Application of the SECAS Gulf-wide Data Suite in Restoration Planning

Case Study of Louisiana's 2017 Coastal Master Plan

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Preface

This report was developed by the Water Institute of the Gulf (the Institute) and Royal Engineers & Consultants, LLC for the U.S. Fish and Wildlife Service (USFWS) and synthesizes information from multiple federal and state agencies across the northern Gulf of Mexico. It is intended to be a demonstrative example of how the Gulf-wide Data Suite, developed from the foundation of the Southeast Conservation Adaptation Strategy (SECAS), could be used alongside the Louisiana (LA) Coastal Master Plan restoration planning mechanism. This report highlights one example of how SECAS, the Gulf-wide Data Suite, and state-based planning mechanisms can be used together to maximize co-benefits of restoration and conservation action. This report summarizes the Gulf-wide Data Suite (prototype Gulf-wide Blueprint, Integrated Ecosystem Stress, and Social Vulnerability) and key aspects of the history, governance, and technical development of the LA Coastal Master Plan. Potential processes for linkage, leverage, and integration between SECAS and the LA Coastal Master Plan are investigated through example analyses and data summaries. A series of recommendations specific to engagement with the LA Coastal Master Plan are provided.

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List of Acronyms

Acronym	Term
CPRA	Coastal Protection and Restoration Authority
CWPPRA	Coastal Wetlands, Planning, Protection and Restoration Act
DEM	Digital Elevation Model
DOA	Division of Administration
DOTD	Department of Transportation and Development
FDT	Framework Development Team
FWOA	Future Without Action
GOHSEP	Governor’s Office of Homeland Security and Emergency Preparedness
GOMESA	Gulf of Mexico Energy Security Act
HSI	Habitat Suitability Index
ICM	Integrated Compartment Model
LDAF	Louisiana Department of Agriculture and Forestry
LDEQ	Louisiana Department of Environmental Quality
LDI	Louisiana Department of Insurance
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LED	Louisiana Department of Economic Development
NGO	Non-Governmental Organization
OCPR	Office of Coastal Protection and Restoration
SECAS	Southeast Conservation Adaptation Strategy
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

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Executive Summary

The Southeast Conservation Adaptation Strategy (SECAS) was formed in fall 2011 to improve the health, function, and connectivity of southeastern U.S. ecosystems by at least 10 percent by 2060. To assist in the project planning and implementation strategies needed to achieve this ambitious goal, a dynamic data synthesis process was undertaken to produce a conservation prioritization map known as the Southeast Conservation Blueprint (the Southeast Blueprint). There are several subregional blueprints compiled within the Southeast Blueprint that are developed largely from a bottom-up governance framework based on 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. However, this also presents a challenge for planning and management processes that are larger than one individual subregion due to differences in analytical and data approaches used within each subregion. To address this need for regionally consistent restoration planning, a Gulf-wide Data Suite was developed which consists of uniform data inputs and a single analytical approach along the entire northern Gulf of Mexico coast, designed to operate synergistically with SECAS. The datasets within this suite fall under three categories that can be used to investigate co-benefits of conservation and restoration project planning: 1) a prototype conservation priority Blueprint based on natural resource and cultural value; 2) ecosystem stress; and 3) social vulnerability.

The Southeast Blueprint engages multiple stakeholders across the region in a common discussion of conservation project prioritization and planning. The Gulf-wide Data Suite was developed to inform management decisions around habitat-based restoration and conservation project planning along the northern Gulf of Mexico coast, in particular through large programs associated with *Deepwater Horizon* (DWH) settlement funds (DWH NRDA Trustees, 2016; RESTORE Act, 2012; Vilsack, 2016).

Coastal Louisiana (LA) provides a key example of a state facing the threats of an uncertain future, as a disappearing coastal landscape threatens LA's natural, economic, and cultural resources. The Coastal Protection and Restoration Authority (CPRA) was formed by the LA Legislature following Hurricanes Katrina and Rita in 2005 and was charged with development of a comprehensive coastal protection and restoration strategy for LA. CPRA developed the LA Coastal Master Plan to serve as a guiding document for that strategy. The LA Coastal Master Plan is updated on a six-year cycle.

The primary focus of the LA Coastal Master Plan is to create and maintain coastal wetlands through a variety of restoration techniques (e.g., marsh creation) and to reduce storm surge-based flood risk to LA's coastal communities. To accomplish this, each iteration recommends a series of restoration and risk reduction projects. Risk reduction project selection is informed by surge/wave modeling and risk assessment modeling. Restoration project selection is informed by a specifically developed suite of numerical models called the Integrated Compartment Model (ICM), which evaluates the ecosystem impacts of potential actions projected 50 years into the future against a Future Without Action (FWOA) scenario. The ICM's analysis is focused on physical processes (e.g., eco-hydrology, barrier island morphology, wetland morphology) and vegetation and ecosystem outcomes. The model outcomes from the ICM are then used as a decision support system, enabling decision makers to compare and then rank projects, formulate alternatives, evaluate alternatives, and support deliberations regarding project inclusion and sequencing. While habitat restoration does not fall within the primary focus of the LA

Coastal Master Plan, the nature of the land building projects allows for a wide array of habitats to be restored.

This report demonstrates the opportunities for cross-cutting linkages between the LA Coastal Master Plan and SECAS (specifically the Gulf-wide Data Suite), and explores how to bridge the gap between landscape restoration aimed at mitigating coastal land loss and restoration conducted for natural resource value in LA. This demonstration has two primary objectives: 1) provide a detailed history and technical overview of the LA Coastal Master Plan in the context of the state's coastal restoration efforts; and 2) identify marsh creation projects that also provide high potential natural resource value aligned with SECAS objectives. To accomplish this, the Gulf-wide Data Suite spatial layers were overlaid with marsh creation projects identified from the LA 2017 Coastal Master Plan to illustrate how conservation prioritization could be used to support proposed projects by highlighting potential co-benefits. Based on expert engagement, opportunities for co-benefits were investigated for LA's 2017 Coastal Master Plan projects located adjacent to LA Department of Wildlife and Fisheries (LDWF) refuges and other federally protected areas to better enhance existing biodiversity protection, increase landscape connectivity, and increase resilience of the LA coastline.

This work offers a framework by which the co-benefits of restoration planning for ecosystem services and natural resource prioritization can advance shared goals both for LA as well as the broader Gulf of Mexico coastal region. Based on this work, the following recommendations were identified as the opportunities for engagement with the LA restoration planning process in general, and the LA Coastal Master Plan in particular:

- **Recommendation 1: Engage with the LA Coastal Master Plan after initial plan is drafted, but prior to finalization –** The next LA Coastal Master Plan is due for release in 2023, therefore it is expected that the full version of LA's 2023 Coastal Master Plan (including an initial suite of planned restoration projects) will be released for public comment in the third or fourth quarter of 2022. This provides an opportunity for an independent assessment of LA's draft 2023 Coastal Master Plan suite of projects by U.S. Fish and Wildlife Service (USFWS) using the SECAS Southeast Blueprint, Middle Southeast Blueprint, or prototype Gulf-wide Blueprint and associated Gulf-wide Data Suite spatial information.

- **Recommendation 2: Employ SECAS and the Gulf-wide Data Suite to assess benefits of multiple restoration project types –** This analysis focused on evaluating LA Coastal Master Plan marsh creation projects using SECAS Gulf-wide datasets as a demonstration, but additional analysis could consider other types of restoration considered in the LA Coastal Master Plan (e.g., ridge restoration projects and barrier island restoration projects). These project types directly create habitat within a defined footprint and can therefore be directly assessed for benefits. Structural and nonstructural risk reduction projects aimed to mitigate flood and surge hazards also have high potential benefits for increasing marsh health through salinity control and reduced erosion in addition to the flood reduction benefits to local communities.

- **Recommendation 3: Focused analysis for the LA Coastal Master Plan boundary and LA –** The Gulf-wide Data Suite was intended for broad comparisons across the northern Gulf of

Mexico coastal region and was developed to extend landward 50 miles from the southern boundary established by states under the Coastal Zone Management Act (CZMA). As a result, it does not fully encompass the extent of the LA Coastal Master Plan boundary. Depending on the desired utility of the natural resource prioritization data offered by SECAS (the Southeast Blueprint, the prototype Gulf-wide Blueprint, or the Middle Southeast Blueprint), a reanalysis focused on the LA state boundary covering the inland extent of the LA Coastal Master Plan is recommended. A modified northern boundary could include the full coastal boundary as well as the full Atchafalaya Basin watershed and any other areas of specific interest within LA.

- **Recommendation 4: Investigate other restoration programs in LA –** While the LA Coastal Master Plan guides CPRA and their efforts to protect and restore the LA coast, it is a high-level process for planning restoration. The CPRA Annual Plan includes a range of funding mechanisms that implements smaller scale projects. These programs may also have opportunity for co-benefits through habitat value for wildlife resources. The Gulf-wide Data Suite could be used to support these programs by identifying the greatest return on investment opportunities.

- **Recommendation 5: Investigate future potential wildlife habitat value changes –** The LA Coastal Master Plan provides output data out to 50 years into the future (via the ICM), based on a range of sea level rise and subsidence scenarios. Areas of land loss comparing FWOA to a future with full restoration implementation would provide an indication of the area of coastal land lost for different wildlife values under the range of scenarios tested. The LA Coastal Master Plan alternatives assume full project implementation, so conclusions cannot be drawn about the influence of a subset of projects in isolation. However, areas of LA's coast that may be considered highest priority with respect to wildlife resources, and over what time period, can be identified.

The Gulf-wide Data Suite is intended to serve as a wealth of Gulf-wide spatial information to inform discussion and decision making with best available science and is not intended to replace expert opinion and input from subject matter experts with local expertise and knowledge. This information resource contains multiple datasets that are comparable at broad spatial scale. The grid cell resolution and spatial extent means that the datasets can be applied at multiple geographic scales and a large range of restoration planning and management planning programs and processes. The Gulf-wide Data Suite as well as other SECAS data products have strong potential to assist in increasing linkage and attainment of multiple resource priorities from restoration through recognition and quantification of locations that can have multiple benefits. For example, the SECAS prototype Gulf-wide Blueprint could be used to identify areas of marsh not currently being restored that could complete a wildlife corridor, extend an existing wildlife refuge, or increase ecosystem services provided to highly vulnerable coastal communities. Comparing these benefits to ecosystem stress data can provide an indication of some key threats that may need to be considered to maximize likelihood of projects success, and consideration of social vulnerability may be relevant for synergies with other funding mechanisms or assist in reporting on the broad range of co-benefits from implemented restoration.

1.0 Introduction

This report investigates potential synergies between the Southeast Conservation Adaptation Strategy (SECAS) and the Louisiana (LA) Coastal Master Plan to provide an example of how conservation prioritization information (specifically from the Gulf-wide Data Suite) can be used to communicate co-benefits of restoration for both natural resources and coastal resilience. The objectives of the work detailed here were two-fold: 1) provide a detailed history and technical overview of the LA Coastal Master Plan in the context of the state's coastal restoration efforts; and 2) identify marsh creation projects that also provide high potential natural resource value aligned with SECAS objectives. This work represents a case study for how SECAS data products (including the Gulf-wide Data Suite) could be linked to the LA Coastal Master Plan, addressing Recommendation 2 from Cameron et al. (2020).

1.1. SECAS SOUTHEAST CONSERVATION BLUEPRINT

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 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 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 are "important for buffering high value areas and maintaining connectivity" (Southeast Conservation Adaptation Strategy, 2020b). The Southeast Blueprint is used by a number of organizations (e.g., national wildlife refuges, state wildlife agencies, local government councils, conservation partners, and nonprofit organizations) to access additional restoration funding sources and inform decisions (Southeast Conservation Adaptation Strategy, 2021).

The Southeast Blueprint has drawn from, and compiled, conservation maps (subregional blueprints) from across the southeast region; these subregional plans are developed largely from a locally influenced governance framework that is based on 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 planning and management processes that are larger than one individual subregion due to different analytical and data approaches within each subregion.

1.2. SECAS GULF-WIDE DATA SUITE

To address the needs for regionally consistent restoration planning along the northern Gulf of Mexico, a Gulf-wide Data Suite was developed through a collaboration between the U.S. Fish and Wildlife Service (USFWS) and the Water Institute of the Gulf. The Gulf-wide Data Suite consists of uniform data inputs and single analytical approach along the entire northern Gulf of Mexico coast, designed to operate synergistically with SECAS. The Gulf-wide Data Suite spatial data layers fall under three categories: 1) mapping conservation priority based on natural resource and cultural value (prototype Gulf-wide Blueprint, Figure 1); 2) Integrated Ecosystem Stress (Figure 2); and 3) Social Vulnerability (Figure 3). For further information about the technical development of the Gulf-wide Data Suite, see Kiskaddon et al. (2021). These spatial data provide information that can inform state or regional project planning and reporting by contributing data related to co-benefits of projects for both communities and valued natural resources.

