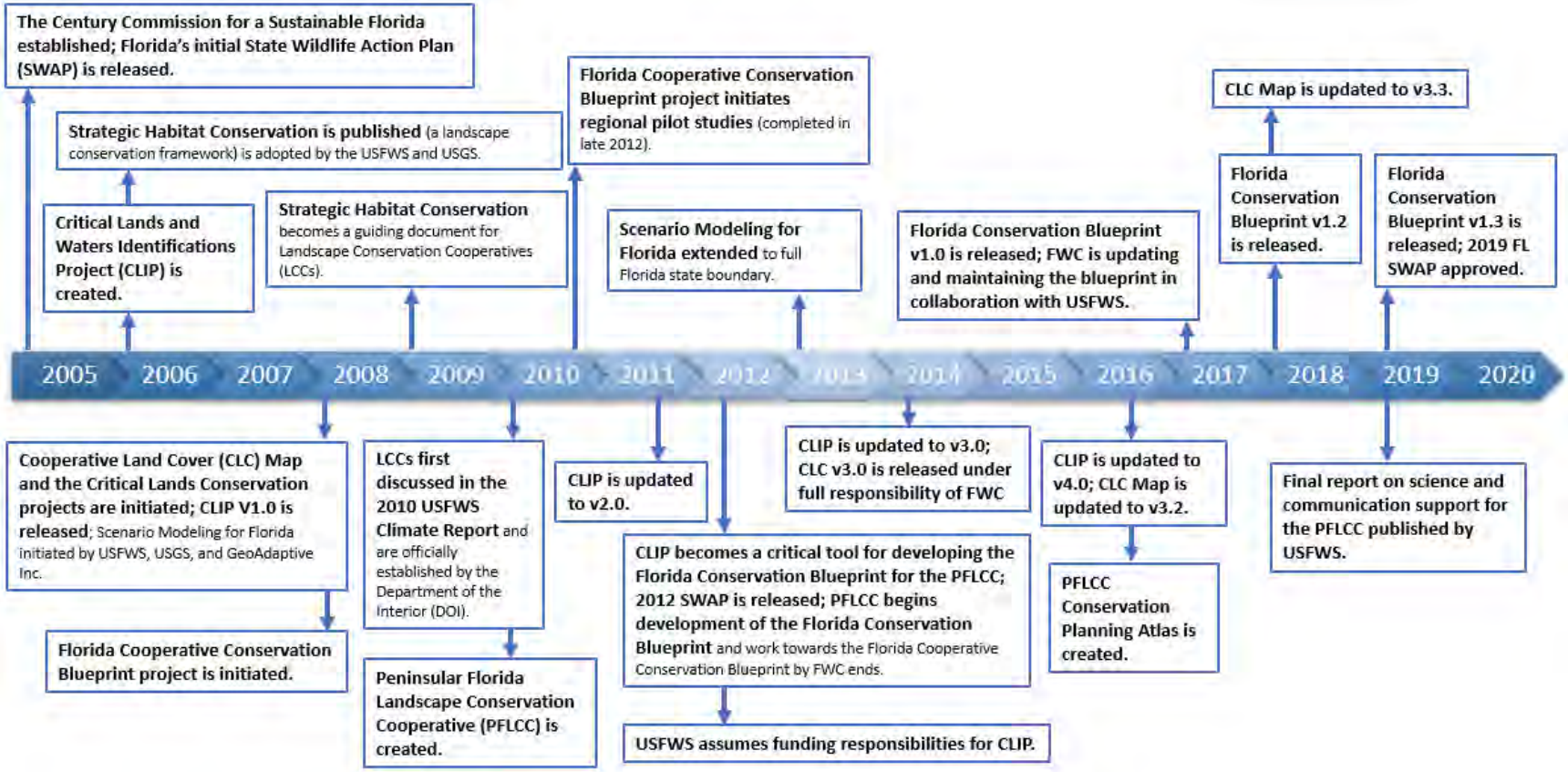


Figure 24. Timeline of the development and governance of the Florida Conservation Blueprint

6.2.2. Post-PFLCC Establishment

The PFLCC was established by the DOI in 2010 as part of the nationwide LCC initiative to address the need for a collaborative approach to the development of landscape-level strategies for understanding, responding, and adapting to climate change impacts. The PFLCC, with support from USFWS, worked in a region that extended from north-central peninsula Florida down to the Florida Keys, and was governed by a steering committee of 22 representatives from NGOs, state, and federal agencies (including USFWS and FWC).

A core component of the LCC structure required the creation of a Landscape Conservation Design (LCD). The process for creating these LCDs is defined by the LCC Network as an "interactive, collaborative, and holistic process resulting in products that provide information, analytical tools, maps, and strategies to achieve landscape goals collectively held among partners" (LCC, 2016, 2020). Specifically, LCDs call for the combining of geospatial data, biological information, and models. In developing and implementing their LCD, PFLCC was able to benefit from the wealth of state-specific datasets that had been developed by prior conservation initiatives (see Section 6.2.1).

FWC identified PFLCC as a potential partner for the Florida Cooperative Conservation Blueprint, and in a 2010 report first suggested that the Cooperative Conservation Blueprint could be integrated into the PFLCC (FWC, 2010). In 2012, PFLCC began development of the Florida Conservation Blueprint, and incorporated data not only from CLIP, but also from CLC, and utilized the Florida SWAP as a starting point for refining these datasets for the Florida Conservation Blueprint. More information on this process can be found in Section 6.4. Around this time, the FWC stopped work on the Cooperative Conservation Blueprint. In 2012, USFWS assumed funding responsibilities for CLIP, and in 2014, FWC assumed full responsibility for the CLC.

As part of the LCC mission to develop science-based mapping and analysis tools for public use, a subset of LCCs in the southeastern US developed an integrated set of CPAs powered by DataBasin to further the USFWS mission to develop "Strategic Habitat Conservation" (USGS & USFWS, 2006). CPAs are "intended to serve as conservation portfolios" for LCCs and "promote connectivity among LCC partners for conservation planning without a need for direct coordination" (GCPOLCC, 2016). CPAs serve as a platform for LCCs to create galleries to showcase their collection of spatial information and supporting documentation. Each CPA portal enables both GIS experts and the public (casual GIS users) to view, download, and perform analyses on spatial information with specific goals in mind. Many data housed in CPAs were used directly in the development of the Southeast Conservation blueprint. In 2016 PFLCC created the PFLCC CPA which provides a publicly accessible, collaborative web-based platform on which "conservation planners and managers can go to view, retrieve and perform analysis on spatial information and access associated information to use in addressing specific conservation goals" (FWC, 2019).

In 2017 the Florida Conservation Blueprint v1.0 was released. LCCs nationwide have been inactive since 2017, and at that time USFWS and FWC have assumed responsibility for maintenance and updates of the Florida Conservation Blueprint with significant input from FWC. The most recent iteration is the Florida

Conservation Blueprint v1.3, which was released in 2019. Further refinement of the Florida Conservation Blueprint is ongoing (see Section 1.1.1 for more information).

6.3. GEOGRAPHY AND ECOSYSTEM

The Florida Conservation Blueprint encompasses the entire state of Florida, as many of the assessments and associated datasets used in the Florida Conservation Blueprint span the entire state. As a result, the Florida Conservation Blueprint overlaps with data and analyses by the SALCC and the GCPOLCC. This overlap fostered collaboration and coordination across the three LCCs.

The Florida Conservation Blueprint encompasses temperate and subtropical ecosystems, including a transitional zone within the Florida Peninsula where "pine and bottomland hardwood elements of the Coastal Plain begin to merge with the tropical elements of south Florida" (PFLCC, 2013). The state of Florida encompasses a wide range of ecosystem types due to its position in a tropical/subtropical transition zone, with multiple types of tropical and temperate forests, shrubland, wetland, and saltwater aquatic vegetation (Appendix). See Section 6.4.1 below for details on habitat designations, referred to as "Conservation Assets" used in the Florida Conservation Blueprint.

The Florida Conservation Blueprint does not extend offshore; the companion Florida Marine Blueprint v.1.0, which was developed under FWC/USFWS coordination, was released in 2019 and provides conservation data for the marine areas out to the Exclusive Economic Zone (EEZ). The Florida Marine Blueprint is discussed in Section 7.0. In documentation related to Conservation Assets (see Section 6.4.1 below), the seaward boundary for estuarine wetlands is "1) an imaginary line closing the mouth of a river, bay, or sound; and 2) the seaward limit of wetland emergents, shrubs, or trees when not included in 1)," and the boundary for "Marine" assets is "open ocean over the continental shelf, and coastline exposed to waves and currents of the open ocean shoreward to: 1) extreme high water of spring tides; 2) seaward limit of wetland emergents, trees, or shrubs; or 3) seaward limit of the estuarine system, other than vegetation" (Benscoter et al., 2015)

6.4. BLUEPRINT STRUCTURE AND METHODOLOGY

CLC provides the primary structure for the Florida Conservation Blueprint with a conservation planning map that consists of 234 land cover classes (FWC, 2019). In the Florida Conservation Blueprint, the CLC land cover is refined to include only those classes that align with the Conservation Assets (previously Priority Resources; detailed below in Section 6.4.1) identified by the PFLCC. These Conservation Assets are then further refined with data from CLIP (see Sections 6.4.2 and 6.4.3).

Terminology for Conservation Assets and indicators has changed during the development of the Florida Conversation Blueprint. Conservation Assets were previously named "priority resources" but FWC notes that "though a descriptive term, [priority resources] became confusing when they were further spatially prioritized within the Florida Conservation Blueprint. In order to rectify any confusion, priority resource was changed to Conservation Asset, as this term inherently denotes value and prioritization. Additionally, the term conservation target has been changed to indicator" (FWC, 2018).

6.4.1. Conservation Assets

Conservation Assets are defined by PFLCC as the "set of biological and ecological features and ecological processes important in the current and future landscape" (FWC, 2019). Conservation Assets were partially derived from Priority Resources defined by the PFLCC in the PFLCC Science Plan (PFLCC, date unknown). The characteristics used to define and select Conservation Assets were determined by the PFLCC Partners (FWC, 2019), and include ecological features and processes that:

- are responsive to conservation actions,
- clearly relate to PFLCC key components,
- are defined in a way that links to other classification systems (e.g., NatureServe) and other LCCs,
- each have a limited number of Indicators, and
- have buy-in from PFLCC leadership and partners.

Conservation Assets are broadly defined habitats or ecotypes such as 'coastal uplands' and 'mangrove swamp'. These Conservation Assets were further refined by PFLCC in partnership with the USGS

The resulting Conservation Assets comprise nine terrestrial systems which consist of coastal uplands, freshwater aquatic (springs, rivers and streams, ponds, and lakes), freshwater forested wetlands, freshwater non-forested wetlands, hardwood forested uplands, high pine and scrub, pine flatwood and dry prairie, and working lands (I and II). The three freshwater aquatic systems (springs, rivers and streams, and ponds and lakes) have been re-aligned and are now individual conservation assets (rather than sub-systems within "freshwater aquatic"). Two estuarine systems, mangrove swamp and saltwater marsh, are included in the Florida Conservation Blueprint v1.3.

For each Conservation Asset, between one and five indicators are defined with quantifiable metrics so that the status of a given Conservation Asset could be assessed. The metrics for each indicator were, where appropriate, assigned a target so as to provide the PFLCC with measurable objectives and accountability for conservation planning and decision making, and the ability to track the health of an ecosystem through time (FWC, 2019). For full documentation of the PFLCCs process of defining indicators (conservation targets) for each Conservation Asset, see Benscoter et al. (2015).

6.4.2. Core Data Layers

Core data layers utilized in the Florida Conservation Blueprint are summarized in Figure 25 and outlined below.

Cooperative Land Cover Map

The land cover classes that comprise the Conservation Assets defined by the PFLCC (described in the previous Section) are mapped with the use of the CLC. The CLC map details land cover classes across Florida at a 10 m scale, and is developed from "existing federal, state and local data sources and expert review of aerial photograph and ground conditions." The CLC is revised and updated every 6–12 months (FWC, 2019).

The structure of CLC's land cover data is based on the Florida Land Cover Classification System, which provides a single classification system of well-defined land cover classes. This single classification system enables coordination between Florida agencies that engage in conservation. The Florida Land

Cover Classification system is hierarchical, with parent classes (labelled ‘State’) that provide a broad level of differentiation between land cover classes at the regional or state level, and child classes (labelled ‘Site’) used at increasing levels of detail for local or site-level scales (FWC, 2019). While the Florida Land Cover Classification System is unique to Florida, the classification system permits a level of flexibility for coordination with neighboring states.

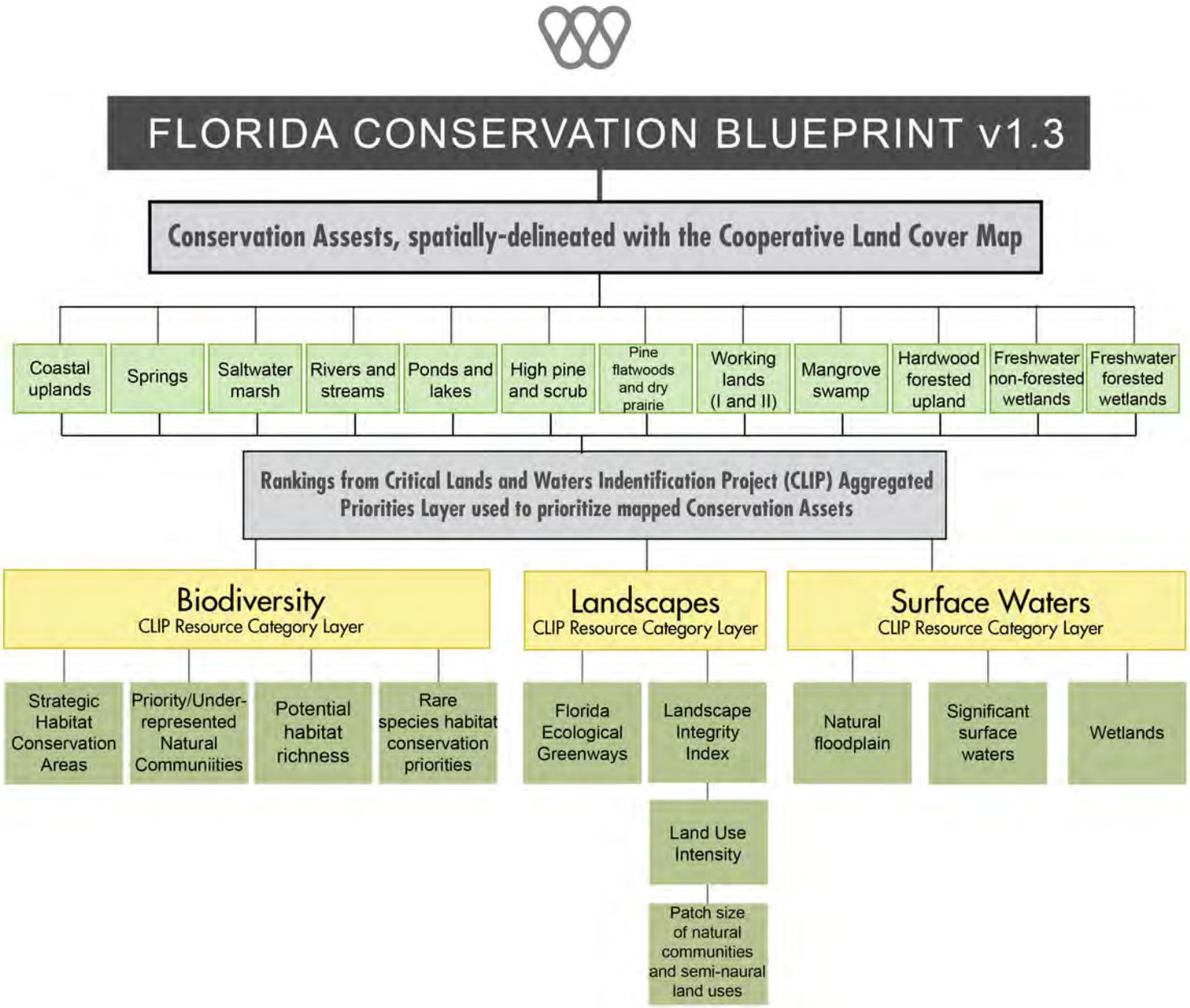


Figure 25. Inputs to the Florida Conservation Blueprint v1.

The Conservation Assets that are spatially delineated by the CLC map are then refined and prioritized with data from CLIP. CLIP is a hierarchical model that utilizes available GIS data (detailed in full in Oetting et al., 2016b) to identify statewide areas of interest for protecting biodiversity, water resources, ecosystems services, and other natural resource values (FWC, 2019). The CLIP database can also overlay CLIP priorities onto other datasets (e.g., threats to natural resources or opportunities for conservation) to highlight areas of synergy or conflict (Oetting et al., 2016b). Core CLIP datasets are grouped into three Resource Category layers: Biodiversity, Landscape, and Surface Waters. Within each of these Resource Category layers, regions are assigned a priority value to describe their conservation value. These values range from P1 (highest priority) to P5 (lowest priority). These Resource Category layers and their inputs are detailed in Figure 25. An aggregated model is then created from these three Resource Category layers. The priorities established in the resource categories are subject to a ruleset that informs the priority ranking of locations within the Aggregated Model (Table 8). The priority rankings from the Aggregated CLIP model are used to refine the spatial extent of the Conservation Assets that are mapped in CLIP, this process is detailed in Section 6.4.3. See Section 6.2.1 for information on the origination of CLIP and how it is updated.

Table 8. Rules used to determine priority rankings for the CLIP Aggregated Model.

Aggregated CLIP Resource Priorities	
Aggregated Priority	**IF Resource Category Layer Priorities meeting the following conditions**
Priority 1	Biodiversity P1; Landscape P1; or Surface Water P1; Biodiversity, Landscape AND Surface Water P2
Priority 2	Biodiversity P2; Landscape P2; or Surface Water P2; Biodiversity; Landscape AND Surface Water P3
Priority 3	Biodiversity P3; Landscape P3; or Surface Water P3
Priority 4	Biodiversity P4; Landscape P4; or Surface Water P4
Priority 5	Biodiversity P5; Landscape P5; or Surface Water P5

6.4.3. Integration of Core Data Layers into the Florida Conservation Blueprint

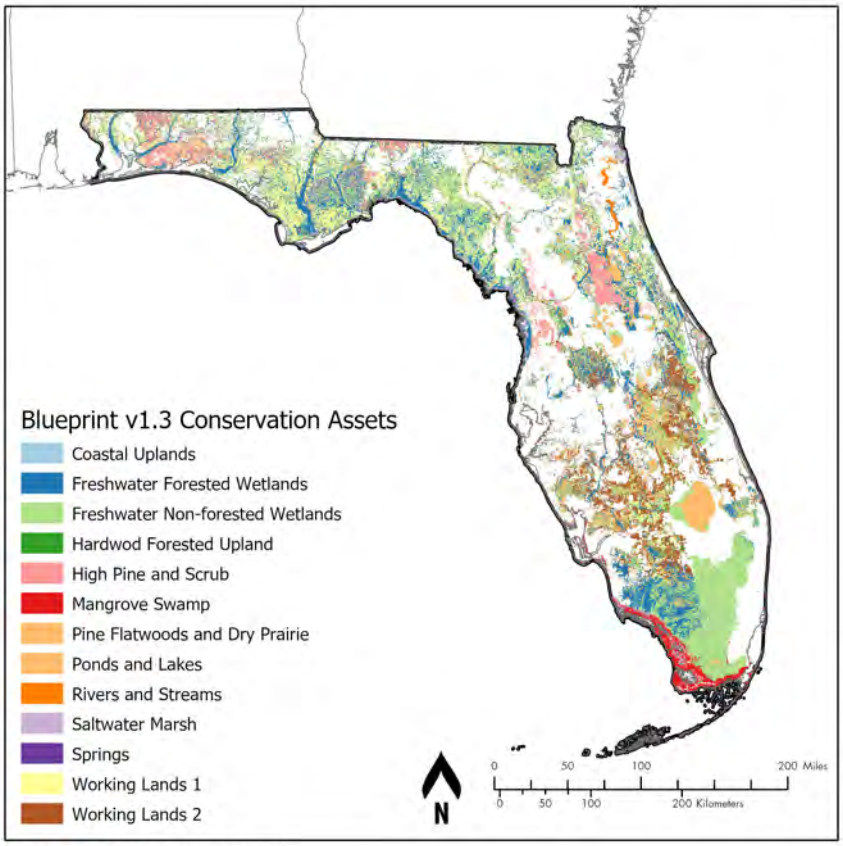
The Florida Conservation Blueprint v1.3 uses 11 Conservation Assets selected by the PFLCC (9 terrestrial and 2 estuarine habitats; Figure 26), maps those assets with the use of CLC, and then refines the domain of those mapped Conservation Assets based on prioritization ranks from several core and resource categories from CLIP. The CLIP Aggregated Model is used to assign final priority levels to the Florida Conservation Blueprint. The Conservation Assets layer is retained where identified priority level criteria were met: CLIP Landscape Resource layer: P1, P2, P3.

- CLIP Significant Surface Water Layer: P1, P2
- CLIP Priority/Under-represented Natural Communities: P1

- CLIP Rare Species Habitat Conservation Priorities (referred to as 'fnaihab' in documentation): P1
- CLIP Natural Floodplain: P1, P2
- CLIP Wetlands, P1, P2

Once this process is complete, in the integrated map, areas ranked as P1 in CLIP Aggregated Model remain P1, and all others are classified as P2.

The resulting map is the Florida Conservation Blueprint, which shows areas that are designated as Conservation Assets that are over one acre in size, and that can also be categorized as P1 (high conservation priority) or P2 (medium conservation priority) in CLIP 4.0 (Figure 27). A full explanation of the technical process for integrating CLIP and CLC-derived Conservation Assets can be found in Appendix A of *Final Report on Peninsular Florida Landscape Conservation Cooperative* (FWC, 2019).



Data Source: https://flcpa.databasin.org/datasets

Figure 26. PFLCC Conservation Assets (Mapped as CLIP Priority Resource Classes) classified as P1 and P2. CLIPs designation of these priority areas determine their inclusion in the Florida Conservation Blueprint.

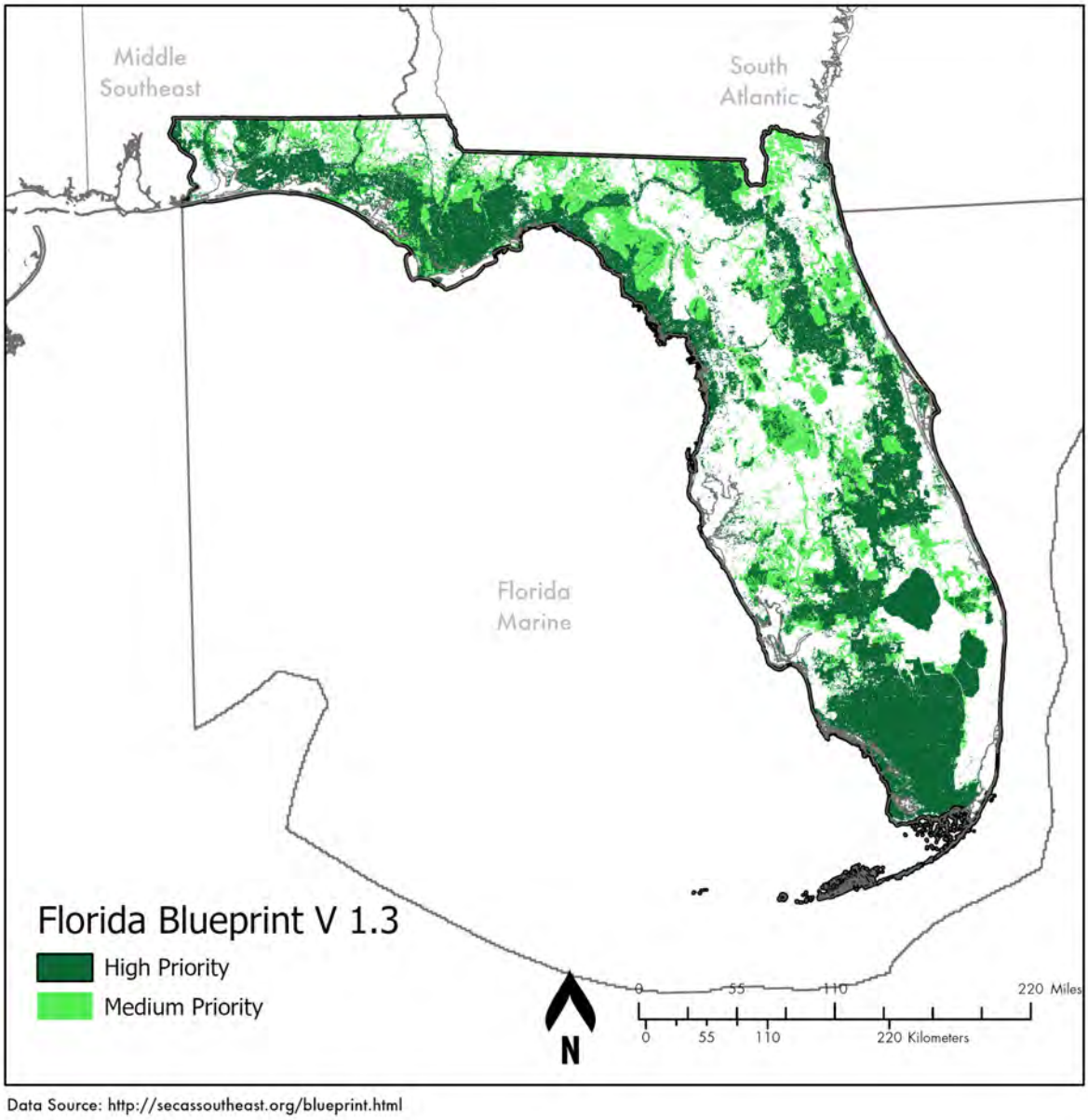


Figure 27. Florida Blueprint v1.3, showing P1 (high) and P2 (medium) priority conservation areas

The Florida Conservation Blueprint also includes an additional Connectivity Layer (Figure 28) to represent landscape connectivity and hubs across the state. This layer is based primarily on CLIP datasets. The Hubs were developed by extracting values 9 and 10 from the CLIP Landscape Integrity (core) layer. Areas identified as Conservation Assets were retained within the extracted areas. Contiguous areas less than 20,000 acres were removed. The connectors were developed by extracting P1 and P2 areas of the CLIP Greenways (core) layer. Areas identified as Conservation Assets were retained within the extracted areas. The two layers (Hubs and Connectors) were combined, and areas identified in both processes were labeled as Hubs in the final layer.

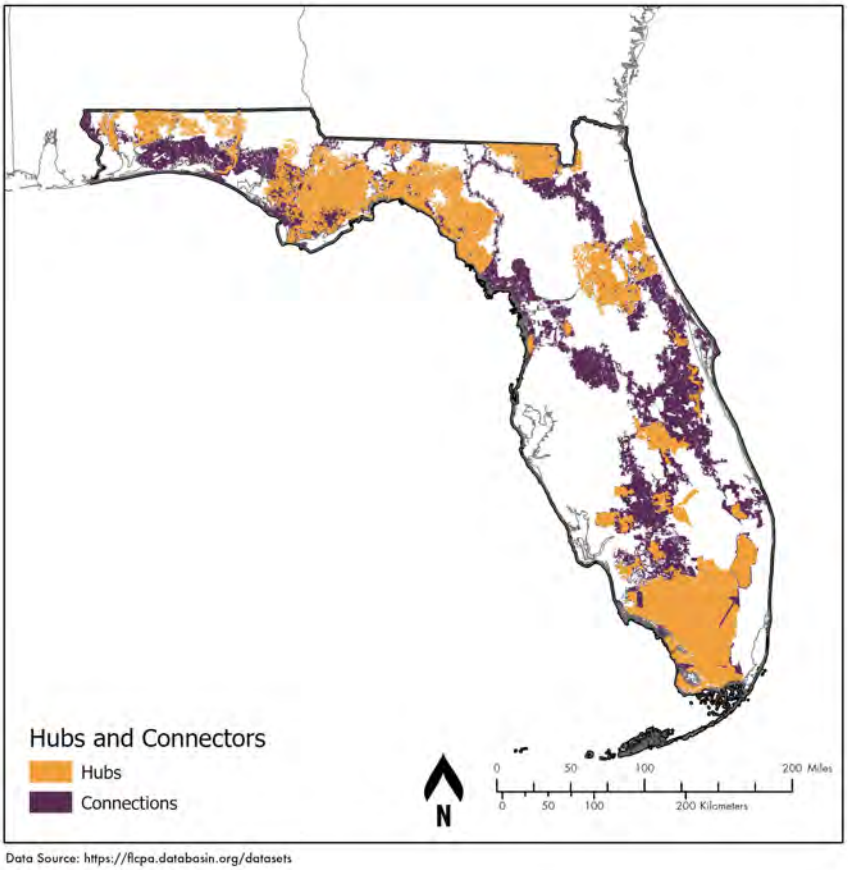
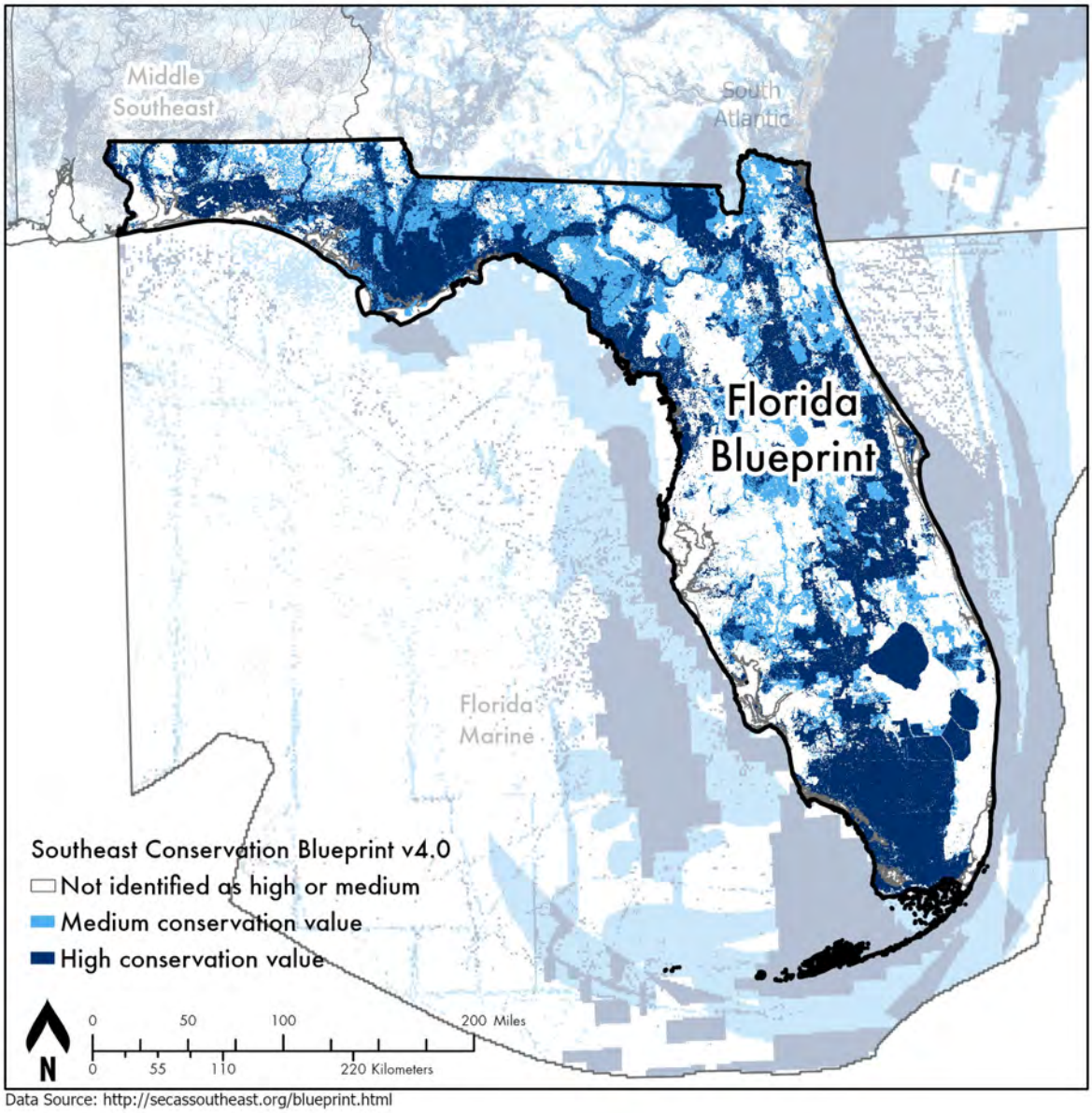


Figure 28. Florida Conservation Blueprint Hubs and Connectors derived from CLIP data.