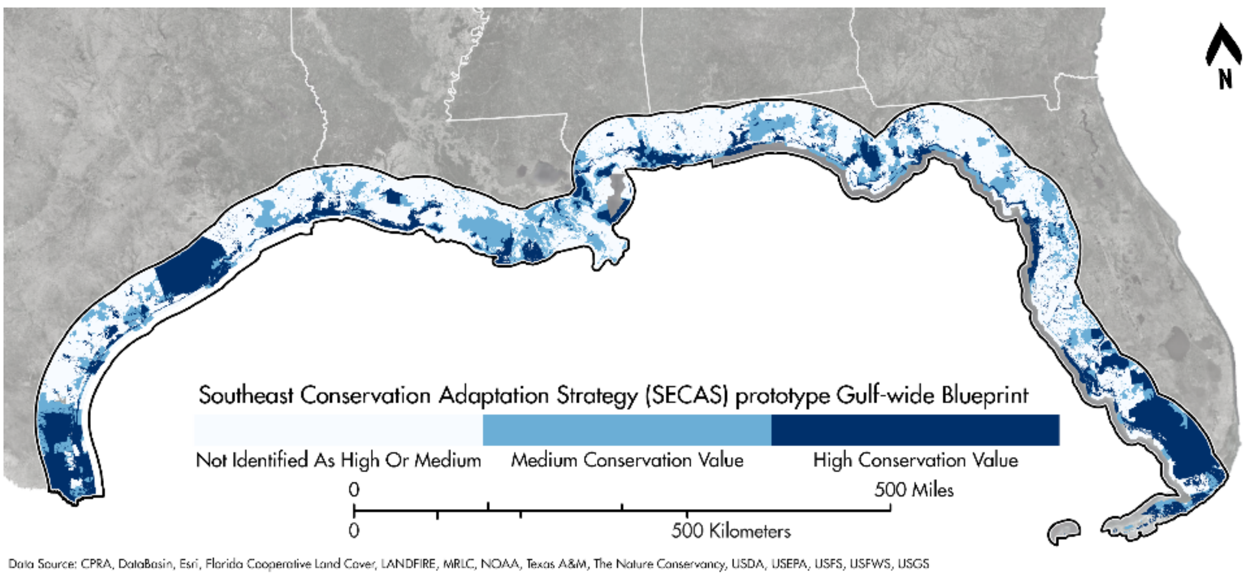


Figure 1. SECAS prototype Gulf-wide Blueprint reflecting prioritization categories defined by the Southeast Conservation Blueprint.

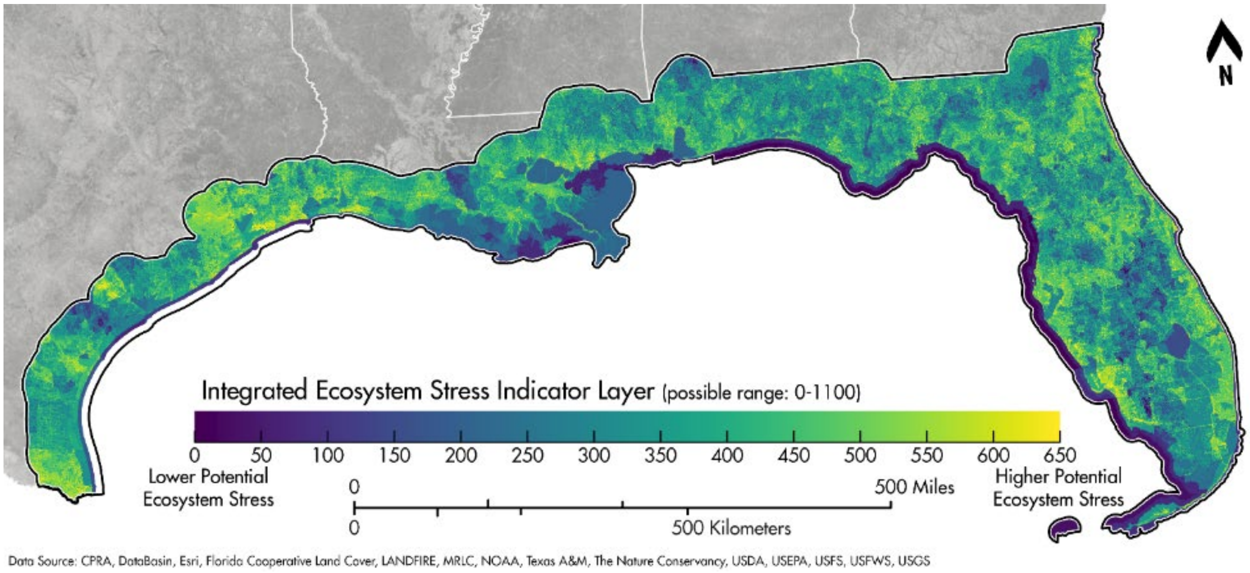


Figure 2. Gulf-wide Integrated Ecosystem Stress spatial data layer. This layer reflects the unweighted cumulative sum of Ecosystem Stress Indicators across the project area. Color scale indicates that 0 (dark purple) = no stressor present, 650 (yellow) = highest cumulative unweighted sum of ecosystem stress observed across the Gulf (of a maximum 1100).

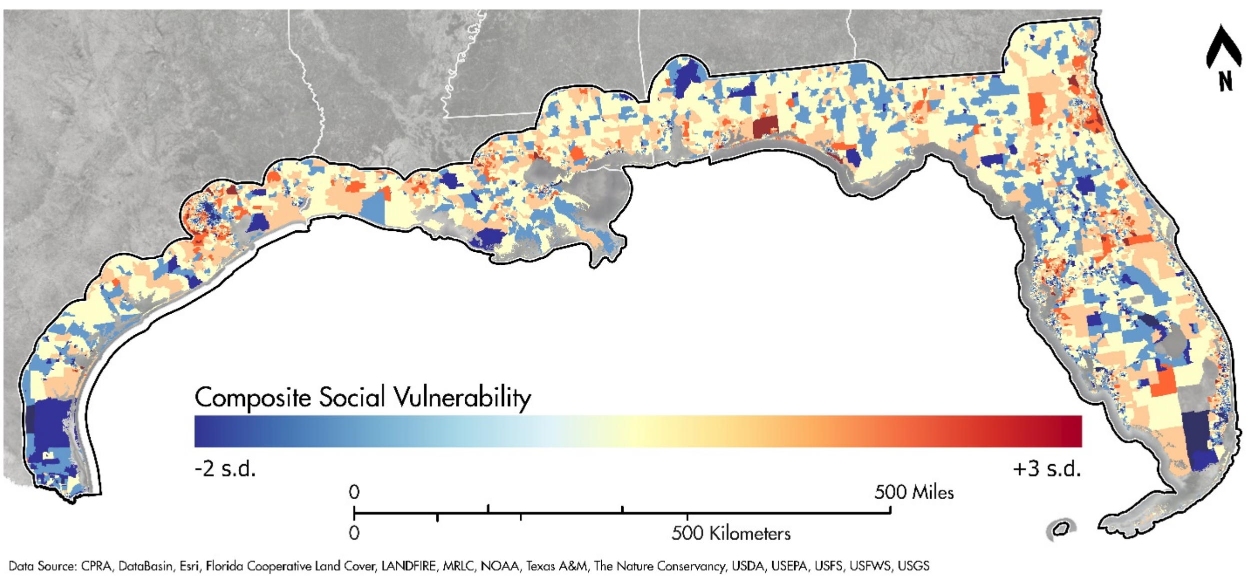


Figure 3. Gulf-wide Social Vulnerability composite index (SoVI) spatial data layer. Color scale reflects standard deviations from the project area social vulnerability mean.

1.3. LA CONTEXT AND THE LA COASTAL MASTER PLAN

Coastal LA provides a case study of a state facing an uncertain future, specifically one in which natural, economic, and cultural resources are threatened by a disappearing coastal landscape. Over the past two decades there has been increasing recognition of large-scale landscape change as a result not only of urban and agricultural development, but also of large-scale changes such as rising sea level, changes to precipitation regimes, and shifting temperature patterns (Perring et al., 2015; Toivonen et al., 2021;

Watson & Venter, 2017). Acknowledging these threats, coastal states like LA turn an increased focus to the resilience of human communities to impacts such as flooding, land loss, and drought by implementing restoration programs where the use of habitat, ecosystem, or nature-based approaches can be cost effective.

The LA Coastal Master Plan guides the state's restoration and protection efforts (CPRA, 2017). The LA Coastal Master Plan employs a variety of restoration techniques that may provide co-benefits including support to the health and function of flora and fauna resources and enhancing landscape connectivity. The following section (**Section 2.0**) details its governance, history, and underlying mechanics.

1.4. THE BENEFITS OF SYNERGY BETWEEN SECAS AND STATE RESTORATION PLANNING

Currently there are many programs and initiatives that include landscape restoration planning, specifically on the Gulf coast, that are often lacking in guidance on how to weigh trade-offs and consider co-benefits between natural resource value (e.g., biodiversity) and ecosystem services (e.g., protection of communities from nuisance flooding; Van der Biest et al., 2020; Tallis et al., 2009; Ockendon et al., 2018). A system, framework, or toolset that connects physical habitat creation with potential natural resource benefits is a tremendous asset for streamlining both planning (pre-implementation) and reporting (post-implementation). Communication of co-benefits from multiple lenses (e.g., natural resource value, social equity and vulnerability, ecosystem services) could increase potential funding and action, benefitting both local goals of restoration as well as broader goals of preserving regional biodiversity and landscape connectivity.

2.0 LA Coastal Master Plan

2.1. INTRODUCTION

The Coastal Protection and Restoration Authority (CPRA) was formed by the LA Legislature following Hurricanes Katrina and Rita in 2005 and was charged with development of a comprehensive coastal protection and restoration strategy for coastal LA. The LA Coastal Master Plan was developed to serve as a guiding document for that strategy and is based upon the best available science and engineering. The first LA Coastal Master Plan was published in 2007 and has been updated every five years thereafter (i.e., 2012 and 2017). The next iteration will be published in 2023 and will subsequently be updated every six years. Each LA Coastal Master Plan goes through an extensive legislative approval process, which is detailed in LA Rev Stat § 49:214.5.3.

In 2009, CPRA began development of a robust planning framework supported by sound technical tools for evaluating coastal restoration and protection projects and enabling strong, impartial decision making. These tools include numerical models that predict changes to the coastal LA landscape and ecosystems over a 50-year horizon and a computer-based decision support tool that allows for consideration of stakeholder preferences. The LA Coastal Master Plan planning framework, technical tools, and their application have been reviewed extensively by advisory boards and committees as well as through peer-reviewed, published manuscripts and reports. This application of best available science combined with extensive stakeholder engagement and peer review led to unanimous approval of LA's 2012 and 2017 Coastal Master Plans by the LA Legislature.

At its core, the LA Coastal Master Plan is a list of restoration and protection projects recommended for implementation in coastal LA over a 50-year period. The suite of restoration and protection projects included is based on two decision drivers: 1) create and maintain coastal wetlands and 2) reduce storm surge-based flood risk to LA's coastal communities (CPRA, 2017). Development of the LA Coastal Master Plan is further refined through consideration of five objectives and guided by a set of principles to fulfill those objectives.

The information presented in **Section 2.0** is largely based on the LA Coastal Master Plan process employed through completion of the LA 2017 Coastal Master Plan. This report does not capture the full extent of changes implemented for the LA 2023 Coastal Master Plan.

2.1.1 Master Plan Objectives

The LA Coastal Master Plan acknowledges that decisions based solely on creating and maintaining wetlands or reducing flood risk will not provide a comprehensive solution to address LA's coastal issues. Accordingly, its five objectives (CPRA, 2017) further define its purpose as:

1. Flood Protection: Reduce economic losses from storm surge-based flooding to residential, public, industrial, and commercial infrastructure.
2. Natural Processes: Promote a sustainable coastal ecosystem by harnessing the natural processes of the system.
3. Coastal Habitats: Provide habitats suitable to support an array of commercial and recreational activities coast wide.

4. Cultural Heritage: Sustain, to the extent practicable, the unique cultural heritage of coastal LA by protecting historic properties and traditional living cultures and their ties and relationships to the natural environment.
5. Working Coast: Promote a viable working coast to support regionally and nationally important businesses and industries.

2.1.2 Master Plan Principles

The guidelines by which the LA Coastal Master Plan fulfills its objectives are referred to as principles and represent the knowledge and experience gained over decades of coastal planning. The principles help to instill in all stakeholders the urgent need for implementation of restoration and protection projects. They also remind LA Coastal Master Plan leadership that the plan must set clear expectations and prioritize long-term solutions, engage stakeholders in the planning process, and adapt to changing circumstances. Further, principles are key components the planning framework. For example, LA Coastal Master Plan principles include efficient use of resources and accounting for uncertainties. The planning tool is used to constrain the list of projects included in the LA Coastal Master Plan based on the availability of limited resources such as funding and sediment, and future climate uncertainty is considered by evaluating potential projects across a range of future environmental conditions. The full list of LA Coastal Master Plan principles is fully described on pages 48-49 of the LA 2017 Coastal Master Plan (CPRA, 2017)

2.2. HISTORY AND GOVERNANCE

CPRA was initially formed as a board through Act 8 of the LA Legislature's First Extraordinary Session of 2005 (http://legis.la.gov/legis/ViewDocument.aspx?d=329530) in response to the devastation resulting from Hurricanes Katrina and Rita and an acknowledgement that the state needed an integrated and comprehensive approach to coastal protection and restoration. Act 8 identified the membership and responsibilities of the board and charged the CPRA with development and implementation of a comprehensive coastal protection plan that would be revised and updated every five years and a plan of action and expenditures that would be submitted to the legislature annually for approval. The coverage area for these plans was defined as the LA coastal zone and contiguous areas subject to storm or tidal surge. Act 523 of the LA Legislature's 2009 Regular Session created the Office of Coastal Protection and Restoration (OCPR), which brought together staff with coastal protection expertise within the Department of Transportation and Development and staff with coastal restoration expertise in the Department of Natural Resources under one state entity directed by the CPRA board. In total, OCPR was composed of 142 staff members from these two departments.