The resulting Florida Conservation Blueprint can be viewed in a number of ways: The Florida Conservation Blueprint as Conservation Assets, the Florida Conservation Blueprint by priority levels (P1 and P2), the Connectivity layer by Conservation Assets, and with Connectivity displayed by priority level (P1 and P2). These maps are available to view and download on the Florida Conservation Planning Atlas website.

6.4.4. Integration into the Southeast Conservation Blueprint

The Florida Conservation Blueprint (Figure 27) is incorporated into the Southeast Blueprint in two ways: 1) the core layer of the Florida Conservation Blueprint v1.3 is integrated directly into the primary Southeast Blueprint 4.0 layer, with area categorized as P1 in Florida shown as "high conservation value" in the Southeast Blueprint and areas categorized as P2 shown as "medium conservation value", and 2) the hubs and connectors layer of the Florida Blueprint is used in the hubs and corridors layer of the Southeast Blueprint. In the portion of the Southeast Blueprint that intersects with the Gulf Coast, the hubs, and corridors layer (named as "Hubs and Connectors" on DataBasin) applies only to the spatial extent of the South Atlantic Conservation Blueprint and the Florida Conservation Blueprint. See Section 2.4 for a summary of how data from this subregion were integrated into the Southeast Blueprint v4.0 as well as for more information about the Hubs and Corridors layer of the Southeast Blueprint v4.0.



Data Source: http://secassoutheast.org/blueprint.html

Figure 29. The Southeast Blueprint with Florida Blueprint input area highlighted.

6.4.5. Schematic Overview of Blueprint Mechanics

Figure 30. Simplified process schematic of the Florida Blueprint v1.3 illustrates a simplified overview of how data is integrated and prioritized in the Florida Blueprint v1.3 with eventual use in the Southeast Blueprint.

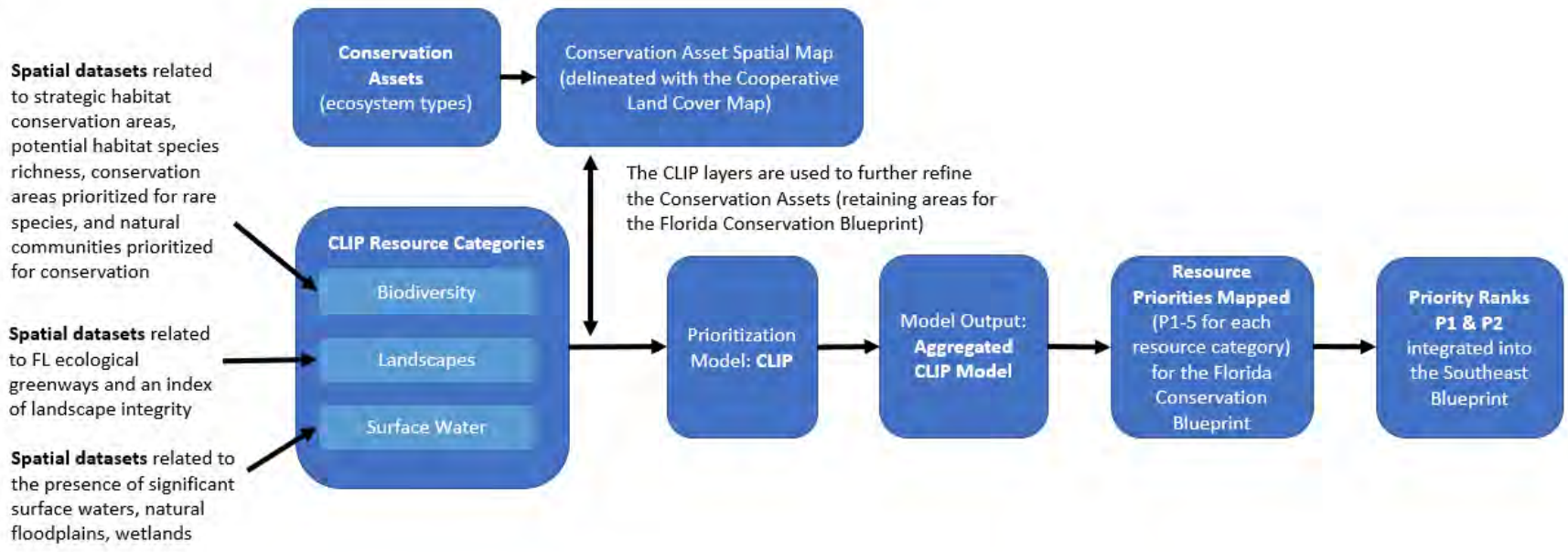


Figure 30. Simplified process schematic of the Florida Blueprint v1.3 and integration into the Southeast Blueprint.

6.5. ONGOING MONITORING AND DEVELOPMENT

Since 2017, when the nationwide initiative to support LCC Steering Committees ended, USFWS and FWC have served as leaders of the Florida Conservation Blueprint under a cooperative agreement. The Florida Conservation Blueprint is now considered a state-federal blueprint to support "conservation and streamlined regulation for Florida" (FWC, 2018). Under the new leadership, some partnerships and collaborations established by the PFLCC for future development and consultation regarding the Florida Conservation Blueprint have continued. Within this, the overall goal and mission of the Florida Conservation Blueprint remains largely the same, with USFWS and FWC focused on improving and expanding upon the PFLCC's earlier work.

FWC and USFWS have extended the spatial coverage for Florida with the development of the Florida Marine Benthic Cover Map, and the Florida Marine Blueprint. These were released in 2018 and have been included in the Southeast Blueprint. For a full discussion of the Marine Benthic Cover Map and the Florida Marine Blueprint, see Section 7.0 below.

An improved freshwater mapping layer has been developed by FWC. This layer includes information regarding substrate type, bathymetry, and river and lake classification types. This freshwater mapping does not use the CLC, but instead uses a model of the National Hydrological Dataset, the NHDPlus HR, as a foundational framework upon which to build freshwater attributes (FWC, 2018).

Work has been initiated to identify current and future threats (e.g., land use change, development, sea level rise) for inclusion in the Florida Conservation Blueprint. Threat assessments will be conducted and used to improve implementation actions that are designed to assist in meeting conservation targets (the target conditions associated with indicators). For more information on these threat assessments, see *Florida Fish and Wildlife Conservation Commission Annual Report on the Co-development of a State-Federal Blueprint for Conservation and Streamlined Regulation for Florida.* FWC and USFWS are also working to refine indicator and target metrics for Conservation Assets. Over the next two years, the USFWS and FWC will work to continue with these updates ahead of the release of the Florida Conservation Blueprint v1.4.

6.6. KEY CONTACTS AND RESOURCES

- Contacts
- Beth Stys, Associate Research Scientist, FWC, Fish and Wildlife Research Institute: beth.stys@MyFWC.com

- Resources
- Florida Conservation Blueprint
- Florida Conservation Planning Atlas
- Critical Lands and Waters Identification Project
- Florida Cooperative Land Cover Map

Further Reading

- Kawula, R., & Redner, J. (2018). *Florida Land Cover Classification System*. Florida Fish and Wildlife Conservation Commission.
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7.0 Florida Marine Blueprint

7.1. INTRODUCTION

The Florida Marine Blueprint is a supplemental blueprint for the Florida Conservation Blueprint that provides coverage of the marine ecosystems within 200 miles (the extent of the U.S. Exclusive Economic Zone; EEZ) of the Florida state coastline. The Florida Marine Blueprint was developed jointly under USFWS and Florida Fish and Wildlife Conservation Commission (FWC; the state wildlife agency for Florida) leadership in 2019 and compiles information from state and federal agencies, as well as NGOs, regarding species locations, richness, valued habitats, and migratory corridors within this region.

The Florida Marine Blueprint, while still a relatively newly developed map, is structured to mirror the Florida Conservation Blueprint. The Florida Conservation Blueprint (detailed in full in Section 6.0) uses two primary data layers; the first of these layers is the CLC which details the land cover classes across the state. The second, CLIP assigns and prioritization rankings across the state, and maps these ranked areas. The CLC and CLIP are combined to create a map of conservation priority rankings for specific Conservation Assets across the state. These Conservation Assets represent ecologically and biologically important areas, ranked by conservation priority.

To that end, FWC has developed two key data layers for the Florida Marine Blueprint. The first is the Marine Benthic Cover Map which provides a similar level of detail for marine and estuarine environments as the CLC provides for terrestrial and freshwater environments. The second layer, named The Florida Marine Blueprint, provides rankings of priority marine and estuarine areas for conservation that are similar, but more detailed, than those provided for marine areas by the Critical Lands and Waters Identification Project (CLIP). At present, the Marine Benthic Cover Map is used to help develop indicators to track the health of marine Conservation Assets, while the Florida Marine Blueprint provides spatially delineated priority rankings based on an area's combined species richness, occurrence of anthropogenic habitats (e.g., shipwrecks, bridges, pipelines), valued habitats and "blueways" (marine migratory corridors).

While the Marine Benthic Cover Map and the Florida Marine Blueprint share a spatial domain and provide complementary data to one another, they are not yet integrated. Rather, a structure is in place that could enable further development consistent with the Florida Conservation Blueprint. The Florida Marine Blueprint v1.0 is integrated into the Southeast Blueprint v4.0. The Marine Benthic Cover Map and the Florida Marine Blueprint are, along with the adjoining Florida Conservation Blueprint, currently overseen by USFWS and FWC.

7.2. HISTORY AND GOVERNANCE

In 2017, when the nationwide initiative to support LCC Steering Committees ended, FWC and USFWS established a joint partnership to oversee the continued development and maintenance of the Florida Conservation Blueprint, its online presence, and its integration into the Southeast Blueprint.

As part of this joint agreement, FWC embarked on a project: "Co-development of a State-Federal Blueprint for Conservation and Streamlined Regulation for Florida" which ran from 2018-2020. This co-

development resulted in many improvements and expansions to the Florida Conservation Blueprint (terrestrial improvements are detailed in Section 6.5). These expansions include the creation of both a Marine Benthic Cover Map, which provides detailed coverage of marine habitat types, and a Florida Marine Blueprint, which maps species locations, valued habitat, and migratory corridors (see Figure 31 for a summary of major milestones in the development of the Florida Marine Blueprint).

While CLIP (see Section 6.4.2) has a Marine Resource Category, marine subject matter experts from FWC and the Fish and Wildlife Research Institute (FWRI; a research body that is supported by FWC) determined as early as 2009 that this resource category was lacking. In an October 2019 review meeting, FWC and FWRI agreed to expand the scope of marine conservation efforts to increase data representation for "several priority marine habitats and species groups, including seagrass, coral/hardbottom, oyster reefs, worm reefs, manatee habitat, north Atlantic right whale habitat, sea turtle nesting habitat, scallop habitat, and sturgeon habitat" (FWC, 2019).

Marine coverage of the Florida Conservation Blueprint was not developed under PFLCC, and this absence was considered by FWC to be a notable gap; they explained in a 2019 report that: "Florida has the most coastal shoreline within the contiguous United States (Livingston 1990). These marine resources, such as saltwater marshes, mangrove swamp, coral reefs, and seagrass beds, help support the diversity of marine life and protect Florida's vast shorelines. A long-term vision devoid of consideration for these ecosystems would be detrimental to longevity and sustainability of Florida's resources. Currently, many of these resources are under considerable pressure by development and are threatened by sea level rise due to climate change, and therefore require action be taken to aid in mitigating these pressures" (FWC, 2019).

Initial versions of the Florida Marine Blueprint, alongside the Marine Benthic Cover Map, were developed by FWC in 2018-2019 and released in 2019. The structure and methodology of those maps is detailed in Section 7.4, and planned developments of these maps is explained in Section 7.5. In 2019 Florida Marine Blueprint was integrated into the Southeast Blueprint v4.0.

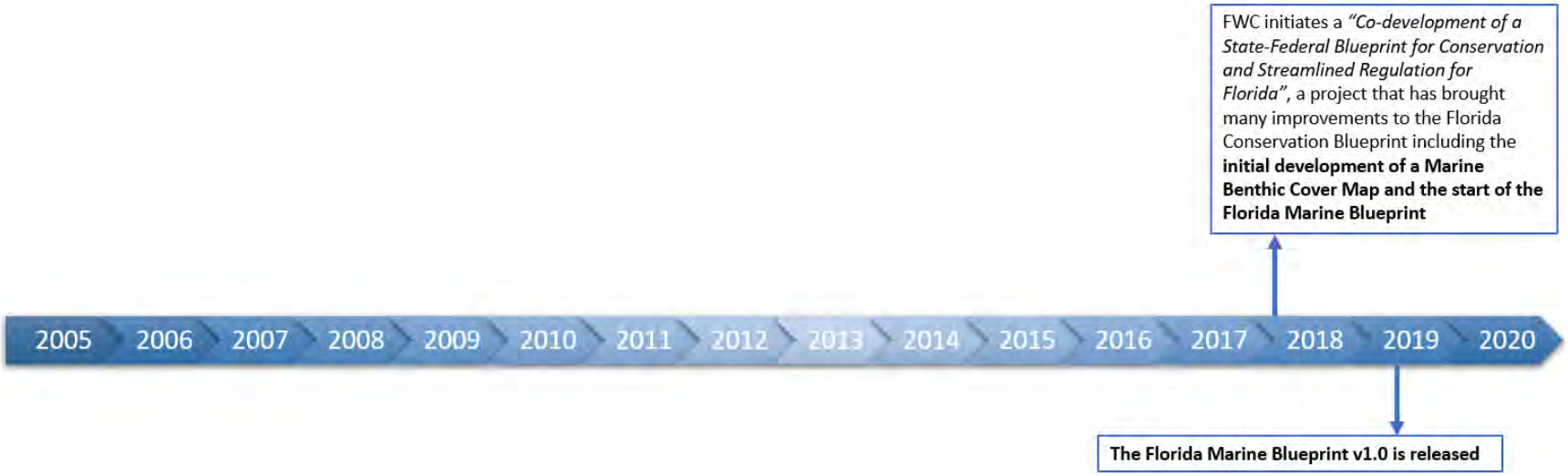


Figure 31. Timeline of the development and governance of the Florida Marine Blueprint

7.3. GEOGRAPHY AND ECOSYSTEM

The outermost boundary of the Florida Marine Blueprint extends to the edge of the EEZ, 200 miles off the coast of Florida and also varies according to areas where jurisdictional boundaries meet with Bermuda, the Bahamas and Cuba. The innermost boundary includes estuarine regions within state boundaries. As such, the EEZ, which is the extent of U.S. management jurisdiction in the marine environment, acknowledges the federally cooperative nature of the Florida Marine Blueprint project as this is the furthest extent to which potential management may extend within the United States. In some places there is a gap between the Florida Marine Blueprint and the Florida Conservation Blueprint listed as NoData, a known issue listed in the Southeast Blueprint v4.0 documentation (Southeast Conservation Adaptation Strategy, 2019a). To classify marine habitats within the Florida Marine Benthic cover map, the Coastal and Marine Ecological Classification Standard (CMECS) was utilized (FGDC, 2012; FWC, 2018). The CMECS is the result of an ongoing collaboration among several organizations including NatureServe, the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (USEPA), the USGS, and the University of Rhode Island. Florida marine ecosystems range from intertidal marine and estuarine habitats (including saltwater marshes and mangrove swamp) to submerged benthic habitats including coral reefs and seagrass beds.

7.4. BLUEPRINT STRUCTURE AND METHODOLOGY

The structure of the Florida Marine Blueprint, while still under development, mirrors the Florida Conservation Blueprint v1.3 by leveraging an underlying habitat data layer (the Marine Benthic Cover Map which is similar to the CLC map for terrestrial areas in Florida), a structure similar to CLIP, and a foundation based on Conservation Assets. The structure of the Marine Benthic Cover Map (discussed below in Section 7.4.2) was developed to mirror the structure of CLC, providing consistent mapping of habitat classes across the marine ecosystem. The configuration of the Florida Marine Blueprint follows a similar approach to that of CLIP, providing a spatial map of habitat priorities based on input data related to biodiversity, habitat, and migratory corridors. In contrast to the Florida Conservation Blueprint, the initial development of the Florida Marine Blueprint focused on documented species occurrence data and potential habitat for important species (e.g., essential fish habitat) rather than focusing on specific habitat types (FWC, 2018).

The Florida Marine Blueprint's final layer of ranked priorities for marine areas is utilized as the Florida marine input to the Southeast Blueprint.

7.4.1. Conservation Assets and Indicators

FWC, working with partners and stakeholders has defined marine/estuarine Conservation Assets. These Conservation Assets were defined by the Peninsula Florida Landscape Conservation Cooperative (PFLCC; original developers of the Florida Conservation Blueprint) as the "set of biological and ecological features and ecological processes important in the current and future landscape" when identified for terrestrial areas, while Indicators are measurable expressions of the health of a Conservation Asset. The current set of Conservation Assets consists of: saltwater marsh, seagrass, mangrove swamp,

coral/hard bottom, and “system-wide” marine/estuarine (FWC, 2018). Two of these Conservation Assets, saltwater marsh and mangrove swamp, are shown in the Florida Conservation Blueprint v1.3, though the ongoing development of Indictors for those Conservation Assets falls within the domain of the Florida Marine Blueprint. The initial set of Indicators for the marine/estuarine Conservation Assets was recently finalized. Indicators can measure the health of each conservation asset and provide a focus for the planning, design, conservation and monitoring trends of those Conservation Assets. For the Marine and estuarine Conservation Assets, FWC worked with a goal to select three to five indicators per Conservation Asset, with one to three measurable metrics per indicator (listed in full in Appendix F).

The Florida Marine Blueprint v1.0, as used in the Southeast Blueprint v4.0, does not represent these Conservation Assets at this time.

7.4.2. Marine Benthic Cover Map

To map the benthic habitats within the boundaries of the EEZ and the State of Florida, FWC utilizes a significant number of data sources including recent state-wide datasets that classified benthic habitats through field observation or aerial imagery (FWC, 2018, Appendix 1A). Thirteen datasets were used in the development of the Marine Benthic Cover Map including datasets of known habitat type occurrences (e.g., coral and hardbottom habitats, estuaries, macroalgae, and worm reef habitats developed by FWC and FWRI). Additional datasets that model benthic habitat suitability through presence point data (e.g., deep coral predictive habitat developed by NOAA) were also incorporated, but only where model output predicted the highest likelihood of habitat suitability. The complete Marine Benthic Mapping protocol is given in Appendix C (Beth Stys FWC, personal communication).

Each habitat unit mapped in this process was provided with an “ecologically descriptive classification” in keeping with the CMECS. To maintain consistency with the CLC map, and to support utilization of the Marine Benthic Cover Map at a variety of scales, each habitat unit was assigned a “State” and a “Site” classification in order to facilitate a crosswalk with existing classification standards: FWC’s Florida Vegetation and Land Cover and the FWC/FNAI CLC land cover types (FWC, 2018). Boundaries were then applied to the Marine Benthic Cover Map to provide an additional classification for habitat units. Boundaries were established to delineate areas within a 30 meter (m) distance of the Florida shoreline as “Nearshore”, while areas > 30 m and <200 m are classified as “Offshore,” and those areas > 200 m to the EEZ as “Oceanic” (FWC, 2018).

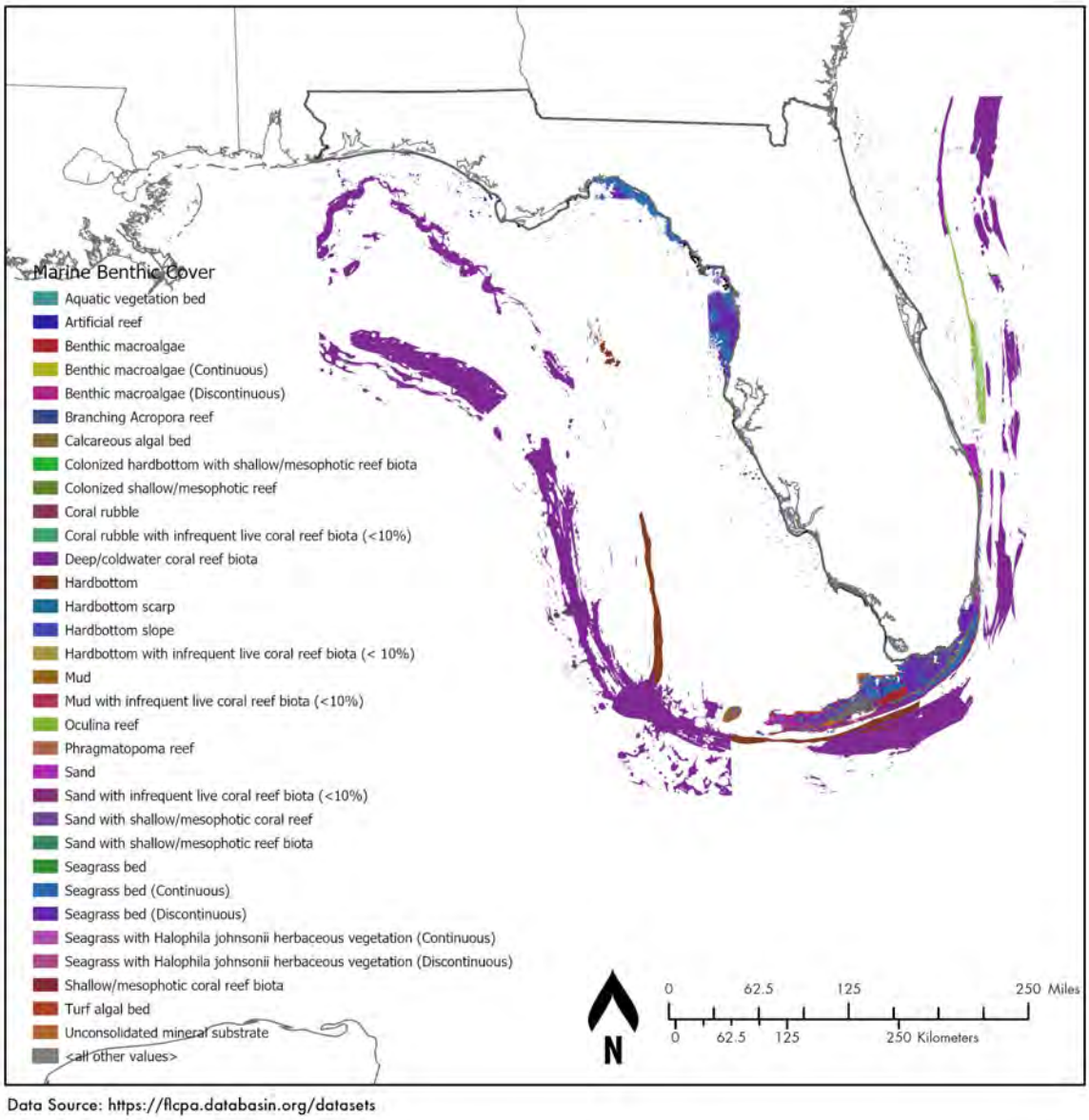


Figure 32. Marine Benthic Cover Map with Site level classification.

7.4.3. Florida Marine Blueprint

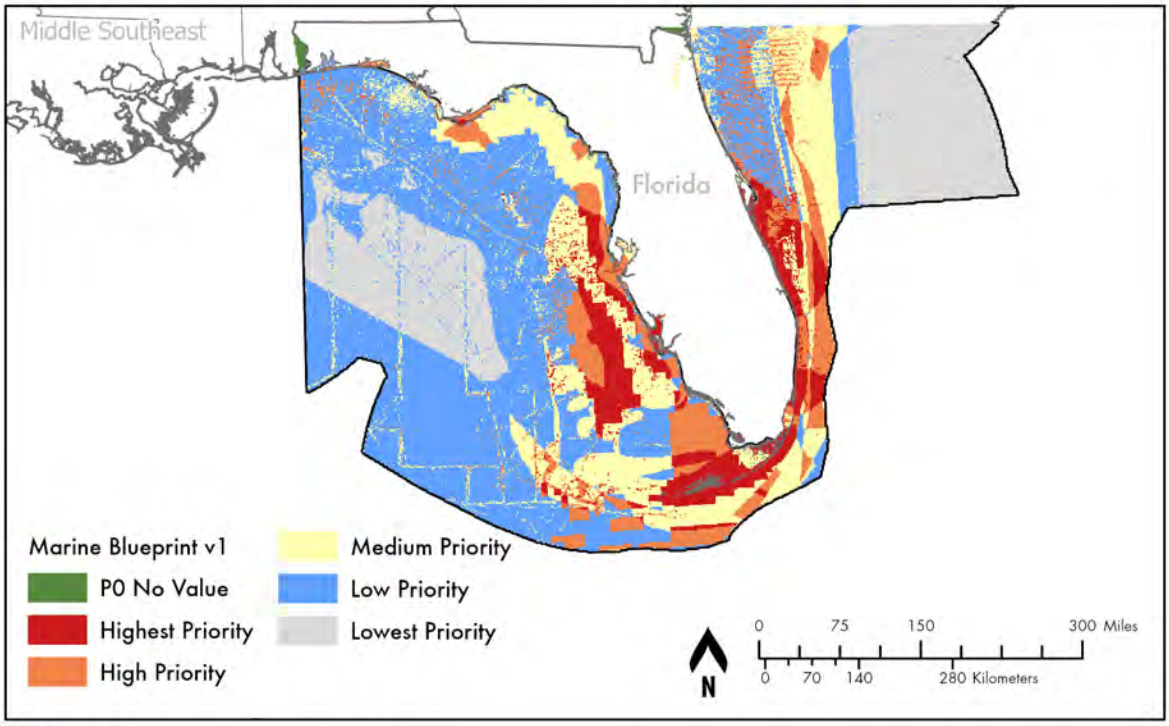
The Florida Marine Blueprint is designed to function similarly to CLIP; across the Florida marine domain, the Florida Marine Blueprint compiles data from a large range of data types and groups them into sublayers related to specific biodiversity and habitat categories. Those categories then serve as a basis for calculating priority rankings for given areas across the marine region based upon the intersections of those sublayers.

In the Florida Marine Blueprint, spatial data layers are grouped into the following categories (descriptions from FWC, 2018):

1. Species Richness: Point location information that addresses values of species diversity based on various nearshore and offshore surveys. Datasets that are included relate to: 1) species considered "protected"; 2) species for which harvest is allowed; and 3) species that contribute to the overall ecological biodiversity of an ecosystem and do not require active management.
2. Valued Habitat: Areas deemed valuable by monitoring agencies (i.e., FWC, National Marine Fisheries Service [NMFS]) based on known or potential use by prioritized species and potential structural benefits of habitats for species (especially critical habitats for fish species of particular concern).
3. Anthropogenic Habitat: Anthropogenic structures that may provide structural habitat for marine species (i.e., pipelines, shipwrecks, railroads, and bridges).
4. Blueways: Migratory corridors, derived from tracking data, of eight commercially important and/or endangered species created by The Nature Conservancy's (TNC) Blueways layer.

For a full list of data inputs for these four categories see Figure 34. For documentation related to integrating data layers and developing prioritization rules see Appendix D, which details the technical GIS processing steps employed to evaluate data layers in the Florida Marine Blueprint.

FWC creates a spatial data layer for each of the above four categories, and priority rankings are then assigned with values between P1 (highest priority) and P5 (lowest priority) based on how these layers intersect. Areas given highest priority (P1) rankings represent the greatest amount of intersection between the four categories.



Data Source: http://secassoutheast.org/blueprint.html

Figure 33. Florida Marine Blueprint v1.0

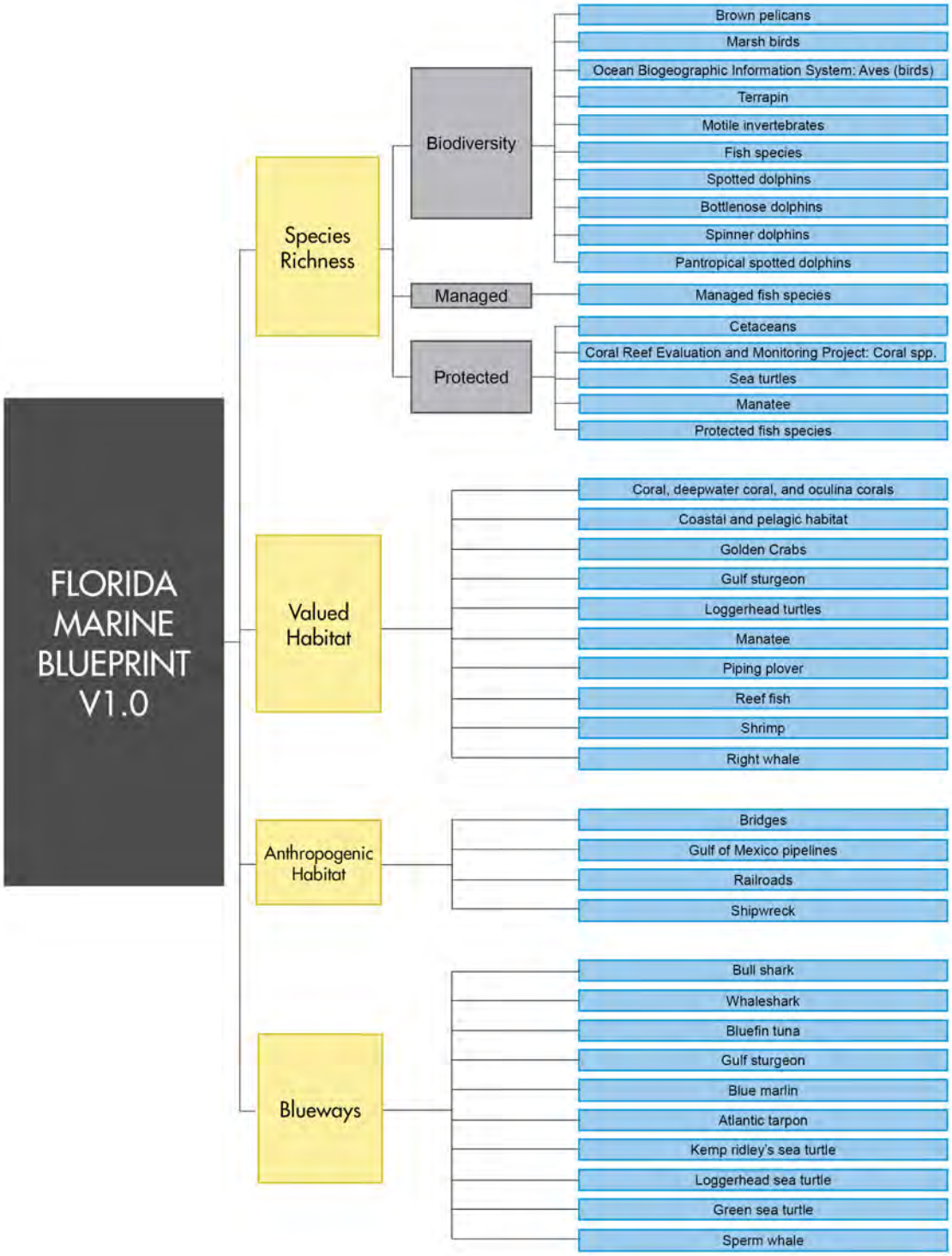
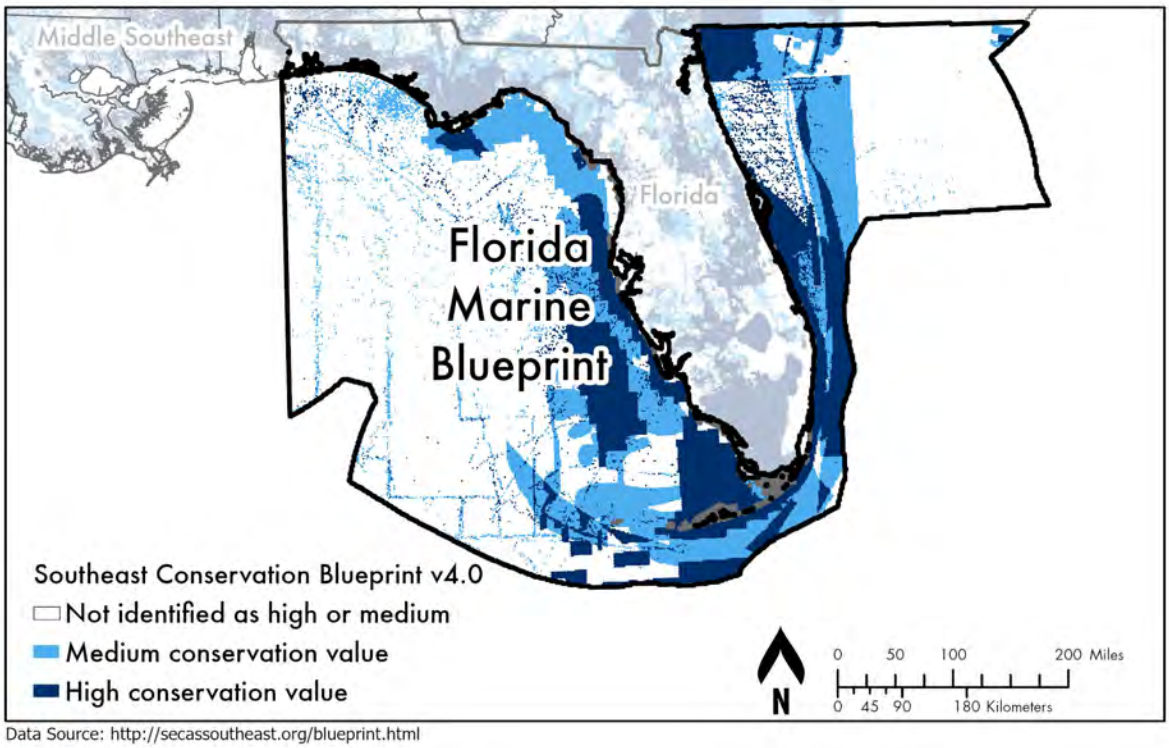


Figure 34. Inputs to the Florida Marine Blueprint v1.0

7.4.4. Integration into the Southeast Conservation Blueprint

Areas identified as "highest" and "high" priority in the Florida Marine Blueprint, those with greatest intersection of valued habitat, species richness, anthropogenic habitat, and blueways, are included as "high conservation value" in the Southeast Blueprint (FWC, 2018). Areas identified as "medium" priority in the Florida Marine Blueprint are shown as "medium" conservation value in the Southeast Blueprint. (FWC, 2018). See Section 2.4 for a summary of how data from this subregion were integrated into the Southeast Blueprint v4.0.