Act 604 of the LA Legislature's 2012 Regular Session renamed CPRA as the CPRA Board and OCPR as CPRA. Act 244 of the LA Legislature's 2018 Regular Session changed the revision frequency for the LA Coastal Master Plan from five to six years. A summary of the major milestones in the development is illustrated in Figure 4.

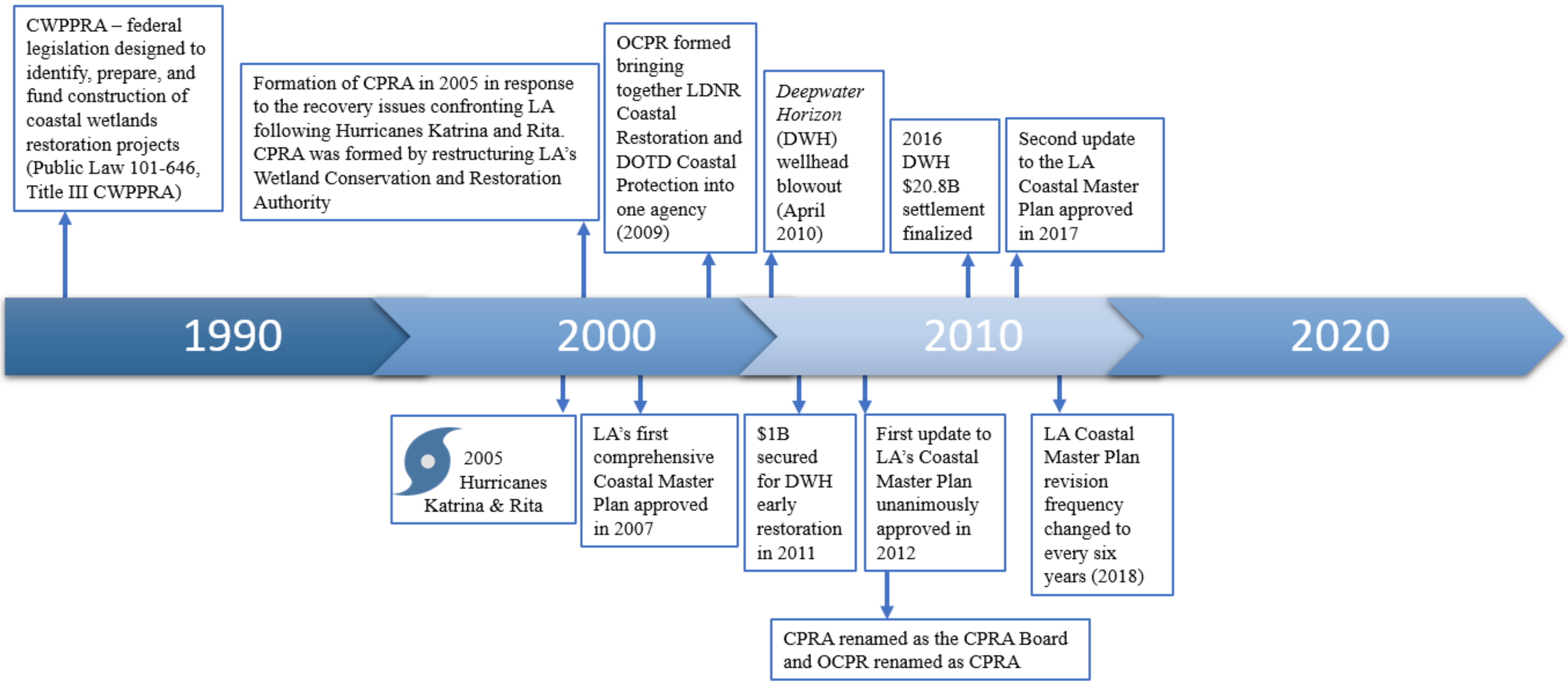


Figure 4. Timeline of major milestones in the development of the LA Coastal Master Plan.

The CPRA Board is legislatively directed "to provide aggressive state leadership, direction, and consonance in the development and implementation of policies, plans, and programs to achieve comprehensive integrated coastal protection, including the encouragement of multiple uses of the coastal area and to achieve a proper balance between development and conservation, restoration, creation, and nourishment of renewable coastal resources" (La Rev Stat § 49:214.1). The CPRA Board is responsible for the direction and development of the LA Coastal Master Plan. CPRA meanwhile serves as the single state authority responsible for the implementation and enforcement of the LA Coastal Master Plan and annual plan (La Rev Stat § 49:214.6.1) as approved by the CPRA Board. The Governor's Office of Coastal Activities functions as the policy arm of the CPRA Board, and the Governor's executive assistant serves as the CPRA Board chairman (La Rev Stat § 49:214.5.1). The CPRA Board is composed of the following 22 members (La Rev Stat § 49:214.5.1):

- Executive assistant to the governor for coastal activities
- Secretary of the Department of Natural Resources (LDNR)
- Secretary of the Department of Wildlife and Fisheries (LDWF)
- Secretary of the Department of Environmental Quality (LDEQ)
- Secretary of the Department of Transportation and Development (DOTD)
- Secretary of the Department of Economic Development (LED)
- Commissioner of Administration (DOA)
- Commissioner of Agriculture and Forestry (LDAF)
- Commissioner of Insurance (LDI)
- Eight members appointed by the governor with at least one appointee who is a resident from each of the following hydrologic basins:
    - Pontchartrain Basin
    - Breton Sound Basin or Mississippi Delta Basin
    - Barataria Basin
    - Terrebonne Basin
    - Atchafalaya Basin
    - Mermentau Basin or Teche/Vermilion Basin
    - Calcasieu/Sabine Basin
- Chair of the Governor's Advisory Commission on Coastal Protection, Restoration, and Conservation
- Director of the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)
- Speaker of the House of Representatives, who serves as an ex officio member
- President of the Senate, or his designee, who serves as an ex officio member
- Lieutenant Governor

On January 23, 2008, Governor Bobby Jindal issued Executive Order BJ 2008-07, which required that "all state agencies administer their regulatory practices, programs, contracts, grants, and all other functions vested in them in a manner consistent with the LA Coastal Master Plan and public interest to the maximum extent possible (La Exec Order No. BJ 2008-07)." Subsequently, Governor John Bel Edwards reaffirmed his predecessor's commitment to the LA Coastal Master Plan and issued Executive Order JBE 2016-09 on April 4, 2016. The executive order specifically stated that: "In order to effectively and efficiently pursue the State's integrated coastal protection goals, all state agencies, departments, and offices shall administer their regulatory practices, programs, projects, contracts, grants, and all other functions vested in them in a manner consistent with the LA Coastal Master Plan and public interest to the maximum extent possible (La Exec Order No. JBE 2016-09)." These executive orders reinforced the dedication and commitment of the state to an integrated coastal protection and restoration planning process and to the sense of urgency under which the state of LA and CPRA are operating as they seek to implement the projects identified in the LA Coastal Master Plan.

Each LA Coastal Master Plan is subject to a rigorous approval process, which begins when each draft plan is made available for public review and feedback. During the public comment period, a series of public hearings is held across the LA coast to both brief the public on the contents of the plan and to obtain feedback that will be used to refine the plan. Once public feedback is incorporated into the plan, it is presented to the CPRA Board for review and approval. Following CPRA Board approval, the LA Coastal Master Plan is sent to the LA Legislature for review and approval. It must be approved by the Natural Resources and Transportation committees from both sides of the legislature as well as the full House and Senate. During this process, the legislature can only vote for or against the plan, they cannot change it without remanding it to CPRA to re-start the planning process.

2.3. GEOGRAPHY AND ECOSYSTEM

The land loss crisis that coastal LA faces is well documented. Between 1932 and 2016, over 4,800 square kilometers of wetlands were lost across LA's coastal parishes; this represented a loss of approximately 25 percent of LA's wetlands (Couvillion et al., 2017). Although the rate of land loss peaked in the 1970s at 83.5 square kilometers per year, LA continues to lose over 28 square kilometers of wetlands per year (Couvillion et al., 2017).

The LA Coastal Master Plan covers the LA coastal area, which includes over 37,000 square kilometers of lowland plains, deltaic lobes, and open water (Couvillion et al., 2017), as well as areas landward of the coastal area that may be impacted as climatic conditions change over the next 50 years. Expansion beyond the coastal area ensures that the focus is not on political subdivisions or boundaries defined for regulatory purposes but rather on the dynamic coastal landscape that falls within the jurisdiction of CPRA. This area encompasses developed areas and their respective hurricane protection systems as well as uplands, swamps, river deltas, marshes, and barrier islands.

Although the LA Coastal Master Plan's focus is on land building, the diversity of habitats within its geographic extent, the range of restoration project types recommended, and the need to fulfil its third objective of providing coastal habitats to support recreational and commercial activities allow for a wide array of habitats to be restored. While the LA Coastal Master Plan focuses both on land change and changes in storm-surge based flood risk, the remainder of this chapter focuses solely on the former. Additionally, the restoration projects recommended are specific to wetland habitats and are not planned for uplands or developed areas.

2.4. LA COASTAL MASTER PLAN STRUCTURE AND METHODOLOGY

The LA Coastal Master Plan development process consists of four key elements: development of projects, modeling of projects and groups of projects, evaluating project outcomes with a planning tool, and outreach and engagement throughout the process (Figure 5). At the start of each new LA Coastal Master Plan cycle, a group of candidate restoration and protection projects is identified. This group of projects includes projects from the previous iteration that were not implemented, new project ideas solicited via an open call, and new project ideas developed through Regional Workgroups. Project ideas received through the open call are submitted by a variety of sources including local, state, and federal agencies; non-governmental organizations (NGO); and members of the public. Given the scale of land loss in coastal LA, projects that are similar in intended impact or geography are often combined such that projects put forward for evaluation are expected to produce regional (rather than local) benefits. Restoration project types include marsh creation, barrier island restoration, ridge restoration, hydrologic restoration, oyster reef restoration, sediment diversions, and shoreline protection. Following project identification, the suite of projects is modeled using an integrated modeling framework to predict project outcomes over 50 years across a range of environmental scenarios (i.e., sea level rise, subsidence, precipitation, etc.). A Future Without Action (FWOA) condition is also modeled and is used as the baseline against which individual project outcomes are compared. Projects are then evaluated against each other with the use of a decision support tool known as the 'planning tool' (**Section 2.4.5**). A robust outreach and engagement plan is implemented for each LA Coastal Master Plan and generally extends from project development through final plan approval.

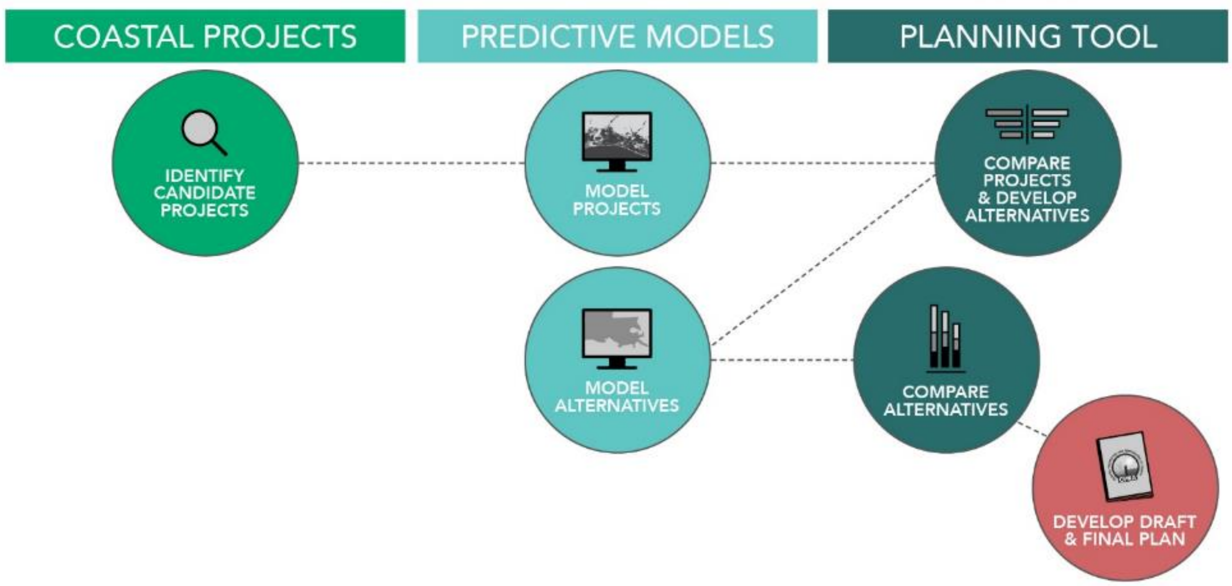


Figure 5. LA Coastal Master Plan development process (CPRA, 2020).