Data Source: http://secassoutheast.org/blueprint.html

Figure 35. The Florida Marine Blueprint v1.0 as used in the Southeast Blueprint v4.0

7.4.5. Schematic Overview of Blueprint Mechanics

Figure 36 provides a simplified overview of how data is integrated and prioritized in the Florida Marine Blueprint v1.0 and utility in the Southeast Blueprint.

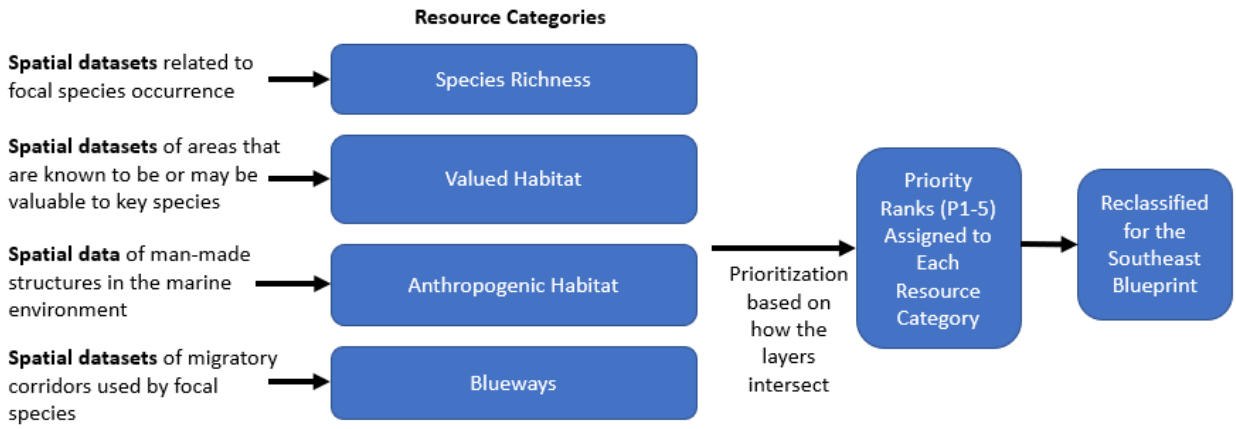


Figure 36. Simplified process schematic of the Florida Marine Blueprint v1.0 and integration into the Southeast Blueprint.

7.5. ONGOING MONITORING AND DEVELOPMENT

The Marine Benthic Cover Map and the Florida Marine Blueprint are currently in v1.0 and ongoing development of both components is anticipated. For the Marine Benthic Cover Map, FWC notes that "while the current Marine Benthic Cover Map and its classifications are extensive, this map will serve as a starting point for representing the extent of Florida's marine ecosystems. As more of the marine habitat is researched and reclassified, the Marine Benthic Cover Map will be altered to reflect these changes in habitat extent and classification" (FWC, 2018). Additionally, analysis of the metrics that are used for indicators is currently being conducted to assess the health of both indicators and their corresponding Conservation Assets. Once indicators work is finished, the Florida Marine Blueprint will receive an update in the form of detailed spatial modelling and interpolation of previously used, though updated, and new datasets. This second iteration will help address the "rough edges" present in the current version. Some examples include species occurrence and richness modelling, water quality data as well as potentially including fishing effort or fishery valued areas utilizing data from Global Fishing Watch.

7.6. KEY CONTACTS AND RESOURCES

Contacts:

- Beth Stys, Associate Research Scientist, FWC, Fish and Wildlife Research Institute: beth.stys@MyFWC.com
- Anthony Gillis, Fish and Wildlife Biological Scientist III, FWC, Fish and Wildlife Research Institute: Anthony.Gillis@myfwc.com

Resources:

Florida CPA
Florida Marine Blueprint v1.0
Florida Marine Benthic Cover Map

8.0 Recommendations and Future Needs

To support SECAS in reaching their 2060 goal of increasing the health, function, and connectivity of ecosystems by 10 percent, use of the Southeast Blueprint by multiple planning mechanisms at the federal, state, and local scales will be needed. Over the next 15 years in the northern Gulf of Mexico, the largest source of restoration funding is expected to be through Deepwater Horizon (DWH) fines, penalties, and settlement entities. A major focus of this restoration funding is large-scale ecosystem and habitat restoration efforts which presents an opportunity for engagement with, and use of, the Southeast Blueprint to inform these management and restoration planning and prioritization processes.

However, the spatial scale of these restoration efforts in the northern Gulf coast highlights a concern that the different methodologies used by each subregion may limit direct use of the Southeast Blueprint, as the conservation priorities of each subregional blueprint used within the Southeast Blueprint are not directly comparable. As has been noted since the first SECAS Symposium in 2015, the central themes of the different subregional blueprints are common and drive towards the same measures of success, but use different data, targets, metrics or priority resources (Morris, 2015). The current opportunity is to focus on the common themes and measures of success to develop an example blueprint that has unified data and analytical approaches at a spatial scale larger than one subregion, for example the northern Gulf of Mexico.

> **Recommendation 1:** Develop an example cross regional blueprint for the northern Gulf of Mexico that is consistent with the aims and goals of all spatially relevant subregional blueprints and uses one consistent set of metrics and analysis approach. This blueprint would facilitate engagement of the Southeast Blueprint in conservation and restoration planning processes that cover the northern Gulf of Mexico.

There is ongoing and increasing recognition of large-scale landscape change as a result of not only local stressors, such as development or transition of forest or wetland to agricultural land, but also of large-scale changes such as changes to rainfall and temperature patterns, storm intensity, and rising sea level. One consequence of this in terms of land management is an increased focus on resilience of human communities to impacts such as flooding, land loss, and drought. This focus results in the development of projects that serve to directly protect and, increasingly, to recognize that habitat, ecosystem, or nature-based approaches can be cost-effective and provide additional benefits such as support to other flora and fauna resources, with additional benefits to those vulnerable communities.

The latter category of nature-based projects, which includes projects such as those conducted under USACE's Engineering with Nature initiative, comprise a large investment in habitat and landscape-scale restoration that has the potential to be synergistic with ongoing land conservation projects to increase intactness of natural resources. To maximize the benefits of restoration while accounting for the high cost of data acquisition, restoration managers and planners could use synthetic data, such as the Southeast Blueprint, to inform the relative value of restoration actions in different geographic locations for supporting priority natural resources. To assist in facilitating this utility of the Southeast Blueprint, a

conscious effort to be inclusive of habitat and ecosystem restoration as well as conservation would be beneficial.

> **Recommendation 2:** Communicate the utility of the Southeast Blueprint for restoration projects to increase utilization of the Southeast Blueprint in management prioritization and planning. Previously the Southeast Blueprint has been used largely in conservation planning, but there are presently large investment mechanisms for landscape scale restoration for which the Southeast Blueprint has additional utility. In the northern Gulf of Mexico there are significant landscape scale restoration efforts underway as a result of the settlement for DWH. Most of those restoration projects are habitat-based with explicit goals of benefiting multiple natural resource types injured by the DWH event, including avian fauna.

> **Recommendation 3:** Compile social data of human community resilience and vulnerability to directly overlay on the Southeast Blueprint. This effort would serve to increase utility of the Southeast Blueprint and provide an opportunity for utilization in identifying conservation and natural resource co-benefits from projects with a primary human community protection or resilience goal. Because policy and planning processes frequently focus on the needs of and opportunities for human communities, this recommendation will increase the potential for the blueprint to be utilized in decision-making processes.

> **Recommendation 4:** Continue to develop synthesis of data related to threats to potential conservation or restoration efforts. This would inform project and program planners with a high-level indication of project success, as well as provide context of a project footprint's surrounding area. This is especially relevant if aiming to identify areas valuable for restoration in addition to conservation (Recommendation 2).

In conclusion, the current process of compiling subregional analysis, engagement, and prioritization into an overall Southeast Blueprint provides an important governance engagement process that is highly valuable for informing conservation and land management decisions at moderate spatial scales. Programmatic, planning, and funding mechanisms that have spatial extents that cover more than one subregion currently have limited ability to utilize the Southeast Blueprint or engage with SECAS. This opportunity for engagement would be greatly enhanced if an additional step were added to 1) generate blueprints at relevant spatial scales (for example the northern Gulf of Mexico coastal region); 2) utilize uniform input data and analytical approaches; 3) facilitate comparisons with human community vulnerability; and 4) integrate key indicators of current and future potential ecosystem threats. An active engagement with funding mechanisms for habitat and landscape restoration, in addition to habitat and landscape conservation, has potential to increase overall natural resource intactness and assist SECAS is achieving their goal.

Table 9. Summary of specific technical needs for the Southeast Blueprint and the subregional blueprints detailed in this report.

Blueprint	Technical Needs
Southeast Blueprint	For planning purposes at the local level, the Southeast Blueprint v4.0 companion guide currently directs planners to existing subregional technical documentation. Providing links to the most up-to-date technical documentation underpinning subregional blueprints is important for planners to better understand what data and priorities are informing the prioritized conservation areas.
	The Hubs and Corridors layer that provides information on connectivity currently only extends to the spatial extent of the Florida Blueprint, the South Atlantic Blueprint, and the Appalachian Blueprint. Data availability is noted as the limiting factor in fully extending this layer to the full Southeast Blueprint spatial extent.
	Development of a Threat Assessment for the Southeast Blueprint is ongoing, with plans to incorporate additional layers and visualization tools into the Southeast Blueprint CPA
Texas CHAT	WAFWA maintains the overall CHAT, but documentation suggests that individual states are expected to update their datasets 'regularly' with their own frequency. The most recent update by Texas to the region-wide CHAT occurred in July 2018.
Middle Southeast Blueprint	Currently coordinated by USFWS, a small-scale update is expected in 2020 with a more significant update for FY 2021 that will improve habitat mapping along the Gulf Coast.
South Atlantic Blueprint	The next blueprint update is expected in Fall 2021 with future plans of incorporating sea-level rise and urbanization threats.
Florida Blueprint	Ongoing development to identify current and future threats (e.g., land use change, development, sea level rise) for inclusion in the Florida Blueprint.
	Indicator refinement and development of Conservation Asset metrics is ongoing ahead of the release of the next Florida Blueprint (v1.4).
Florida Marine	The Marine Benthic Cover Map and the Florida Marine Blueprint are currently in v1.0 and development on both is ongoing.
	Indicator and Conservation Asset metric refinement is ongoing for the Florida Marine Blueprint ahead of the next Florida Marine Blueprint iteration.

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Appendices

APPENDIX A

Ecosystem habitat classifications for each Gulf state. Habitat classifications are derived from NatureServe/USNVC Classification Scheme, with the lowest level of classification detail at the Formation level.

Code	Class	Subclass	Formation	Florida	Alabama	Mississippi	Louisiana	Texas
1.A.1	Forest & Woodland	Tropical Forest & Woodland	Tropical Dry Forest & Woodland					
1.A.2			Tropical Lowland Humid Forest					
1.A.3			Tropical Montaine Humid Forest					
1.A.4			Tropical Flooded & Swamp Forest					
1.A.5			Mangrove					
1.B.1		Temperate & Boreal Forest & Woodland	Warm Temperate Forest & Woodland					
1.B.2			Cool Temperate Forest & Woodland					
1.B.3			Temperate Flooded & Swamp Forest					
1.B.4			Boreal Forest & Woodland					
1.B.5			Boreal Flooded & Swamp Forest					
2.A.1	Shrub & Herb Vegetation	Tropical Grassland, Savanna & Shrubland	Tropical Lowland Grassland, Savanna & Shrubland					
2.A.2			Tropical Montaine Grassland & Shrubland					
2.A.3			Tropical Scrub & Herb Coastal Vegetation					
2.B.1		Temperate & Boreal Grassland & Shrubland	Mediterranean Scrub & Grassland					
2.B.2			Temperate Grassland & Shrubland					
2.B.3			Boreal Grassland & Shrubland					
2.B.4			Temperate to Polar Scrub & Herb Coastal Vegetation					
2.C.1		Shrub & Herb Wetland	Tropical Bog & Fen					
2.C.2			Temperate to Polar Bog & Fen					
2.C.3			Tropical Freshwater Marsh, Wet Meadow & Shrubland					
2.C.4			Temperate to Polar Freshwater Marsh,					

			Wet Meadow & Shrubland					
2.C.5			Salt Marsh					
3.A.1	Desert & Semi-Desert	Warm Desert & Semi-Desert Woodland, Scrub & Grassland	Tropical Thorn Woodland					
3.A.2			Warm Desert & Semi-Desert Scrub & Grassland					
3.B.1			Cool Semi-Desert Scrub & Grassland					
4.A.1	Polar & High Montaine Scrub, Grassland & Barrens	Tropical High Montane Scrub & Grassland	Tropical High Montaine Scrub & Grassland					
4.B.1		Temperate to Polar Alpine Tundra	Temperate & Boreal Alpine Tundra					
4.B.2			Polar Tundra & Barrens					
5.A.2	Aquatic Vegetation	Saltwater Aquatic Vegetation	Benthic Macroalgae Saltwater Vegetation					
5.A.3			Benthic Vascular Saltwater Vegetation					
5.B.1		Freshwater Aquatic Vegetation	Tropical Freshwater Aquatic Vegetation					
5.B.2			Temperate to Polar Freshwater Aquatic Vegetation					
6.A.1	Open Rock Vegetation	Tropical Open Rock Vegetation	Tropical Cliff, Scree & Other Rock Vegetation					
6.B.1		Temperate & Boreal Open Rock Vegetation	Temperate & Boreal Cliff, Scree & Other Rock Vegetation					

APPENDIX B

Habitat Condition Index ruleset figures derived from the GCPO LCC Blueprint v1.0 (2017).