The Framework Development Team (FDT) served as the primary advisory group for LA's 2012 and 2017 Coastal Master Plans. The FDT was composed of approximately 40 members from federal agencies (e.g., USFWS, National Marine Fisheries Service, and USACE), state agencies (LDWF, LDNR, and GOHSEP), and local governments as well as representatives from NGOs (e.g., Ducks Unlimited, America's Wetland Foundation, National Audubon Society, The Nature Conservancy, Coastal Conservation Association, Pontchartrain Conservancy, National Wildlife Federation, Environmental Defense Fund, etc.), business and industry, academia, and coastal communities. For LA's 2017 Coastal Master Plan, 10 meetings were held with the FDT between 2014 and 2017. During these meetings, members were asked to provide feedback and guidance on key elements as well as tradeoffs that had to be made given limited resources and uncertainties about future conditions. Within the FDT, five Focus Groups were established to provide feedback on specific issues faced by communities, fisheries, landowners, energy and industry, and navigation. For LA's 2017 Coastal Master Plan, three to six meetings were held with each focus group between 2014 and 2017. For LA's 2023 Coastal Master Plan, the FDT was renamed as the Coastal Advisory Team, and the Focus Groups were reframed as Regional Workgroups. As noted above, the Regional Workgroups were asked to provide ideas for new projects that could be considered for LA's 2023 Coastal Master Plan.

2.4.1 Integrated Compartment Model

The suite of numerical models (or subroutines) used to evaluate the ecosystem impacts of restoration projects is known as the Integrated Compartment Model (ICM) which was developed specifically to evaluate candidate LA Coastal Master Plan projects. The ICM includes subroutines for eco-hydrology, barrier island morphology, wetland morphology, vegetation, and ecosystem outcomes (Figure 6). Model simulations for FWOA, projects, and alternatives (i.e., groups of projects) are completed for a 50-year period. The ICM is used to predict future changes to LA's coastal landscape and ecosystem with and without implementation of projects recommended in the LA Coastal Master Plan. To accomplish this, the ICM analyzes changes in hydrodynamic variables (e.g., salinity, water level, etc.), wetland area and elevation, vegetation species and distribution, and habitat suitability for a variety of species (e.g., eastern oyster, brown pelican, brown shrimp, spotted seatrout, bald eagle, seaside sparrow, etc.). A series of technical reports that provide detailed descriptions of each component of LA's 2017 Coastal Master Plan models is available at the following URL: https://coastal.la.gov/our-plan/2017-coastal-master-plan/. Reports documenting model improvements completed for LA's upcoming 2023 Coastal Master Plan are available at the following URL: https://coastal.la.gov/our-plan/2023-coastal-master-plan/technical-resources/.

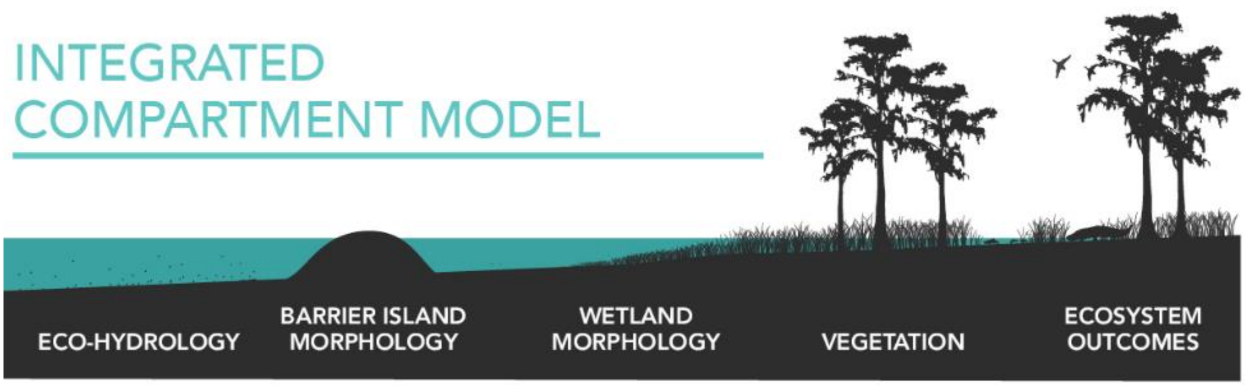


Figure 6. ICM subroutines (CPRA, 2020).

2.4.2 Environmental Scenarios

Prior to the start of model simulations for each LA Coastal Master Plan, environmental scenarios composed of a suite of environmental drivers (e.g., sea level rise, land subsidence rate, etc.) and representing a range of plausible future conditions are developed based upon recent literature, available data, feedback from experts, and sensitivity analyses (Meselhe et al., 2017). Because it is impossible to determine how each of the environmental drivers will change over time and across coastal LA, specific values for each driver and scenario are selected to explore how a range of future conditions could shape LA's coastal landscape both with and without implementation of LA Coastal Master Plan projects. Each candidate project is modeled to evaluate its performance under each of the environmental scenarios.

For LA’s 2017 Coastal Master Plan, the environmental drivers included in each scenario were precipitation, evapotranspiration, sea level rise, subsidence, storm frequency, and storm intensity (Figure 7; CPRA, 2017). LA’s 2017 Coastal Master Plan scenarios were labeled low, medium, and high. These scenarios, from low to high, represented worsening environmental conditions over the 50-year model simulation. LA’s 2012 Coastal Master Plan included three additional drivers: 1) marsh collapse threshold, 2) Mississippi River discharge, and 3) Mississippi River nutrient concentration. These were not included as drivers in LA’s 2017 Coastal Master Plan for the following reasons: 1) marsh collapse was identified as a process uncertainty rather than an environmental uncertainty and was incorporated directly into the wetland morphology subroutine; 2) there was lack of evidence to support future changes in Mississippi River discharge, and 3) model outputs that relied on changes in nutrient concentrations were not primary decision drivers (i.e., they did not contribute directly to land change) (Meselhe et al., 2017). One notable change in the values used for environmental drivers between LA’s 2012 and 2017 Coastal Master Plans was for sea level rise. The two scenarios employed for LA’s 2012 Coastal Master Plan used values of 0.27 meters and 0.45 meters for sea level rise over the 50-year period of analysis (CPRA, 2012) while LA’s 2017 Coastal Master Plan employed three scenarios with sea level rise values of 0.43 meters, 0.63 meters, and 0.83 meters (CPRA, 2017). Thus, the highest value used for LA’s 2012 Coastal Master Plan was similar to the lowest value used for LA’s 2017 Coastal Master Plan. The increase in sea level rise values selected for each plan reflected the range of plausible values identified in the most recent literature available.

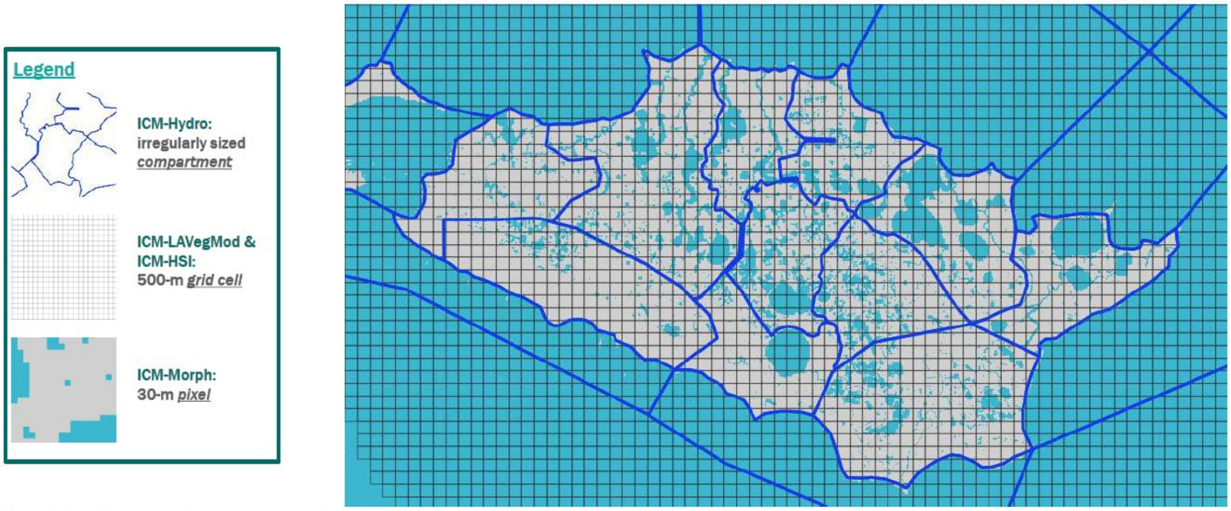
SCENARIO	PRECIP	ET	SEA LEVEL RISE	SUBSIDENCE	STORM FREQUENCY	AVG STORM INTENSITY
2017 COASTAL MASTER PLAN						
LOW	>HISTORICAL	<HISTORICAL	1.41′	20% OF RANGE	-28%	+10.0%
MEDIUM	>HISTORICAL	HISTORICAL	2.07′	20% OF RANGE	-14%	+12.5%
HIGH	HISTORICAL	HISTORICAL	2.72′	50% OF RANGE	0%	+15.0%

Figure 7. Drivers and values used in environmental scenarios (CPRA, 2017).

2.4.3 ICM Subroutine Domains

The domain for each ICM subroutine varies in spatial extent and cell size (Figure 8). For example, the hydrology domain is composed of irregular compartments; it encompasses the coastal zone and extends landward to capture upstream drainage and seaward to capture offshore conditions. The wetland morphology domain has a resolution of 30 meters and encompasses the LA coastal zone and extends to the 10-meter elevation contour landward and sufficiently seaward into the Gulf of Mexico to alleviate any boundary condition concerns associated with other components of the ICM. The 2017 barrier island subroutine was built on cross-shore profile transects spaced 100 meters apart with elevation data at 2-meter intervals along each profile. The 2023 barrier island subroutine retains the 100-meter longshore spacing and uses a 5-meter spacing in the cross-shore for each profile, which is then interpolated to the

30-meter resolution of the wetland morphology subroutine. The vegetation and HSI outputs are calculated on a regular, 500-meter, orthogonal grid that covers the same spatial area as the wetland morphology domain described above. Additional domain information on each of the ICM subroutines can be found in White et al., (2017) and Dalyander et al., (2020).



ICM resolution for Marsh Island in Vermilion Bay. Irregular polygons in dark blue are ICM-Hydro compartments; Orthogonal grid in black is the ICM-LAVegMod and ICM-HSI 500x500-m grid cells; Gray and teal landscape is the 30-m raster resolution of ICM-Morph.

Figure 8. Example grids for hydrology, vegetation, HSI, and wetland morphology subroutines (CPRA, 2020).

2.4.4 ICM Processes, Inputs, and Outputs

Outputs from the hydrology subroutine include salinity (mean annual, max 14-day annual, growing season, monthly), water surface elevation (mean annual, max monthly), tidal prism volume (annual), water level variability (growing season), mineral sediment deposition (monthly), and temperature (mean monthly). Many outputs from the hydrology subroutine serve as inputs to other subroutines. The wetland morphology subroutine projects wetland elevation change based on mineral sediment deposition and organic matter accretion. Wetland area change is based on salinity stress, inundation stress, marsh edge erosion, and subsidence. Outputs from the wetland morphology subroutine include a coastwide digital elevation model (DEM) for each year as well as land/water composition for each 30-meter pixel. The barrier island morphology subroutine produces an annual DEM and change in tidal inlet area. The vegetation subroutine uses mean annual salinity, mean annual water surface elevation, water level variability for the growing season, and maximum annual 14-day salinity to produce percent coverage for each species for each approximately 25 ha grid cell annually. HSI calculations require input from hydrology, morphology, and vegetation subroutines and are calculated annually. While specific inputs vary, HSI values are generally determined by combining water quality suitability indices (e.g., salinity, temperature) and landscape suitability indices (e.g., percent water, marsh type). HSI models output a value between 0 and 1 for each grid cell for each species annually, with higher values representing habitat that is more suitable for the species. Additional discussion of ICM processes, inputs, and outputs is provided in Brown et al., (2020).

2.4.5 Planning Tool

The planning tool is a decision support system that is used to compare and rank projects based on the model outcomes discussed above, formulate alternatives, evaluate alternatives, and support deliberations regarding project inclusion and sequencing (Figure 9; Groves et al., 2017). Data and information produced by the planning tool throughout the evaluation process are distilled and made available to the LA Coastal Master Plan team via interactive visualizations.