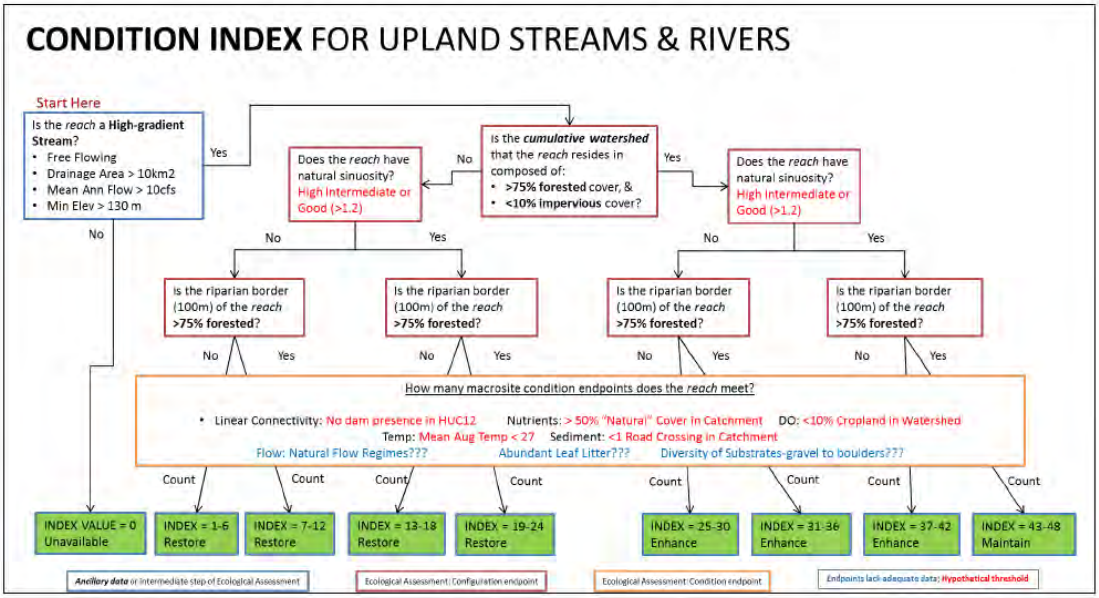

Figure 1. Decision Rule Set for assessing the current condition of the Upland Streams & Rivers habitat system (i.e. broadly defined habitat). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Endpoints related to Configuration. Metrics in orange boxes are Endpoints related to Condition. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values. Red font indicates hypothetical thresholds used for mapping.

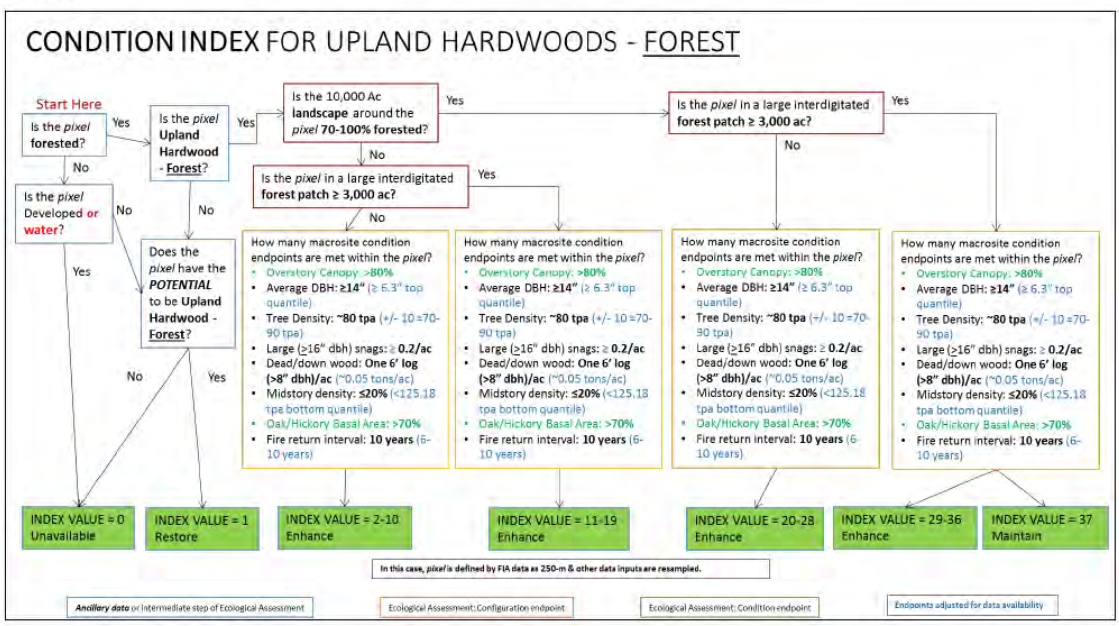

Figure 1. Decision Rule Set for assessing the current condition of the Upland Hardwoods (Forest) habitat system (i.e. broadly defined habitat or BDH). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Landscape Endpoints related to Configuration. Metrics in orange boxes are Landscape Endpoints related to Condition. Green font indicates variables with higher weight due to data quality. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values.

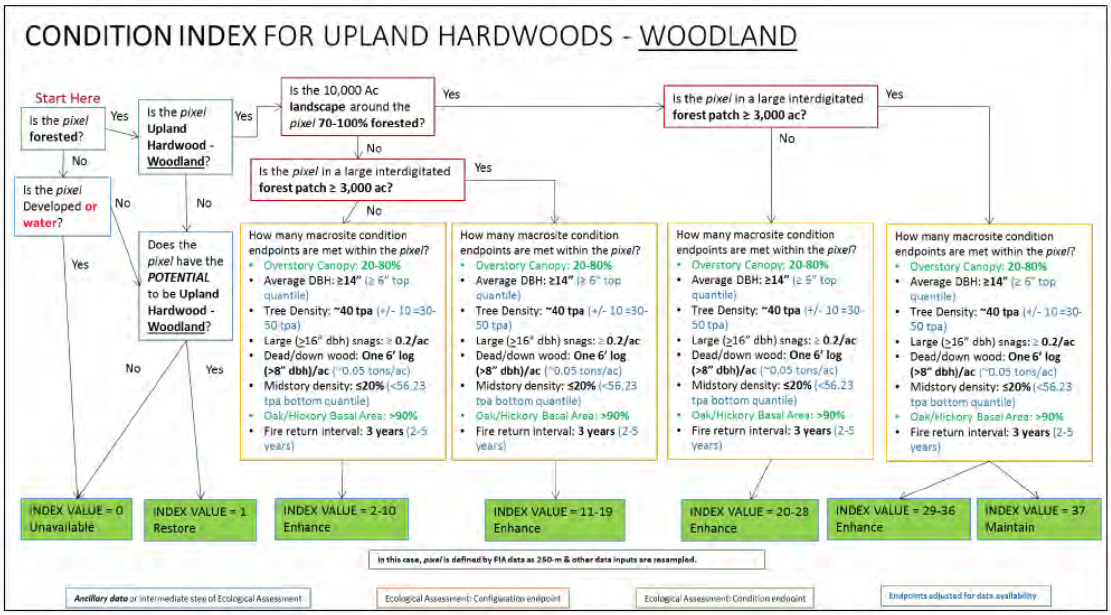

Figure 1. Decision Rule Set for assessing the current condition of the Upland Hardwoods (Woodland) habitat system (i.e. broadly defined habitat or BDH). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Landscape Endpoints related to Configuration. Metrics in orange boxes are Landscape Endpoints related to Condition. Green font indicates variables with higher weight due to data quality. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values.

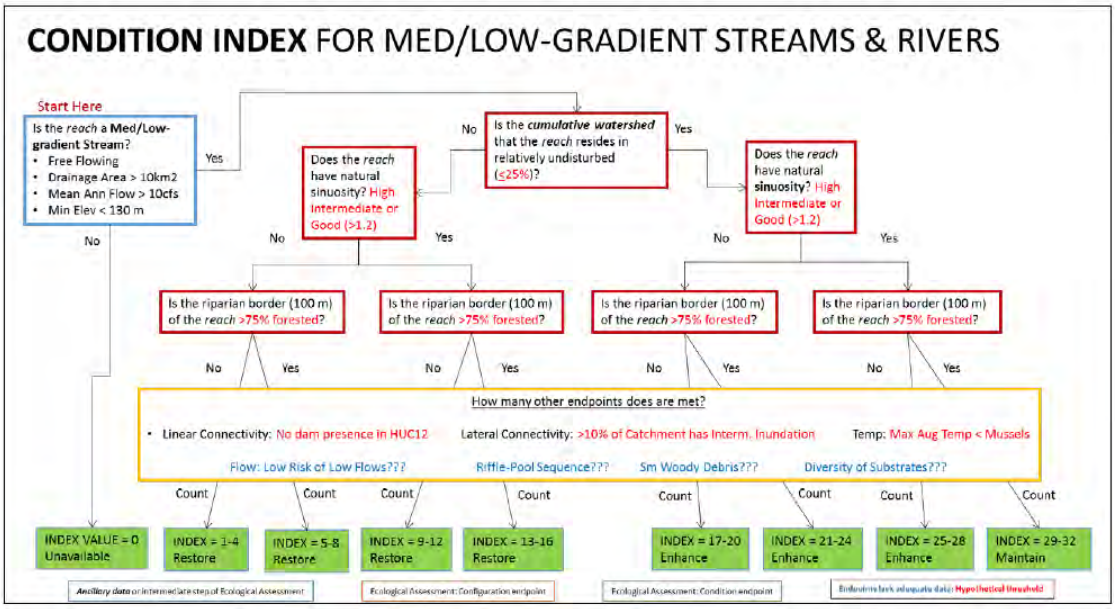

Figure 1. Decision Rule Set for assessing the current condition of the Med/Low-gradient Streams & Rivers habitat system (i.e. broadly defined habitat). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Endpoints related to Configuration. Metrics in orange boxes are Endpoints related to Condition. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values. Red font indicates hypothetical thresholds used for mapping.

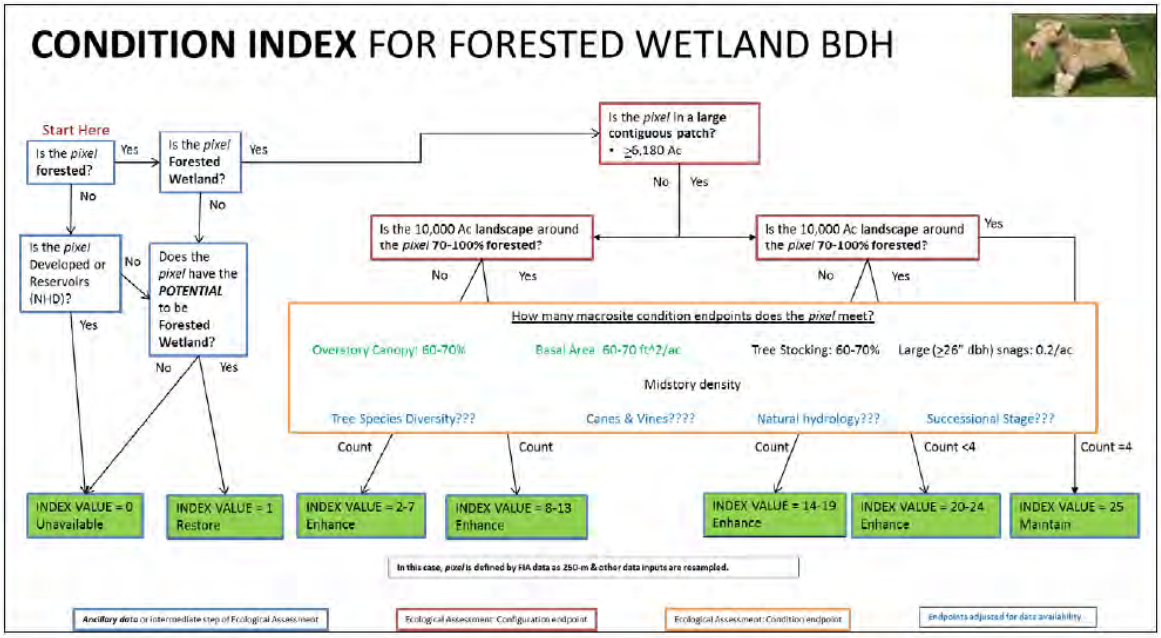

Figure 1. Decision Rule Set for assessing the current condition of the Forested Wetlands habitat system (i.e. broadly defined habitat or BDH). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Landscape Endpoints related to Configuration. Metrics in orange boxes are Landscape Endpoints related to Condition. Green font indicates variables with higher weight due to data quality. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values.

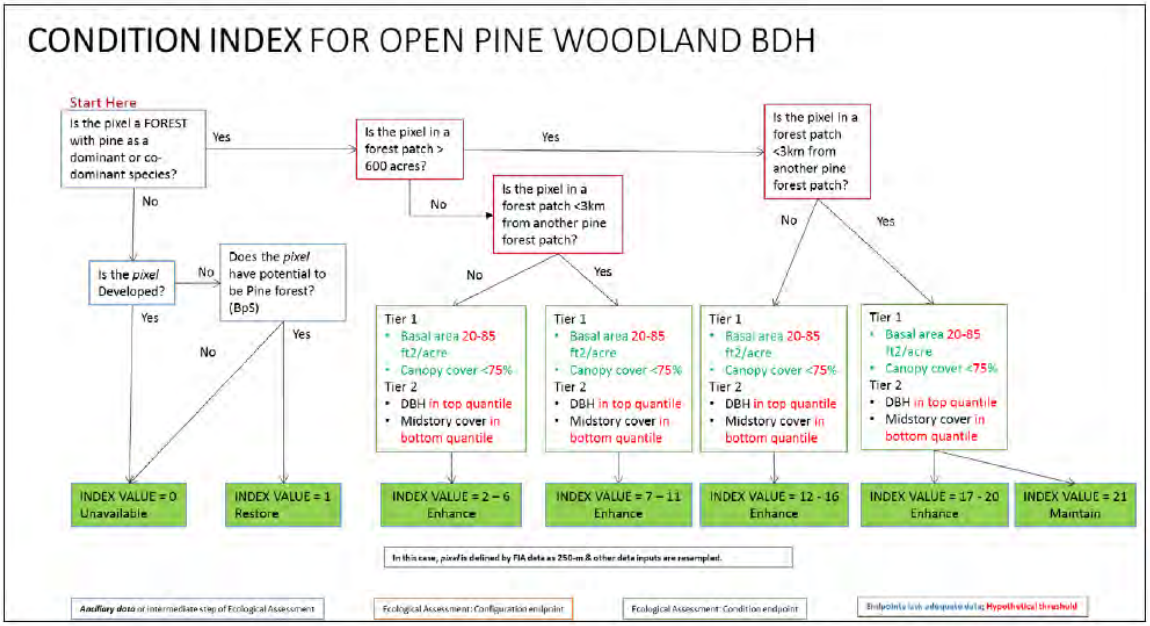

Figure 1. Decision Rule Set for assessing the current condition of the Open Pine habitat system (i.e. broadly defined habitat). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Landscape Endpoints related to Configuration. Metrics in orange boxes are Landscape Endpoints related to Condition. Green font indicates variables with higher weight due to data quality. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values.

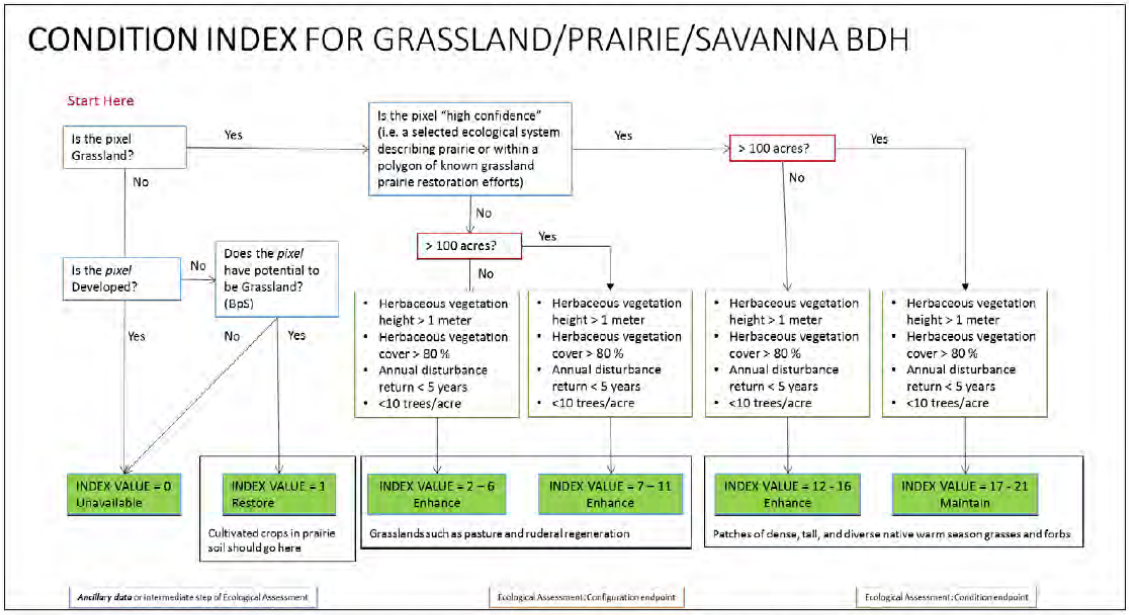

Figure 1. Decision Rule Set for assessing the current condition of the Grasslands habitat system (i.e. broadly defined habitat or BDH). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Landscape Endpoints related to Configuration. Metrics in orange boxes are Landscape Endpoints related to Condition. Green font indicates variables with higher weight due to data quality. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values.