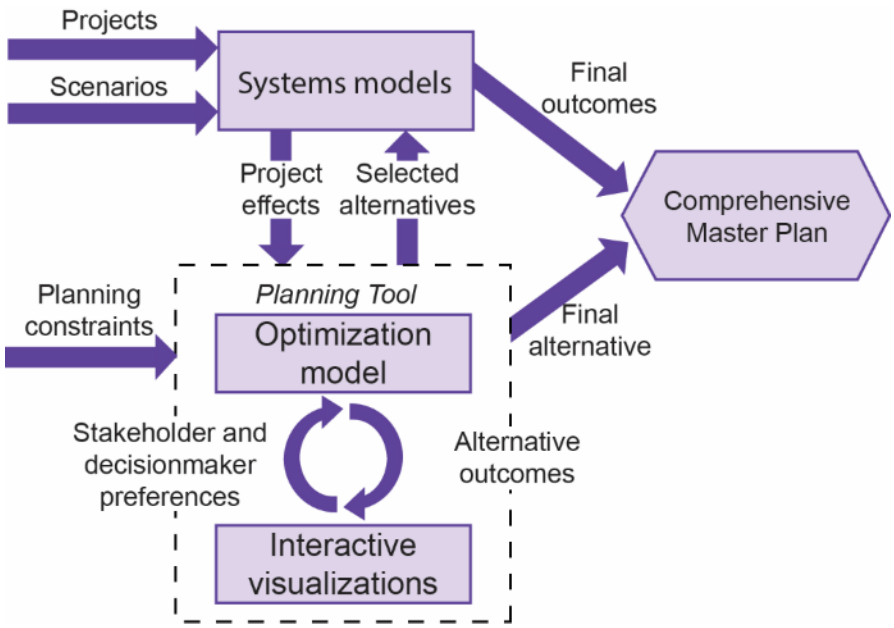


Figure 9. Depiction of how the planning tool supports the LA Coastal Master Plan decision-making process (Groves et al., 2014).

For the LA 2017 Coastal Master Plan, the fundamental decision driver for selecting restoration projects was the amount of wetland area built or maintained by the project in both the near term (i.e., 20 years) and the long term (i.e., 50 years). Each restoration project was ranked based upon its cost effectiveness in producing wetland acreage when compared to the FWOA condition. For example, a project that produces 200 acres (compared to FWOA) at $50,000 per acre would be ranked more highly than one that results in 200 acres (compared to FWOA) at $100,000 per acre.

Once individual projects are ranked, the planning tool is used to assemble groups of restoration projects (i.e., alternatives) that will result in the greatest amount of land building over the 50-year period of analysis. As part of the alternative formulation process, the planning tool selects projects based upon funding and sediment resource constraints. LA's 2012 and 2017 Coastal Master Plans were constrained by a total funding amount of $50B equally allocated between restoration and protection projects. The total amount of available sediment was identified prior to the planning tool evaluation, and projects were not selected if sufficient sediment resources were not available to construct them. This constraint applied to marsh creation projects which require mechanical dredging of sediment.

Data on community and environmental metrics are also considered in the project evaluation process. Environmental metrics such as fish and wildlife habitat suitability (HSIs) are most relevant for SECAS and can be used to understand how benefits differ between projects and how projects are linked to the LA Coastal Master Plan objectives.

Once alternatives are identified, they are modeled using the ICM. The planning tool is then used to identify key differences in model outcomes among the various alternatives and to consider which alternative provides the best near- and long-term investments across environmental scenarios. It is important to note that the planning tool does not decide which alternative is recommended in the LA Coastal Master Plan; it is simply used to support the deliberations that occur throughout the decision-making process. LA's 2017 Coastal Master Plan recommended implementation of 79 restoration, 13 structural protection, and 32 nonstructural projects; those projects are depicted in Figure 10.

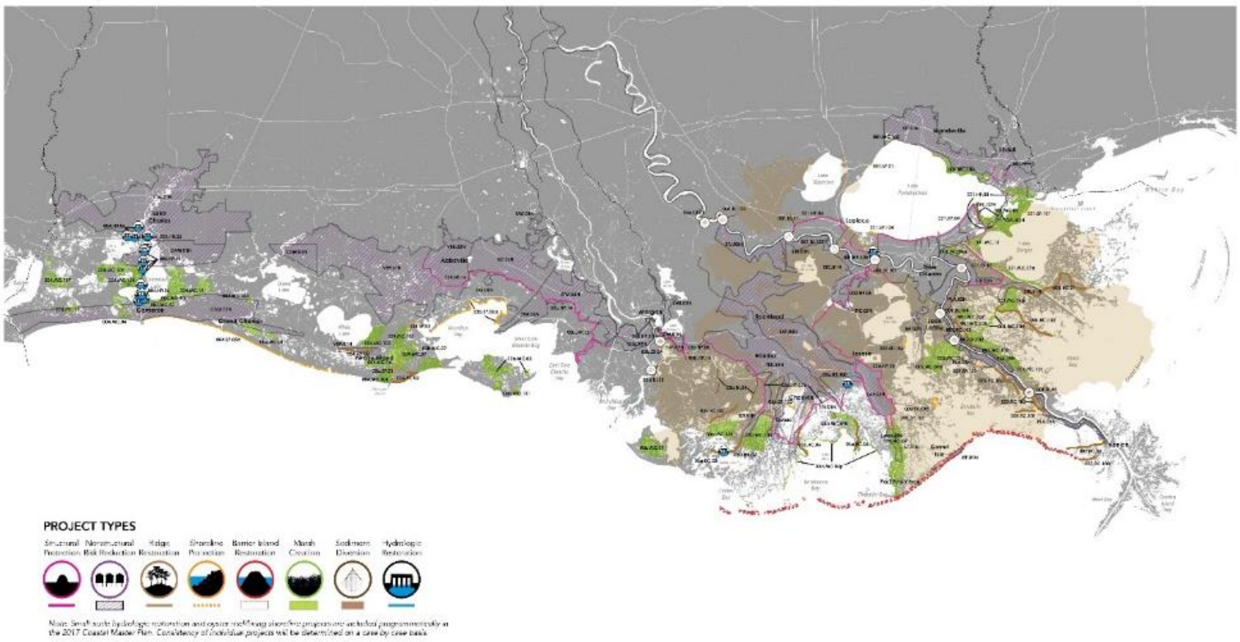


Figure 10. LA's 2017 Coastal Master Plan projects (CPRA, 2017).

2.4.6 Master Plan Data Viewer

A range of data and model outputs are made available by CPRA through the Master Plan Data Viewer following plan finalization (Figure 11). For LA's 2017 Coastal Master Plan, the viewer includes layers with the location of restoration projects in the final plan as well as project descriptions and estimated costs. The viewer also includes model outputs for land change and vegetation change for FWOA and future with plan implementation for each environmental scenario and for every 10-year time step through year 50. All LA Coastal Master Plan data shown in the viewer are available for download.

Figure 11. LA Coastal Master Plan Data Viewer Interface.

2.4.7 LA Coastal Master Plan Implementation

Following legislative approval of each LA Coastal Master Plan, CPRA is authorized to implement projects recommended in the plan. Because the full $50B is not available for project implementation, decisions on the sequence in which projects are implemented are largely based upon availability of funding over time. CPRA does not receive recurring revenue from the State's General Fund. The only recurring State funds are based on mineral revenues and are generally used for administrative and operating expenses. The Coastal Wetlands, Planning, Protection and Restoration Act (CWPPRA) was enacted in 1990 and provides over $75M annually to identify, design, construct, and monitor coastal restoration projects in LA (Pub. L. No. 101-646). More recent funding sources include those related to the DWH oil spill (e.g., National Fish and Wildlife Foundation [NFWF]; Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2011 [RESTORE Act]; Natural Resources Damage Assessment [NRDA], etc.). Funding available to LA through NFWF totals $1.2B and can only be used for Mississippi River diversions and barrier islands. Over $1B will be made available to LA via the RESTORE Act through 2031; while the majority of these funds have been dedicated to restoration projects (e.g., River Reintroduction into Maurepas Swamp), RESTORE Act funds are also used to support the Center of Excellence. The $5B in funding available through NRDA is provided in annual allocations over a 16-year period ending in 2032. The LA Trustee Implementation Group (LA TIG) oversees expenditure of the NRDA funds, and CPRA serves as the State's representative on the LA TIG. LA's NRDA funds are apportioned across categories of natural resources injured as a result of the oil spill with over $4B allocated to restore and conserve wetlands, coastal, and nearshore habitats. Because the LA Coastal Master Plan is not fully funded, implementation of costly, large-scale projects can be delayed until sufficient funds become available to complete construction. Other funding sources like the Gulf of Mexico Energy Security Act (GOMESA), which are not as constrained in their use, have largely been used for implementation of protection projects. CPRA works with local, state, and federal agencies as well as other funding entities to leverage all available sources of funding to implement projects as quickly as possible.

2.5. REPORTING AND ECOSYSTEM MONITORING

Each iteration of the LA Coastal Master Plan summarizes the restoration implementation that has occurred since the previous iteration. To report on ecosystem condition over the decades of coastal restoration effort, the state of LA has developed an integrated and comprehensive ecosystem monitoring program.

In 2003, LA commenced development of a coastwide integrated monitoring program to report on the effectiveness of the large increase in restoration effort due to establishment of CWPPRA in 1990. Over the past two decades, this has developed into a coastwide foundational monitoring network termed the System Wide Assessment and Monitoring Program (SWAMP). SWAMP is used to assess ecosystem condition and restoration effectiveness at multiple spatial scales, and expands on and provides the overall framework for specific sub-programs such as the Coastal Reference Monitoring System (CRMS), the Barrier Island Comprehensive Monitoring program (BICM), the Fisheries-Independent Monitoring Program (FIMP), and supports the Barrier Island System Management (BISM) program. The data for these programs are stored and managed in the Coastal Information Management System (CIMS).

System Wide Assessment and Monitoring Program (SWAMP): The monitoring variables and objectives of SWAMP characterize and track the physical and ecological systems in coastal LA to support understanding and assessment of trends and distributions of habitat types, as well as floral natural resources and nekton. The data broadly includes weather and climate, biotic integrity, water quality, hydrology, physical terrain, population and demographics, housing and community characteristics, economy and employment, ecosystem dependency, residential properties protection, and critical infrastructure and essential services protection. Integration of sampling location and replication was designed with a rigorous statistical analysis, examination of modeling needs, and thorough reviews of previous planning and monitoring efforts.

Coastwide Reference Monitoring System (CRMS): Originally developed by the CWPPRA Task Force to characterize coastal LA wetlands, CRMS has been used by other programs, including NRDA, to evaluate change in LA's coastal ecosystems. Data collection focuses on hydrology, vegetation, surface elevation dynamics, soil properties, and land/water configuration. The network includes 390 sites across coastal LA that encompass the range of ecological conditions and habitat types where restoration actions are considered. Trajectories of reference sites are compared with project site data to assess attainment of restoration objectives by individual projects in reference to the wider system.

Barrier Island Comprehensive Monitoring (BICM)*:* BICM uses both historical and new data collections to assess and monitor changes in the aerial and subaqueous extent, sedimentology, and habitats of barrier islands and shorelines in LA and is critical to informing the BISM program (below). BICM commenced in 2006, phase one and phase two of this program are complete and were funded by the LA Coastal Area Science and Technology Program and the NFWF, respectively. Data include: habitat types, sediment texture, geotechnical properties, geomorphology, and vegetation composition. Aerial still and video photography are used for documenting shoreline changes, habitat mapping, land change analyses, topographic (light detection and ranging [LiDAR]) surveying for elevation determination, bathymetric surveying, and sediment sampling.

LA Fisheries Independent Monitoring Program (FIMP): FIMP is a comprehensive fish and shellfish monitoring program using multiple gear types, coordinated by LDWF. The coastwide FIMP Program began in 1967 and is used to track the relative abundance, status and trends, species composition and size distribution of key fish and shellfish within LA's five coastal basins.

LA Barrier Island System Management (BISM): Initially funded by NFWF, BISM enables restoration projects to be integrated components of a long-term, system-wide, and holistic regional sediment management (RSM) approach that supports increased restoration project longevity and a more sustainable barrier island system. In addition, BISM utilizes adaptive management principles to minimize costs and maximize benefits while achieving barrier island restoration targets.

Data Storage, Management, Delivery (CIMS): CIMS provides geospatial, tabular database, and document access to CPRA's suite of protection and restoration projects, CRMS stations, LA Coastal Master Plan, geophysical data, and coastal community resiliency information. Standard protocols for data acquisition (collection and processing), quality assurance, and quality control are outlined to ensure data quality prior to incorporation in the CIMS database. Restoration projects that are not associated with DWH NRDA have alternate sources of funding data and information support by CIMS.

2.6. KEY CONTACTS AND RESOURCES

Contacts

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  Strategic Planning Assistant Administrator
  stuart.brown@la.gov

Resources

- CPRA
- LA Coastal Master Plan
- LA Coastal Master Plan Data Viewer

3.0 Opportunities for Reducing LA's Land Loss and Flood Risk while Increasing Natural Resource and Cultural Co-Benefits

3.1. BACKGROUND

The rapidly changing coastal landscape of LA is home to diverse habitats, abundant wildlife, and a population that is highly reliant on primary use of natural resources for food, income, and recreation. LA has invested considerably in restoration planning that is essential to both ensure community resilience as well as maintenance of ecosystem function and values. The commonalities between landscape restoration and biodiversity planning creates an opportunity for synergy.

Two types of investigations are presented here to demonstrate the opportunities for cross-cutting linkages between landscape restoration and biodiversity planning. First, marsh creation projects from LA's 2017 Coastal Master Plan were identified that could provide high potential natural resource value and align with SECAS objectives (**Section 3.2**). Second, two areas where co-benefits of march creation could promote both landscape connectivity for natural resources and coastal resilience were examined (**Section 3.3**). Lastly, a set of recommendations is proposed to advance the utility of this work in aligning goals and priorities of SECAS and the LA Coastal Master Plan (**Section 4.0**). This work offers a framework to weigh co-benefits of restoration planning for ecosystem services and natural resource prioritization that can advance shared goals both for LA and the broader Gulf of Mexico coastal region.

3.2. ASSESSMENT OF MARSH CREATION PROJECTS USING THE SECAS GULF-WIDE DATA SUITE

The aim of this first demonstration is to illustrate how the Gulf-wide Data Suite can be used to identify march creation projects planned by the state of LA that also provide ancillary co-benefits to natural resources and therefore could be a focus of support from USFWS. Marsh creation projects recommended in LA's 2017 Coastal Master Plan were selected for this demonstration due to their defined geographic boundaries, however the entire suite of marsh projects was not included due to the spatial extent of the prototype Gulf-wide Blueprint which was not developed specifically for comparison to the boundary of the LA Coastal Master Plan. Some important projects within LA's 2017 Coastal Master Plan, those around Lake Pontchartrain, were not included. A comprehensive region-wide assessment of all marsh creation projects would require re-analysis using the Gulf-wide Data Suite (or, alternatively, analysis using the Southeast Conservation Blueprint). Similar analyses using the Gulf-wide Data Suite and other LA Coastal Master Plan restoration types (e.g., ridge creation, sediment diversions) are also possible but out of scope of this work

3.2.1 Prototype Gulf-wide Blueprint, Integrated Ecosystem Stress, and Social Vulnerability of Marsh Creation Projects

The Gulf-wide Data Suite (**Section 1.2**) is composed of multiple spatial data layers that operate synergistically with the goals and vision of SECAS (Figure 1, Figure 2, Figure 3). To highlight synergies between SECAS and state-level restoration planning, information provided in the Gulf-wide Data Suite was used to investigate marsh creation projects from LA's 2017 Coastal Master Plan. The three summary layers from the Gulf-wide Data Suite were overlayed with the marsh creation project footprints. Cells intersecting with each project area were summarized to determine project-scale values (mean ± SD of cell values within each project area) for prototype Gulf-wide Blueprint prioritization (Figure 12), Integrated

Ecosystem Stress (Figure 13), and Social Vulnerability (Figure 14). Importantly, these data are not intended to serve as a substitute for site-level planning, monitoring, or evaluation.

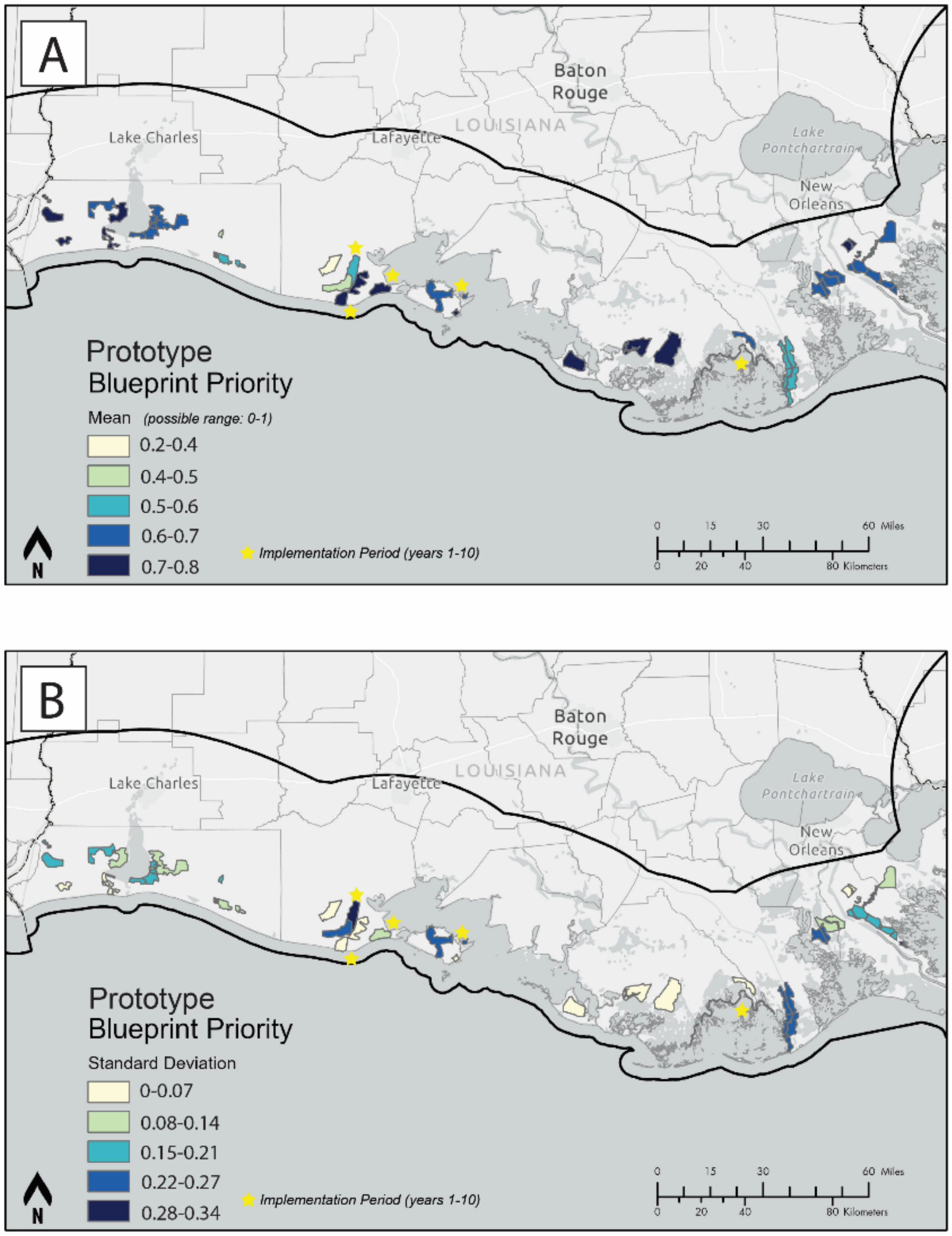

Figure 12. Prototype Gulf-wide Blueprint priority values for marsh creation projects. Average (A) and standard deviation (B) values were calculated for all LA's 2017 Coastal Master Plan marsh creationmarsh creation projects that intersect with the prototype Gulf-wide Blueprint project area. Projects classified as LA's 2017 Coastal Master Plan early implementation period projects (to be completed in years 1-10) are indicated by star symbols.

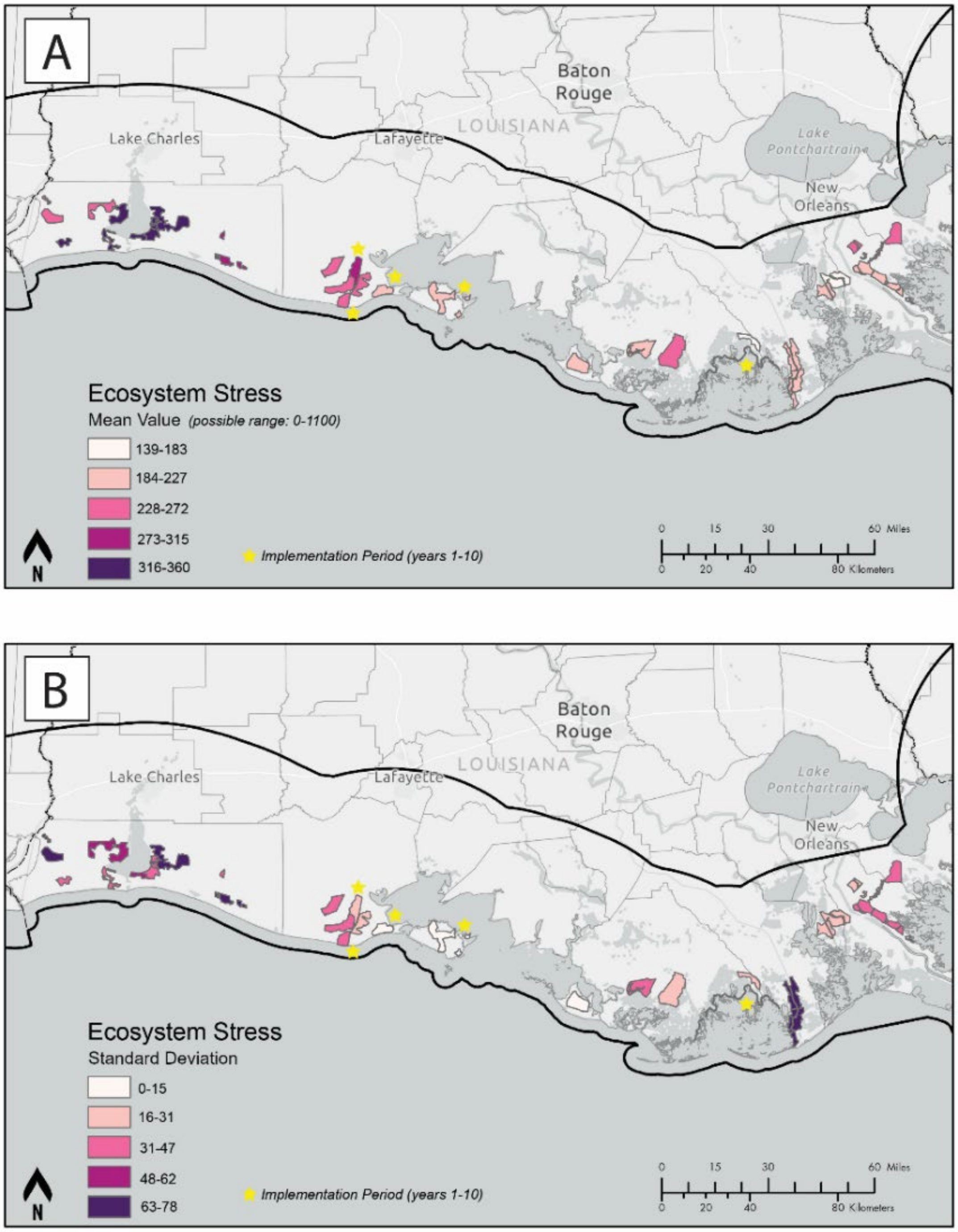

Figure 13. Gulf-wide Integrated Ecosystem Stress values for marsh creation projects. Stress values are based on cumulative unweighted sum of all stressors. Average (A) and standard deviation (B) values were calculated for all LA's 2017 Coastal Master Plan marsh creation projects that intersect with the prototype Gulf-wide Blueprint project area. Projects classified as LA's 2017 Coastal Master Plan early implementation period projects (to be completed in years 1-10) are indicated by star symbols.

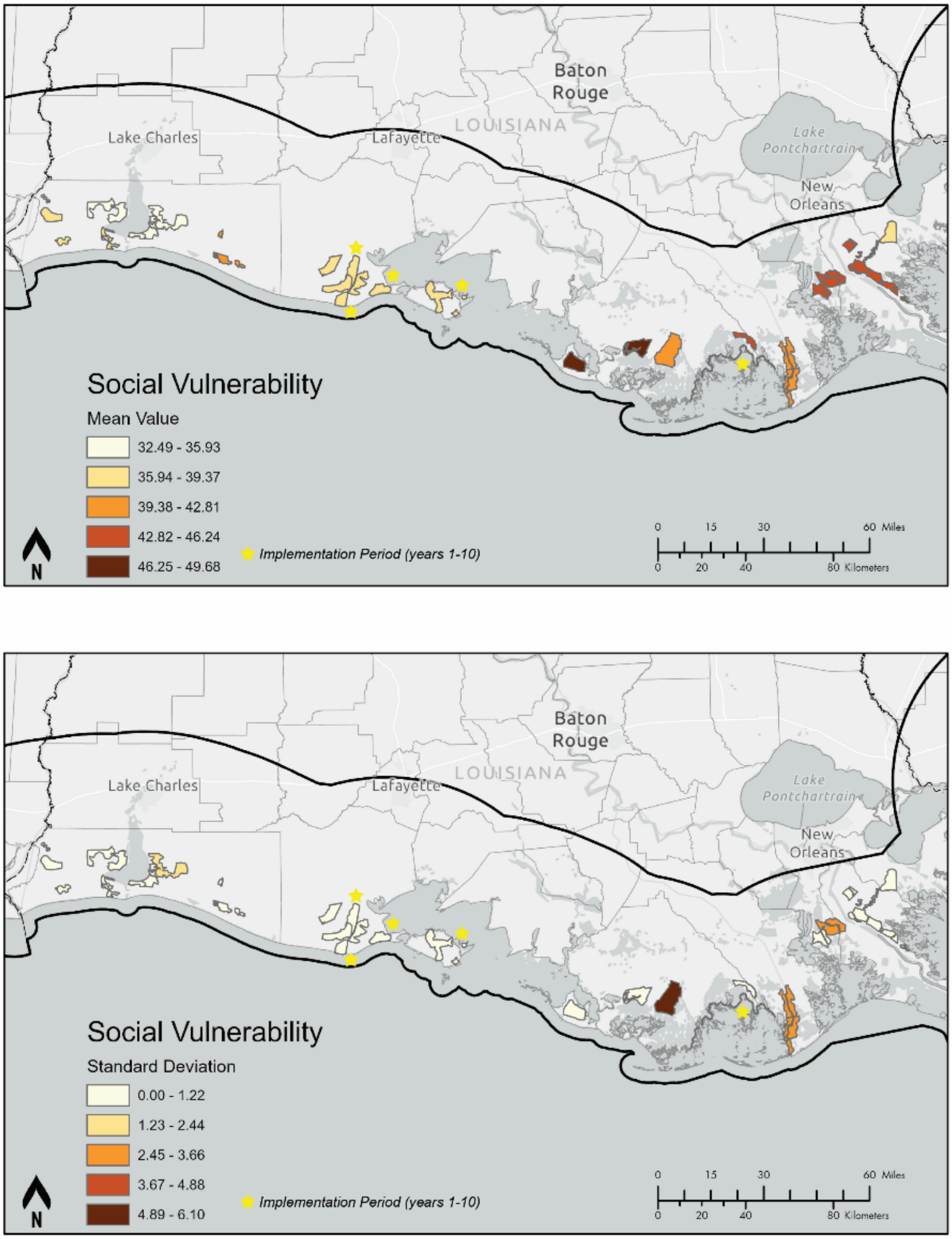

Figure 14 Gulf-wide Social Vulnerability composite index (SoVI) values for marsh creation projects. Average (A) and standard deviation (B) values were calculated for all LA's 2017 Coastal Master Plan marsh creation projects that intersect with the Gulf-wide Blueprint project area. Projects classified as LA's 2017 Coastal Master Plan early implementation period projects (to be completed in years 1-10) are indicated by star symbols.