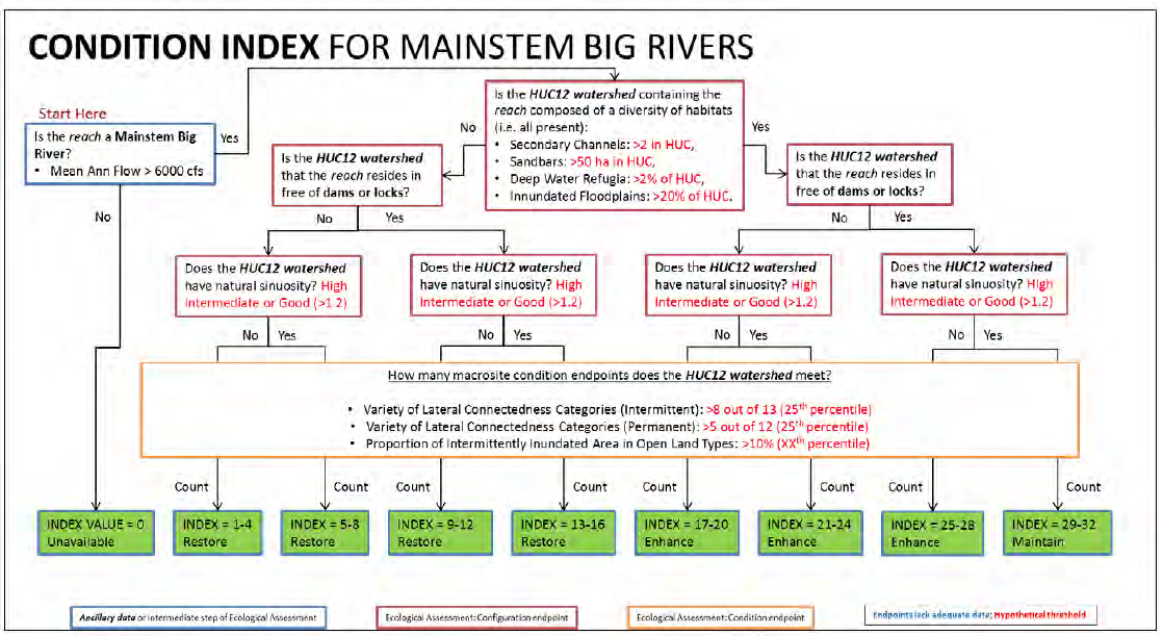

Figure 1. Decision Rule Set for assessing the current condition of the Mainstem Big Rivers habitat system (i.e. broadly defined habitat). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Endpoints related to Configuration. Metrics in orange boxes are Endpoints related to Condition. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values. Red font indicates hypothetical thresholds used for mapping.

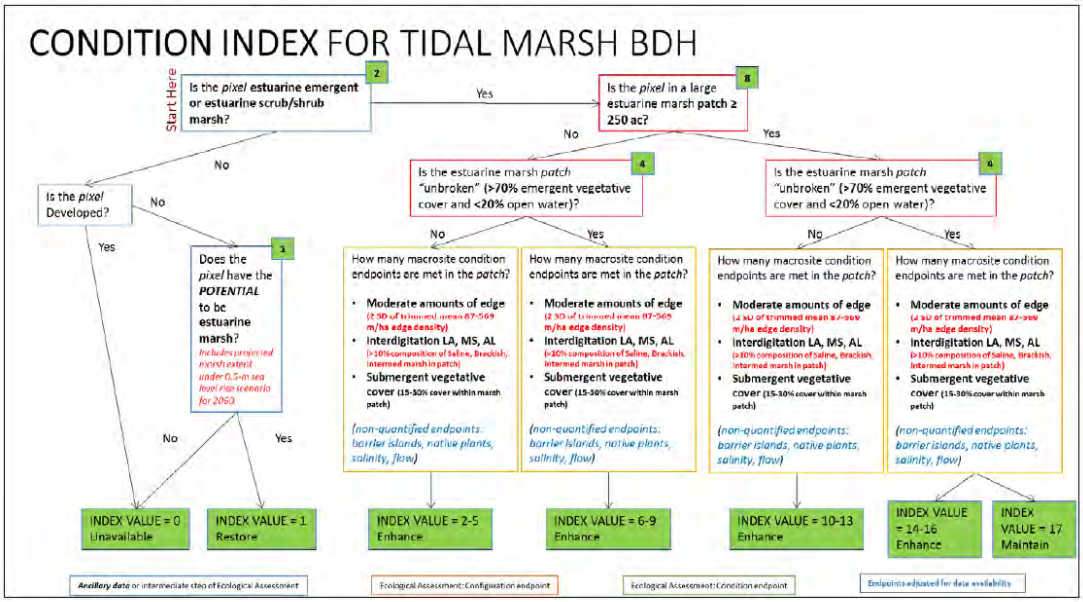

Figure 1. Decision Rule Set for assessing the current condition of the Tidal Marsh habitat system (i.e. broadly defined habitat or BDH). Blue boxes indicate ancillary data or intermediate steps for the Ecological Assessment. Metrics in red boxes are Landscape Endpoints related to Configuration. Metrics in orange boxes are Landscape Endpoints related to Condition. Green font indicates variables with higher weight due to data quality. Blue font indicates Endpoints listed in the Integrated Science Agenda not currently incorporated into the Index due to lack of sufficient data or adequate threshold values.

APPENDIX C

GIS protocol for joining datasets for the Marine Benthic habitat map utilized in the Florida Marine Blueprint v1.0. Information was derived from personal communications with FWC (personal communication with Beth Stys, 2020).

1. *Project* all layers into "FDEP Alber HARN" coordinate system
    a. This is the coordinate system of the terrestrial CLC map
2. Create polygons of 30- and 200-meter depths and National EEZ
    a. Use bathymetry layer to draw new polygon at each depth
3. < 30 m delineates near (in-) shore habitats
    a. > 30 and < 200 m delineate offshore habitats
    b. > 200 m to EEZ delineates oceanic habitats
4. Use *Intersect* of EEZ boundary layer (see previous step) with following habitat shapefile
    a. Removes data and polygons outside the bounds of this cooperative project
    b. Raw data files used (agency)
        i. Seagrass (FWC)
        ii. Halophila johnsonii seagrass
        iii. Macroalgae (FWC)
        iv. Coral and Hardbottom (FWC)
        v. SAMBA Hardbottom (TNC)
        vi. Worm Reefs (FWRI/TNC)
        vii. Florida Unified Reef Tract (FWC)
        viii. Artificial Reefs (FWC)
        ix. Coral Habitat Suitability Modelling Very High (NOAA)
            1. Individuals species layers:
                a. Gulf of Mexico:
                i. Feature Dataset: NOAACoralGOM
                b. Southeast U.S.
                i. Feature Dataset: NOAACoralSeUS
5. *Erase* Florida Shapefile with Florida estuaries shapefile
    a. Some seagrass was on "land" and estuaries file helped place this
6. Unified Reef Tract (4.b.viii.), SAMBA Hardbottom (4.b.vi.) and Coral Hardbottom (4.b.v.) files parsed into separate layers based on desired classification in attribute fields
    a. Polygons were selected and *Exported* as follows (Layer/Att. Field):
        i. Coral Hardbottom/DESC:
            1. "Coral"
            2. "Hardbottom"
            3. "Hardbottom with seagrass"
        ii. SAMBA/CONF_ZONE
            1. "Very high confidence of hardbottom"
            2. "High confidence Oculina Reef"
            3. "High confidence of hardbottom w/ pts.w/in 1 km"
            4. "High confidence hardbottom w/ >= 3 pts w/in 3.14 km^2 circle"
        iii. Unified Reef Tract/ClassLv0
            1. "Coral and hardbottom"
            2. "Unconsolidated sediment"
            3. "Seagrass"

7. Full Unified Reef Tract layer (3.b.vii.) used to *Erase* all other layers (3.b.)
    a. Dataset came from highly reputable FWC source, is recent and highly detailed
8. Unified Reef Tract seagrass layer (5.a.iii.3.a) was *Merged* with FWC seagrass polygon (3.b.i.)
9. Halophila johnsonii (3.b.ii.) *Intersected* and *Merged* with full seagrass layer (7.)
10. For artificial reef point file (3.b.viii.)
    a. Nearest neighbor calculation run (mean = 500 m, z = -100, p = 0.00000001)
    b. A 500 m *Buffer* and polygon file created to "connect" potential artificial reef complexes
    c. All *Intersecting* polygons were *dissolved* into each other
11. Attribute tables *exported* in order to reclassify to CMECS hierarchical classification scheme including
    a. Biotic Component
        i. Setting, Class, Subclass, Group, Community and Modifier
    b. Geoform Component
        i. Origin, Geoform, Geoform type
    c. Substrate component
        i. Origin, Class, Subclass, Group, Modifier
    d. CLC classification
        i. State, Site, Modifier, Subsystem (i.e., nearshore, offshore, oceanic)
    e. Some components (10.a.-c.) will be removed in final product
12. All attributes filled in with as much of source field attribute information.
13. State, Site, Modifier, and subsystem will used for CLC use and potential integration
    a. Component priorities were as follows:
        i. Biotic
        ii. Substrate
        iii. Geoform
    b. All rock, pavement and calcium carbonate classified as "Hardbottom"
    c. Most detailed component placed in Site and second most in State
    d. If Subclass (Biotic & Substrate) and Geoform is most detailed, classification is placed into both, State and Site CLC classification
    e. Modifiers "Continuous" and "Discontinuous" only ones kept and applied only to "Seagrass" and "Macroalgae" classifications
14. New tables and columns attached to attribute tables using spatial joins and new layers exported
15. Hierarchy for layer importance created to prioritize habitats where they overlap.
16. Lower-level layers *Erased* to higher level layers
17. All layers *Merged*
    a. Attribute fields were all parsed down to CLC State, Site, Modifiers and Subsystem fields
18. *Repair Geometry* on all Marine CLC (16.)
19. *Create Topology*, add feature and rules to enforce Topology
    a. Topology cluster tolerance = 0.5 m
    b. Rules = "Must not overlap"
20. Fix Errors by *Merging* and *Dissolving* all errors that do not follow rules
21. *Intersect* Marine CLC (16.) with 30 m polygon (2.b.)
    a. Classify polygons as "Inshore" in Subsystem attribute field
22. *Enforce Topology* and fix errors
23. *Repair Geometry*
24. *Intersect* Marine CLC (16.) with 200 m polygon (2.c.)
    a. Classify polygons as "Offshore" in Subsystem attribute field
25. *Enforce Topology* and fix errors

26. *Repair Geometry*
27. *Erase* Marine CLC (16.) with 200 m polygon (2.c.)
    a. Classify polygons as “Oceanic” in Subsystem attribute field
28. *Enforce Topology* and fix errors
29. *Repair Geometry*
30. *Merge* all layers
31. *Enforce Topology* and fix errors
32. *Repair Geometry*
33. Carry out *Eliminate* to remove polygons that would be lost to rasterization
    a. Select all polygons that are less than or equal to 110 m^2
    b. Polygons were then dissolved into neighboring polygons with largest area
34. *Repair Geometry*
35. NOAA Coral Habitat suitability added to Marine CLC
    a. From each species layer, polygons were selected if “Gridcode” attribute field was 10.
        i. “Gridcode” = 10 (Very high likelihood of coral species inhabiting that area
    b. All species layers *Intersected* with FLEEZ (2.d.)
        i. Individual Species Layers saved by region
    c. All layer *Merged* by region
    d. Gulf of Mexico and Southeastern U.S. layers were *Merged* for all of Florida
36. *Reclassify* NOAA Deepwater Coral data
    a. STATE = Deep/coldwater coral reef biota
    b. SITE = Deep/coldwater coral reef
37. Run *Dissolve* with STATE and SITE within NOAA Deepwater coral data set
    a. *Enforcing topology* would be too time consuming
    b. Classification is as detailed as can be for dataset
    c. Make sure “Create multipart features” is unchecked
38. *Extract* Artificial reefs from Marine CLC and *Erase* deepwater data set with it
    a. Artificial reefs are confirmed where NOAA corals are modelled
39. *Erase* Marine CLC with Deepwater Coral dataset
    a. This will cause NOAA dataset to remove and fill SAMBA and Coral hardbottom polygons that are modelled on older data and are less detailed/informative
40. *Merge* Deepwater coral and Marine CLC (16.)
41. *Enforce Topology*
    a. Fix errors
42. *Repair Geometry*
43. *Dissolve* Marine CLC by STATE, Site, Modifier and Subsystems to remove “hard edges” of similarly classified or “nested” polygons are removed
    a. Uncheck “Create multipart features”
44. *Repair Geometry*
45. Final file to be cleaned to fit with Terrestrial CLC

APPENDIX D

GIS protocol for unifying and scoring datasets for the Florida Marine Blueprint v1.0.

1. MDAT Cetaceans Abundance layer
   a. From original source these layers are at 10 km cell size and can be converted using the following equation:
      - $CV = \frac{RV}{100} \times 2$
   - Where the converted raster value (*CV*) is equal to the original raster value (*RV*) divided by 100 (giving abundance at a 1 km^2 scale) and transformed to 2 km^2 by multiplying by 2
     - *Original equation (sans multiplication) found in the metadata read-me
   b. Raster were then reclassified to cells with CVs ≤ 0.99 set to 0 and CVs ≥ 1 set to one. This system ensured there was at least one potential observation with a 2 km^2 cell and allows this data to be seen as presence-absence data in each cell
   c. *Reclassified* layer was the exported and cell size was transformed to the desired 2 km^2 size
   - File:
   d. Species utilized here include:
      i. Spotted dolphins in the Gulf of Mexico (\GoMspotd2km)
      ii. Bottlenose dolphins from Gulf of Mexico and the Atlantic coast (\fleezbotld2km)
         1. This layer was created from separate ec and gom files using Mosaic to New Raster tool in ArcGIS. Mosaic operation was set to SUM, though there was not overlap in presence cells
      iii. Spinner dolphins in the Gulf of Mexico (\GoMspind2km)
      iv. Pantropical spotted dolphins in the Gulf of Mexico (\GoMpspotd2km)
         - *Other species were excluded as result of having values below 1 after transformation
   e. All layers (1.d.i-iv.) were then clipped using the Florida EEZ (FLEEZ) layers in the MarineBenthosCover geodatabase.
2. FIM Offshore/Inshore, Middle Florida Keys Seine, Nearshore Keys fish and inverts data
   a. Middle and Nearshore Key data preparation
      i. Relationships were established between two table and point shapefile
      ii. To tie species data to point data (Lat. And Lon.) must be joined using the following:
         1. In ArcGIS, Conduct a *Join* with the "larger" dataset tables:
            a. FLKeys_NearshoreSurveys_Fish
            b. FLKeys_NearshoreSurveys_Lobster
            c. FLKeys_NearshoreSurveys_MotileInverts
            d. FLKeys_NearshoreSurveys_SessileInverts
            e. MiddleKeys_SeineSurveys_Samples
         2. Select *Field* to Join By (i.e., Survey or SurveyID)
         3. *Join table* is the "smaller" tables:
            a. FLKeys_Nearshore_Surveys
            b. MiddleKeys_SeineSurveys_SampleLocs
         4. Nearshore data needs one more *Join* to the point data, where Middle Key data is done:
            a. Select input dataset (i.e., Fish, Motile inverts, Sessile Inverts and Lobsters)
            b. Field to Join by is SITE

        c. Join table:
            i. FLKeys_NearshoreSurveys_2002_2007_pnt.shp
    iii. Shapefiles were created for each by *adding XY* data in table of content right-click menu to each created table
b. FIM Offshore/Inshore, Nearshore and Middle Keys location data was parsed and separated out and classified into three different layers
    i. Biodiversity
        1. Species that are not considered endangered or in need of protection from harvest or detrimental activities to the population
    ii. Managed
        1. Species that are considered valued to humans, either recreationally or commercially, and have creel and size limits for population management applied to them by Federal or State agencies
    iii. Protected
        1. Species considered endangered and in need of protection from harvest or other detrimental activities to the population
c. The FIM Offshore/Inshore, Nearshore, and Middle Keys locations were then combined by the classification in the previous step.