Across all 32 projects examined, average project natural resource priority (based on the prototype Gulf-wide Blueprint) ranged 0.29-0.83, indicating a wide range of potential for additional project co-benefits to natural resources and communities. A total of 19 projects could be categorized as medium priority (scores 0.55-0.75) and seven projects as high priority (scores >0.75; Figure 12). Mean Integrated Ecosystem Stress ranged between 139–360 across projects (of the total possible 0-1100 range), with highest stress observed within LA's 2017 Coastal Master Plan marsh creation projects occurring in the Lake Charles area of southwestern LA (Figure 13). A total of six projects had a stress value greater than one standard deviation above the mean (>308) calculated across all compared projects. Lastly, Social Vulnerability measured using the SoVI across projects ranged 32–50, with highest vulnerability observed for projects in Terrebonne Parish (Figure 14). Averaging across projects and calculating one standard deviation above the mean, four projects exceed SoVI values of 45 indicating higher social vulnerability for those projects. The variability (standard deviation) of values characterizing each project footprint also varied, but for some projects these values were spatially consistent. Categorization of each project in terms of high and low prototype Gulf-wide Blueprint priority, Integrated Ecosystem Stress, and Social Vulnerability are summarized in Figure 15, Figure 16, and Table 1.

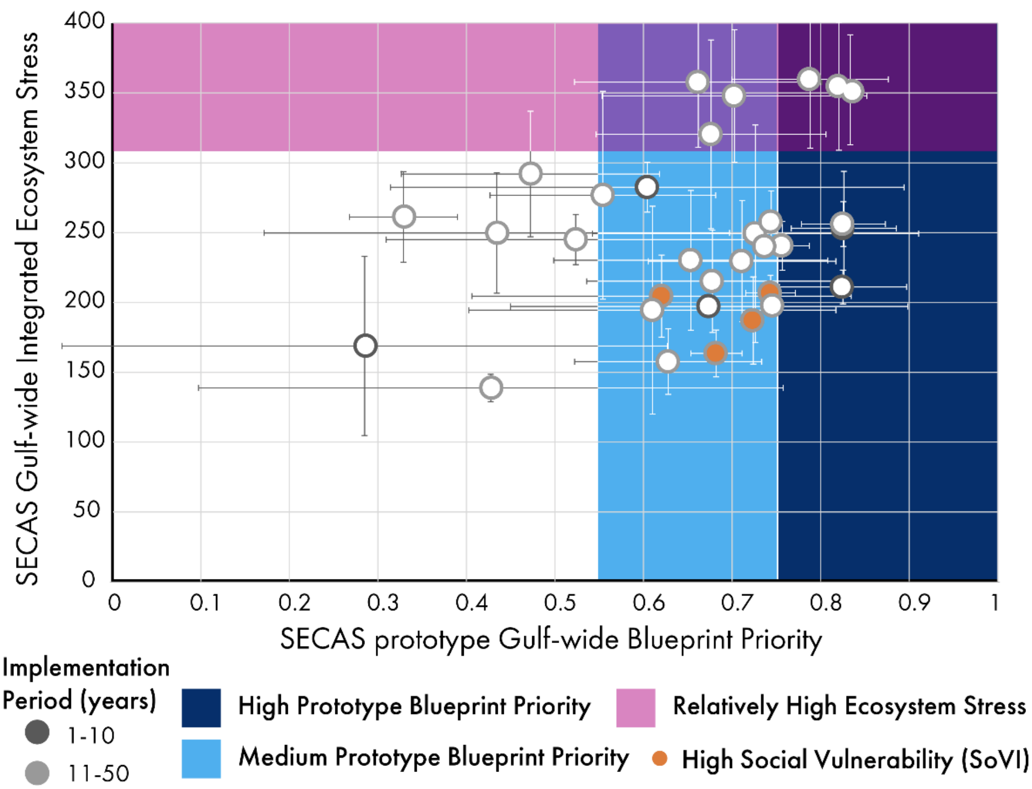

Figure 15. LA's 2017 Coastal Master Plan marsh creation projects plotted by average prototype Gulf-wide Blueprint priority and Integrated Ecosystem Stress. Error bars represent standard deviation of prototype Gulf-wide Blueprint priority score (horizontal) and ecosystem stress (vertical) for each project. Projects reflecting relatively high Social Vulnerability are highlighted. Point outline colors indicate implementation period (1-10 or 11-50). Maximum ecosystem stress possible is 1100 and maximum Gulf-wide stress observed to be 650.

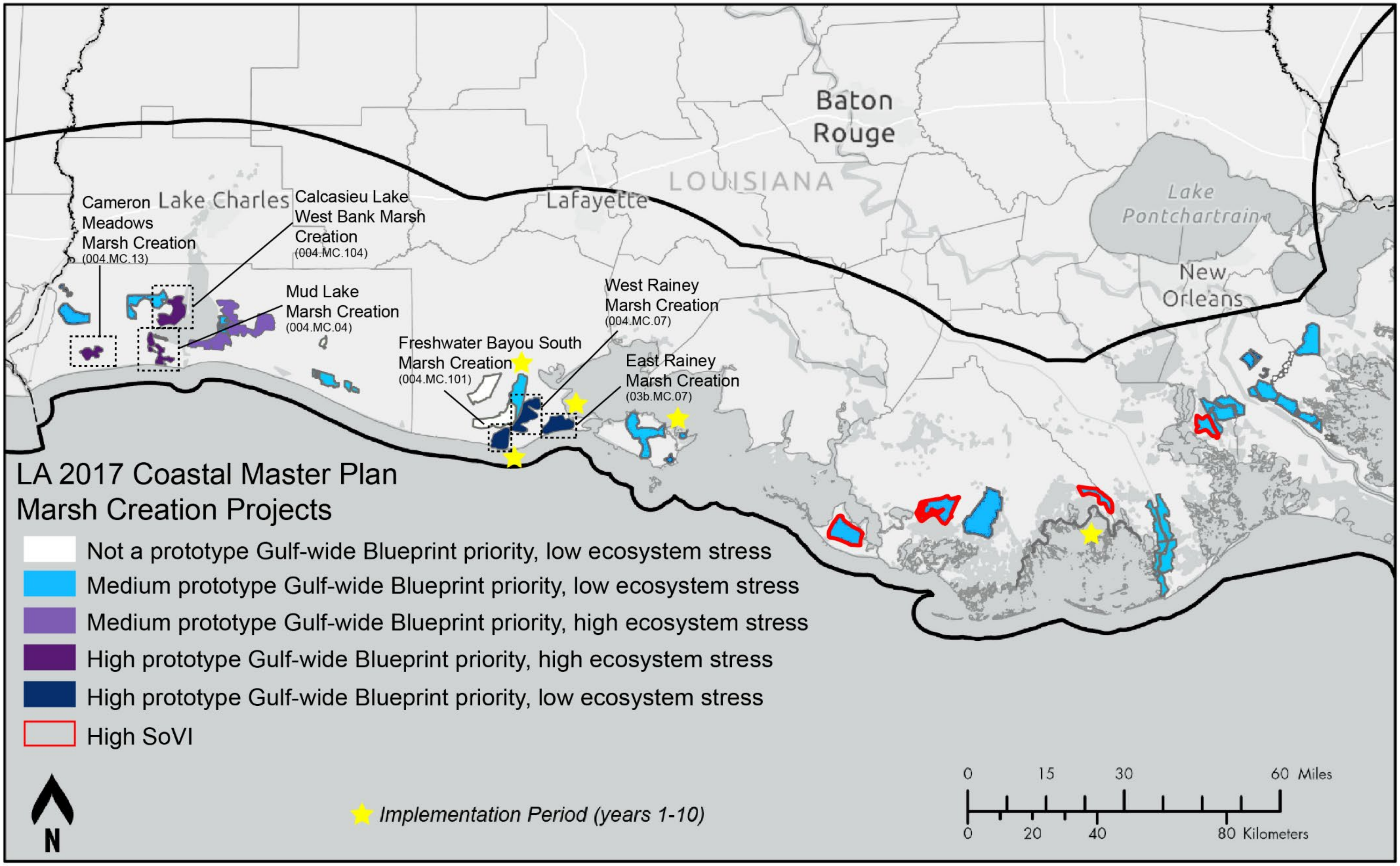

Figure 16. LA's 2017 Coastal Master Plan marsh creation projects colored by prototype Gulf-wide Blueprint priority, Integrated Ecosystem Stress, and Social Vulnerability (SoVI). High ecosystem stress is relative to the other projects examined. Projects classified as LA's 2017 Coastal Master Plan early implementation period projects (to be completed in years 1-10) are indicated by star symbols.

Table 1. Summary of Gulf-wide Data Suite values intersecting with LA's 2017 Coastal Master Plan marsh creation projects. For each marsh creation project, the project name is provided as well as indication of currently planned projects occurring within the project area as listed on the CIMS at the time of writing. Links to associated project information and indication of project status (completed, engineering and design [E&D], out for bid, etc.) are included. For each project row, the mean, standard deviation (SD), and range of values within each project area are given for each component layer: prototype Gulf-wide Blueprint, Integrated Ecosystem Stress, and Social Vulnerability (SoVI). LA's 2017 Coastal Master Plan early implementation project rows are shaded in grey. Projects are ordered by their associated Project ID.

LA's 2017 Coastal Master Plan Project ID `	**Marsh Creation area**	**Current projects (whole or partial) planned within marsh creation area (CIMS)?***	**Project Area (km^2)**	**SECAS Prototype Gulf-wide Blueprint Priority Mean** ± SD *Range (min-max)*	**Cumulative Ecosystem Stress Mean** ± SD *Range (min-max)*	**Composite SoVI Mean** ± SD *Range (min-max)*
				Range Gulf-wide = 0-1	*Range Gulf-wide = 0-650*	*Range Gulf-wide = 0-88.7*
001.MC.06a	Breton Marsh Creation - Component A	N	27.86	**0.71** ± 0.11 *(0.31-0.75)*	**229.76** ± 43.48 *(172-314)*	**39.32** ± 0 *(39.32-39.32)*
001.MC.101	Uhlan Bay Marsh Creation	N	1.22	**0.43** ± 0.33 *(0-0.73)*	**139** ± 9.80 *(127-151)*	**44.44** ± 0 *(44.44-44.44)*
001.MC.102	Pointe a la Hache Marsh Creation	N	54.38	**0.68** ± 0.14 *(0.05-0.75)*	**215.42** ± 36.66 *(139-277)*	**44.44** ± 0 *(44.44-44.44)*
001.MC.104	East Bank Land Bridge Marsh Creation	Y (BS-0038 E&D)	8.12	**0.52** ± 0.21 *(0.18-0.74)*	**245.27** ± 17.91 *(200-275)*	**44.44** ± 0 *(44.44-44.44)*
001.MC.105	Spanish Lake Marsh Creation	N	2.21	**0.74** ± 0.00 *(0.73-0.74)*	**240.25** ± 5.63 *(237-250)*	**44.44** ± 0 *(44.44-44.44)*
001.MC.107	Tiger Ridge/Maple Knoll Marsh Creation	N	17.71	**0.74** ± 0.00 *(0.72-0.75)*	**258** ± 22.02 *(200-312)*	**44.44** ± 0 *(44.44-44.44)*
002.MC.04a	Lower Barataria Marsh Creation - Component A	N	20.94	**0.62** ± 0.21 *(0.08-0.75)*	**204.78** ± 29.35 *(140-252)*	**45.46** ± 0 *(45.46-45.46)*
002.MC.05e	Large-Scale Barataria Marsh Creation - Component E	Y (BA-0207 construction, BA-0048 completed, BA-0164 completed, BA-0039 completed, BA-0043-EB completed)	26.3	**0.63** ± 0.11 *(0.12-0.74)*	**157.88** ± 23.51 *(139-223)*	**43.48** ± 3.50 *(37.27-45.46)*
03a.MC.03p	Terrebonne Bay Rim Marsh Creation Study	Y (TE-0139 E&D)	3.44	**0.29** ± 0.34 *(0-0.74)*	**169.07** ± 64.16 *(87-319)*	**42.86** ± 3.21 *(37.57-45.42)*
03a.MC.07	Belle Pass-Golden Meadow Marsh Creation	Y (TE-0134 E&D, BA-0194 E&D)	57.79	**0.61** ± 0.21 *(0-0.83)*	**194.69** ± 74.39 *(76-360)*	**39.86** ± 2.85 *(37.29-43.02)*
03a.MC.09b	North Terrebonne Bay Marsh Creation - Component B	Y (TE-0117 E&D)	10.96	**0.68** ± 0.03 *(0.65-0.74)*	**163.71** ± 16.77 *(152-220)*	**45.42** ± 0 *(45.42-45.42)*
03a.MC.100	South Terrebonne Marsh Creation	N	75.56	**0.76** ± 0.03 *(0.68-0.79)*	**240.82** ± 17.49 *(223-311)*	**41.97** ± 6.10 *(37.14-49.68)*
03a.MC.101	North Lake Mechant Marsh Creation	Y (TE-0044 completed, TE-0156 E&D, TE-0166 E&D)	34.47	**0.72** ± 0.01 *(0.70-0.75)*	**187.33** ± 31.21 *(137-237)*	**49.68** ± 0 *(49.68-49.68)*
03b.MC.03	Marsh Island Marsh Creation	N	39.86	**0.67** ± 0.22 *(0-0.76)*	**197.40** ± 1.59 *(185-198)*	**37.97** ± 0 *(37.97-37.97)*
03b.MC.07	East Rainey Marsh Creation	N	31.46	**0.82** ± 0.07 *(0.10-0.85)*	**211.31** ± 12.06 *(188-240)*	**36.97** ± 0 *(36.97-36.97)*