3. Species Richness fishnet for point location data
    a. Use *Create Fishnet* tool on the FLEEZ for template extent
        i. *Origin coordinate* will populate automatically
        ii. Set *cell width* and *height* to 2000
            1. Make sure it is in FDEP Albers HARN projection to be sure meters is base measurement
        iii. Set *numbers of rows* and *columns* to 0
            1. These will populate automatically once tool is run
        iv. Uncheck "Create Label Points"
        v. Set *Geometry Type* to Polygon
        vi. Run tool
            - *This will create a fishnet for the full rectangular extent of the EEZ polygon.
    b. *Intersect* FLEEZ with newly created fishnet
    c. *Erase* FLBaseline with FLEEZ fishnet (result of step 3.b.)
    d. Ensure there is a column with individual cell IDs in the final fishnet (result of 3.c.). If not, create a new column and will it in
    e. *Project* species point files to FDEP Albers HARN
    - *Make sure species point files
    f. Conduct a *Spatial Join* with species point file as *Target Feature* and final fishnet (3.d.)
    - *This assigns the Fishnet IDs to individual points within the cells
    g. Use *Delete Identical*, selecting Fishnet IDs and Species fields, to remove points with similar Fishnet IDs AND Species names
        - *This will one point with a unique species name and Fishnet ID in the cell
    h. Conduct *Summary Statistics* on point file (3.g.i.)
        i. Set Species name to *Statistics Field(s)* with COUNT in the Statistics Type
        ii. Set Fishnet ID to *Case field*

- *Creates a table with a count of unique species in each cell that points intersect with the fishnet (i.e., cell with no points will not be included)

i. Carry out tabular *Join* of summary table (3.h.) to Fishnet (3.d.) selecting Fishnet ID as *join* field
j. *Export* Fishnet (3.d.) to solidify join to create final species richness layer
k. Layers created (following step 3.a-j.) include:
    i. Biodiversity
        1. Brown Pelicans
        2. Marsh Birds
        3. OBIS Aves
        4. Terrapin
        5. Motile Invertebrates
        6. Biodiversity Fish Species:
    ii. Managed
        1. Managed Fish Species
    iii. Protected
        1. Cetaceans
        2. CREMP Coral Species
        3. Sea Turtles
        4. Manatee
        5. Protected Fish Species

4. Valued Habitat set up and prep
    a. Valued habitat polygons included:
        i. Coastal and Pelagics
        ii. Coral
        iii. GulfMexicoAtlanticDeepwater Corals
        iv. Golden Crabs
        v. Gulf Sturgeon
        vi. Loggerheads
        vii. Manatee
        viii. Oculina Corals
        ix. Piping Plover
        x. Reef Fish
        xi. Shrimp
        xii. Right Whale
    b. Valued habitat polygons were *Merged* with Florida EEZ polygon
    c. Merged Polygons (4.b.i.) were then *Erased* by the FLBaseline layer
    d. A column was added to the attribute table for Habitat Value
        i. Biodiversity species layers received a value of “1”
            1. Layers are:
                a. Shrimp EFH
                b. Reef Fish EFH
        ii. Managed species layers received a value of “2”
            1. Layers are:

        a. Coastal and Pelagics EFH
        b. Deepwater Coral HAPC
        c. Golden Crab Critical Habitat
        d. Oculina HAPC
    iii. Protected species layers received a value of “3”
        1. Layers are:
            a. Gulf Sturgeon Crti. Hab.
            b. Loggerhead Crit. Hab.
            c. Manatee Crit. Hab.
            d. Piping Plover Crit. Hab.
            e. Coral EFH
            f. Right Whale Hab.
5. Anthropogenic Habitat Layers
    a. ArcLine layers used:
        i. Bridges
        ii. Railroads
        iii. Gulf of Mexico Pipeline
        iv. Shipwrecks in Western Florida
    b. A *Buffer* of 500 meters was created around anthropogenic habitats to make sure habitat is sampled in rasters and does not disappear in rasterization
    c. Buffer layers (5.b) were *Merged*:
    d. The merged layer (5.c.) was then *Merged* with FLEEZ
    e. The intersected buffer layer was *Erased* using FLBaseline
    f. Habitat value attribute field was added and a value of “1” was given to polygons of Anthropogenic habitat
6. Raster creation and calculations
    a. All species and habitat layers were converted into rasters utilizing the *Polygon to Raster* with Species Count or Habitat Value in the *Field* and *Priority Field* input, and *cell size* set to 2000 (for 2 km resolution)
    b. *Raster Calculator* was then used to combine raster layers and add values to each other
        i. Make sure to go to *Environments* to set the extent and S*nap* the rasters to any raster layer created from a species fishnet layer
    c. Layer additions resulted in:
        i. Biodiversity Species
            1. Values: 1 - 119
        ii. Managed Species
            1. Values: 1 - 47
        iii. Protected Species
            1. Values: 1 – 26
    d. Species layers were then *Reclassified* based on 5 level prioritizations with the help of Jenk’s natural breaks of classification. The importance of species presence reclassification values is shifted to prioritize those that are considered a higher priority due to endangered status or management needs (i.e., Protected > Managed > Biodiversity)
        i. Biodiversity Species

        1. Values = Reclassification
            a. 0 = 0
            b. 1 – 7 = 2
            c. 8 – 23 = 3
            d. 24 – 55 = 4
            e. 56 – 119 = 5
    ii. Managed Species
        1. Values = Reclassification
            a. 0 = 0
            b. 1 – 3 = 2
            c. 4 – 10 = 3
            d. 11 – 17 = 4
            e. 18 – 47 = 5
    iii. Protected Species
        1. Values = Reclassification
            a. 0 = 0
            b. 1 – 7 = 4
            c. 8 – 25 = 5
e. Protected and Managed species were then added, using *Raster Calculator*, to each other to look at priority species presences
    i. Values were the *Reclassified* to
        1. 0 = 0
        2. 2 = 2
        3. 3 = 3
        4. 4 – 6 = 4
        5. 7 – 9 = 5
f. Biodiversity Species was then added to the *Reclassified* Protected and Managed species layers using *Raster Calculator*.
    i. Values = Reclassification
        1. 0 = 0
        2. 2 = 2
        3. 3 = 3
        4. 4 – 7 = 4
        5. 8 – 10 = 5
g. *Raster Calculator* was used to add all the valued habitat layers together and *Reclassify* to create prioritizations
    i. Values = Reclassification
        1. 0 = 0
        2. 1 – 2 = 1
        3. 3 = 2
        4. 4 = 3
        5. 5 = 4
        6. 6 – 12 = 5
h. The *Reclassified* Species and Valued Habitat layers were added using *Raster Calculator*

i. Values = Reclassification
    1. 0 = 0
    2. 1 – 2 = 1
    3. 3 = 2
    4. 4 = 3
    5. 5 – 6 = 4
    6. 7 – 10 = 5

i. The Nature Conservancy Blueways layer was utilized in an attempt to incorporate migratory pathways/connectivity. The layer was created by overlapping the tracks of 10 different species
    i. Overlap was seen in 8 of the 10 species
        1. Species included in layer:
            a. Bull shark (*Carcharhinus leucas*)
            b. Whaleshark (*Rhincodon typus*)
            c. Bluefin Tuna (*Thunnus thynnus*)
            d. Blue marlin (*Makaira nigricans*)
            e. Atlantic tarpon (*Megalops atlanticus*)
            f. Gulf sturgeon (*Acipenser oxyrhynchus desotoi*)
            g. Kemp's ridley sea turtle (*Lepidochelys kempii*)
            h. Loggerhead sea turtle (*Carretta carretta*)
            i. Green sea turtle (*Chelonia mydas*)
            j. Sperm whale (*Physeter macrocephalus*)
                - *Only 7 species corridors overlapped within the Florida EEZ
    ii. Values were *Reclassified* and reduced in priority as they are very broad and combined with modelled data.
        1. Values = Reclassification
            a. 1 – 2 = 1
            b. 3 – 4 = 2
            c. 5 – 7 = 3
    iii. The Blueways layer was added using *Mosaic to New Raster* to the reclassified species and habitat layer (5.h.iii) and was *reclassified*
        1. Values = Reclassification
            a. 0 = 0
            b. 1 = 1
            c. 2 – 3 = 2
            d. 4 – 5 = 3
            e. 6 = 4
            f. 7 – 8 = 5

j. Anthropogenic habitat was then added to the layer created in the previous step (5.i.iii) and *Reclassified*
    i. Value = Reclassification
        1. 0 = 0
        2. 1 = 1
        3. 2 = 2

    4. 3 = 3
    5. 4 = 4
    6. 5 – 6 = 5

k. Classify raster values with new string priority value
   i. 0 = ‘P0 No Value’
   ii. 5 = ‘P5 Lowest Priority’
   iii. 4 = ‘P4’
   iv. 3 = ‘P3’
   v. 2 = ‘P2 Medium Priority’
   vi. 1 = ‘P1 High Priority’

APPENDIX E

A summary of the terrestrial, freshwater, and marine indices used in the South Atlantic Blueprint 2020. For further detail related to indicators, ecosystems, or mechanics of the South Atlantic 2020 Blueprint, see the complete documentation on the most recent update blueprint update (South Atlantic Conservation Blueprint, 2020).

- Terrestrial:
    - **Beach Birds**: a continuous index of habitat suitability for four shorebird species on habitat types characterized by sandy beach. The final index ranges from most to least important habitat for the bird species index.
    - **Unaltered Beach**: an index of impacts from hardened structures (jetties, groins, and human infrastructure) on beaches assessed based on proximity of beaches to structures. This index ranges from beaches that are very vulnerable to less vulnerable to alteration.
    - **Resilient Coastal Sites**: the ability of coastal habitats to migrate to adjacent lowlands in order to sustain biodiversity and natural services under increasing inundation (sea level rise). Index ranges from low to high ability to migrate.
    - **Forest Birds**: index of habitat suitability for 12 upland hardwood and forested wetland bird species (based on species modeling by the Atlantic Coast Joint Venture). The index is based on potential occurrence of forest bird species, from less potential to greater potential (increasing occurrences of additional species).
    - **Forested Wetland Extent**: amount (overall acres) of forested wetlands (presence or absence).
    - **Marsh Extent**: amount (overall acres) of freshwater and saltwater marsh (presence or absence)
    - **Marsh Patch Size**: continuous index based on the size of freshwater or saltwater marsh patches with values based on acreage (in hectares) from low (<1 ha patch) to high (6,729 ha patch.
    - **Maritime Forest Extent**: amount (overall acres) of maritime forest (presence or absence)
    - **Previously Burned Pine Habitat**: index of fire-maintained, open canopy habitat (based on LANDFIRE data) as a proxy for regularly burnt habitat based in data between 1999-2010. Values are either 0 (not previously burned or not open canopy) or 1 (previously burned with open canopy).
    - **Pine Birds**: an indicator of habitat suitability for three pine bird species based on species occurrence data and predictive models. This index ranges from all three pine birds absent to all three pine birds present.
    - **Amphibian and Reptile Areas**: draws from spatial area designations that classify areas capable of supporting amphibian and reptile populations (Priority Amphibian and Reptile Conservation Areas), and the index is based on presence or absence of those priority areas.
    - **Greenways and Trails**: this index reflects the quality of recreational experience based on natural condition and connected length of greenways and trails. Natural condition is based on surrounding impervious surfaces and connectivity is based on how far a person can go without leaving a dedicated path. This index ranges from not a greenway/trail/sidewalk/path to a mostly natural and connected path.
    - **Intact Habitat Cores**: this index reflects the size of large, unfragmented patches of natural habitat ranging from low (not a core, <100 acres) to high (a 445,312-acre core).
    - **Low-Urban Historic Landscapes**: a cultural resource indicator based on presence of nationally-recognized historic places and surrounding urban development intensity (meant to identify significant historic places that remain connected to their context in the

natural world, ranging from low [not included in the register of historic places] to high [historic place with nearby low-urban buffer]).

  - **Resilient Terrestrial Sites**: this index reflects the ability of an area to continue to support species diversity and ecosystem function in the face of climate change (largely based on connectivity from **TNC's Resilient Land dataset**). This index ranges from low (developed) to high (above average connectivity) but does not include impacts of sea level rise or fire disturbances.
  - **Urban Open Space**: a cultural resource indicator evaluating current and potential future open space based on distance of undeveloped areas to existing protected lands. This index ranges from low (existing development) to high (protected land).

- Freshwater
  - **Migratory Fish Connectivity**: an index of how far upstream migratory fish (developed for certain species) are observed (including potential for hydrological restoration – e.g., dam removal). Index ranges from low fish connectivity index to high (based on presence of Gulf or Atlantic sturgeon).
  - **Network Complexity**: based on the number of different stream size classes in a rover network not separated by dams, where low values indicate low number of different classes and high values indicates large number of different stream size classes.
  - **Imperiled Aquatic Species**: the number of aquatic species within a watershed that are listed as globally imperiled (**G1** and **G2** ranks) including E/T species. This index ranges from no aquatic imperiled species to 4 or more imperiled aquatic species.
  - **Permeable Surface**: the amount (%) of non-impervious cover by catchment, with low (9% permeable) to high (100% catchment is permeable).
  - **Riparian Buffers**: continuous index of the amount of natural landcover, ranging from 0-100% natural habitat present in floodplain by catchment.
- Marine:
  - **Estuarine Coastal Condition**: a continuous index of water quality, sediment quality, and benthic community condition (abiotic status of open water estuaries), ranging from poor to good.
  - **Potential Hardbottom Condition** reflects the protected status or potential stress (i.e., shipping traffic, dredge disposal) of solid substrate and rocky outcroppings, ranging from hardbottom not predicted to hardbottom present in best condition due to additional protections.
  - **Marine Mammals**: a continuous index of dolphin and whale density (based on monthly or yearly density predictions by species). A low value indicates least important area for marine mammals based on low species density, and a high value indicates the areas is important due to high seasonal density of marine mammals.
  - **Marine Birds**: index of productive areas for birds that feed exclusively or mainly at sea based on seasonal predictions of relative abundance for 16 species, ranging from least important to most important for seasonal abundance of the marine species bird index.

APPENDIX F

Florida Marine Blueprint, Marine and Estuarine **Conservation Assets**, Indicators, and Metrics.

Conservation Asset	**Indicator**	**Metric**
Coral/ Hard Bottom	Coral Biodiversity	Species Richness, Shannon, and Simpson Index values
Coral/ Hard Bottom	Living Tissue Area	Centimeters of living coral tissue
Coral/ Hard Bottom	Fish Biodiversity	Species Richness, Shannon, and Simpson Index values
Coral/ Hard Bottom	Coral Cover	Percent Cover, Colony density
Coral/ Hard Bottom	Water quality	Temp, pH, DO, Chlorophyll a, Nitrate, Nitrite, Ammonia, Total Phosphorus, Turbidity
Seagrass	Spatial extent/texture	Acres; Patchy vs. continuous
Seagrass	Water quality	Temp, pH, DO, Chlorophyll a, Nitrate, Nitrite, Ammonia, Total Phosphorus, Turbidity
Seagrass	Fish Biodiversity	Species Richness, Shannon, and Simpson Index values
Seagrass	Seagrass species composition	Percent cover by species
Saltwater Marsh	Spatial extent	Acres/hectares
Saltwater Marsh	Runoff/Hydrology	length of roads (km) within 300m buffer
Saltwater Marsh	Water Quality	Nitrate, nitrite, ammonia, pH, total phosphorus
Saltwater Marsh	Fish Biodiversity	Species Richness, Shannon, and Simpson Index values
Saltwater Marsh	Secure inland migration	% of inland natural lands
Mangrove	Spatial extent	Acres/hectares
Mangrove	Runoff/Hydrology	length of roads (km) within 300m buffer
Mangrove	Water Quality	Nitrate, nitrite, ammonia, pH, total phosphorus
Mangrove	Fish Biodiversity	Species Richness, Shannon, and Simpson Index values
Mangrove	Secure inland migration	% of inland natural lands
Marine/Estuarine System-wide	Oysters	reef density

Marine/Estuarine System-wide	Oysters	size frequency
Marine/Estuarine System-wide	Water quality	Temp, pH, DO, Chlorophyll a, Nitrate, Nitrite, Ammonia, Total Phosphorus, Turbidity
Marine/Estuarine System-wide	Fish Biodiversity	Species Richness, Shannon, and Simpson Index values

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