LA's 2017 Coastal Master Plan Project ID `	Marsh Creation area	Current projects (whole or partial) planned within marsh creation area (CIMS)?*	Project Area (km^2)	SECAS Prototype Gulf-wide Blueprint Priority Mean ± SD *Range (min-max)*	Cumulative Ecosystem Stress Mean ± SD *Range (min-max)*	Composite SoVI Mean ± SD *Range (min-max)*
				Range Gulf-wide = 0-1	*Range Gulf-wide = 0-650*	*Range Gulf-wide = 0-88.7*
03b.MC.09	Point Au Fer Island Marsh Creation	Y (LA-0001-F completed)	32.85	**0.74** ± 0.03 *(0.65-0.76)*	**207.09** ± 12.58 *(187-226)*	**49.68** ± 0 *(49.68-49.68)*
03b.MC.101	Southeast Marsh Island Marsh Creation	N	3.49	**0.74** ± 0.01 *(0.73-0.75)*	**198** ± 0 *(198-198)*	**37.97** ± 0 *(37.97-37.97)*
004.MC.01	South Grand Chenier Marsh Creation	Y (ME-0032 E&D, ME-0020 headed to bid)	24.57	**0.55** ± 0.13 *(0.47-0.81)*	**277** ± 74.44 *(172-455)*	**41.73** ± 0 *(41.73-41.73)*
004.MC.04	Mud Lake Marsh Creation	Y (CS-0059 completed, CS-0079 E&D)	11.60	**0.83** ± 0.01 *(0.80-0.84)*	**352.45** ± 39.48 *(263-430)*	**37.20** ± 0 *(37.20-37.20)*
004.MC.07	West Rainey Marsh Creation	N	31.52	**0.82** ± 0.05 *(0.21-0.85)*	**256.33** ± 16.01 *(214-289)*	**36.37** ± 0 *(36.37-36.37)*
004.MC.10	Southeast Calcasieu Lake Marsh Creation	Y (CS-0054 completed)	17.39	**0.66** ± 0.14 *(0.49-0.81)*	**257.90** ± 46.68 *(231-438)*	**33.05** ± 0 *(33.05-33.05)*
004.MC.13	Cameron Meadows Marsh Creation	Y (CS-0066 construction)	3.83	**0.82** ± 0.01 *(0.69-0.84)*	**355** ± 45.81 *(262-429)*	**37.20** ± 0 *(37.20-37.20)*
004.MC.16	East Pecan Island Marsh Creation	N	37.29	**0.43** ± 0.26 *(0.22-0.82)*	**249.94** ± 43.11 *(165-318)*	**36.47** ± 0 *(36.47-36.47)*
004.MC.19	East Calcasieu Lake Marsh Creation	Y (CS-0054 adjacent to creation area, completed)	35.69	**0.68** ± 0.13 *(0.45-0.83)*	**320.57** ± 67.60 *(220-489)*	**32.49** ± 1.37 *(28.72-33.05)*
004.MC.23	Calcasieu Ship Channel Marsh Creation	Y (CS-0078 E&D)	5.93	**0.70** ± 0.15 *(0.48-0.83)*	**348.08** ± 47.54 *(288-388)*	**33.05** ± 0 *(33.05-33.05)*
004.MC.100	Freshwater Bayou North Marsh Creation	Y (ME-0031 E&D)	40.53	**0.60** ± 0.29 *(0.21-0.84)*	**282.73** ± 17.85 *(214-289)*	**36.47** ± 0 *(36.47-36.47)*
004.MC.101	Freshwater Bayou South Marsh Creation	Y (ME-0025-SF completed)	27.42	**0.82** ± 0.06 *(0.26-0.85)*	**253.31** ± 40.85 *(191-351)*	**36.47** ± 0 *(36.47-36.47)*
004.MC.102	White Lake Marsh Creation	N	43.39	**0.33** ± 0.06 *(0.28-0.51)*	**261.44** ± 32.44 *(201-343)*	**36.47** ± 0 *(36.47-36.47)*
004.MC.103	Little Chenier Marsh Creation	N	4.01	**0.47** ± 0.15 *(0.40-0.81)*	**292.20** ± 45.00 *(221-355)*	**41.73** ± 0 *(41.73-41.73)*
004.MC.104	Calcasieu Lake West Bank Marsh Creation	Y (LA-0021 completed, CS-0085 E&D, CS-0028-4-5 completed)	36.9	**0.78** ± 0.09 *(0.49-0.83)*	**359.93** ± 49.27 *(239-470)*	**33.31** ± 0 *(33.31-33.31)*
004.MC.105	West Brown Lake Marsh Creation	Y (CS-0028-2 completed, CS-0081 E&D, CS-0028-4-5 completed)	21.08	**0.65** ± 0.15 *(0.47-0.82)*	**230.38** ± 50.08 *(170-303)*	**33.31** ± 0 *(33.31-33.31)*
004.MC.107	West Sabine Refuge Marsh Creation	N	26.04	**0.73** ± 0.18 *(0.32-0.84)*	**249.43** ± 77.86 *(154-426)*	**37.20** ± 0 *(37.20-37.20)*

3.2.2 Gulf-wide Data Suite Sub-Layer Scores for Marsh Creation Projects

The underlying Gulf-wide Data Suite indicators for each project were then compared to further assess specific opportunities for co-benefits to other wildlife resources and to coastal communities. The average project value for each Gulf-wide Data Suite indicator layer was calculated for all marsh creation projects and set on a 0-1 scale for comparison (Figure 17). For further detail related to the individual sublayers of the Gulf-wide Data Suite, see Kiskaddon et al. (2021).

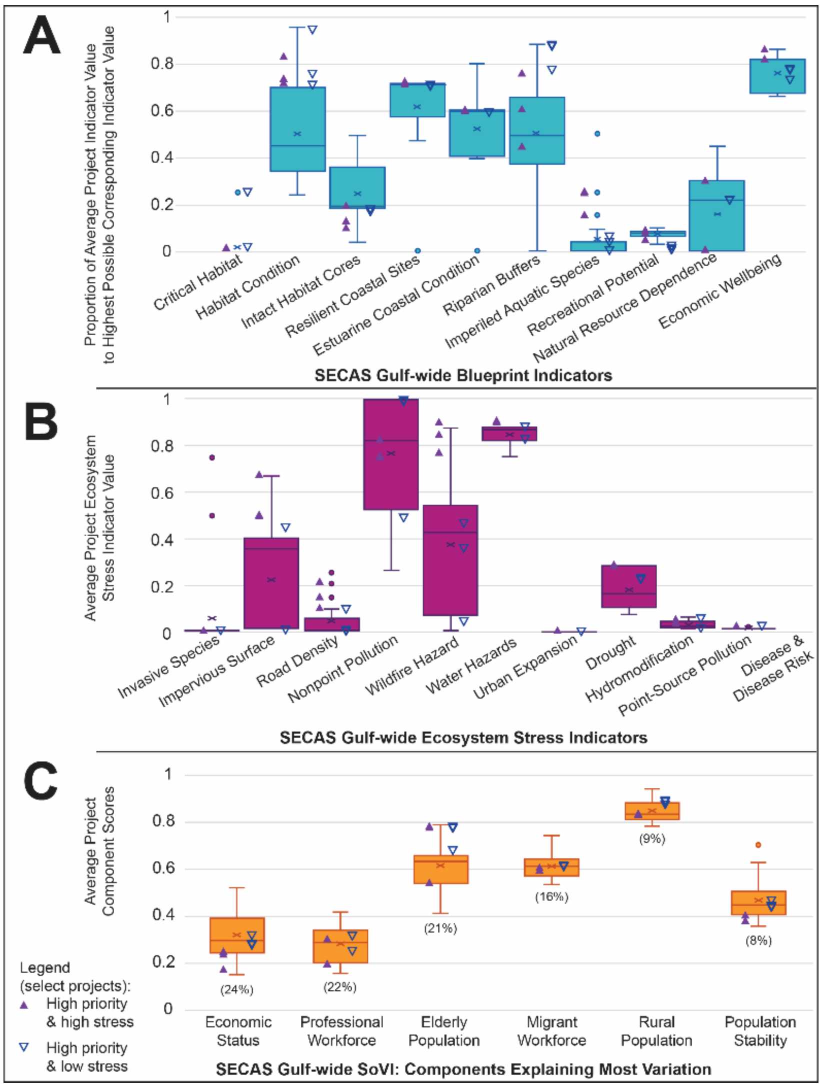

Figure 17. Boxplot of Gulf-wide Data Suite indicator data values examined across LA's 2017 Coastal Master Plan marsh creation projects. Boxes show the minimum, first quartile, median, third quartile, and maximum values. (A) indicator values for the prototype Gulf-wide Blueprint, each given as a proportion of the absolute range across the Gulf-wide area. (B) Integrated Ecosystem Stress indicators. (C) Social Vulnerability components that explain the most variation in the SoVI composite score (variation explained by each component is given in parentheses below each box). Specific projects reflecting high prototype Gulf-wide Blueprint priority & high Integrated Ecosystem Stress, and high Gulf-wide Blueprint priority & low Integrated Ecosystem Stress, are plotted as symbols.

SECAS prototype Gulf-wide Blueprint: Figure 17A shows that individual project values for Natural Resource Indicators, Habitat Condition Indicator, and Socio-Ecological Indicators. Each indicator can vary widely and high Gulf-wide Blueprint priority does not directly equate to highest indicator values. It is important to note that the prototype Gulf-wide Blueprint was created using the Zonation software core area algorithm and that final prioritization is not a direct sum of the underlying indicators (Minin et al., 2014). It is not possible to directly relate the values of the indicators to the overall prototype Gulf-wide Blueprint priority values, however examining the indicators can still provide insight into potential natural resource and community co-benefits. Across all projects, high indicator values for Resilient Coastal Sites of the Gulf of Mexico, Estuarine Coastal Condition and Economic Wellbeing are apparent. Average Habitat Condition Indicator scores were highly variable across projects, with some projects characterized by high values. Marsh creation projects, on average, score low in Recreational Potential in a Gulf-wide context. This is largely because the Recreational Potential Indicator calculation mainly reflects terrestrial recreation and is strongly tied to access by roadways (not including access by boat), and these project areas can be very remote.

Integrated Ecosystem Stress: The Integrated Ecosystem Stress layer was produced as an unweighted sum of underlying indicators (Table 2), making interpretation simpler. Figure 17B examines each indicator layer averaged across projects, where each indicators is scaled from 0 (no/low stress) to 1 (high ecosystem stress) based on applied ecological thresholds. Key Invasive Species, Nonpoint Pollution, and Water Hazards Ecosystem Stress indicators reflect the highest ecosystem stress values across all projects.

Table 2. Summary of Integrated Ecosystem Stress indicators and relevant ecological thresholds. For each indicator, values were set on a 0-1 scale by dividing each project average by 100.

Ecosystem Stress Indicator	**Description**	**Ecological Threshold & Scoring**
Invasive Species	Presence of invasive species, weighted by state-prioritization *(range Gulf-wide: 0-100; across projects: across projects: 50-75)*	0: no data; 50: non-prioritized key invasive species present; 75: state-prioritized key invasive species present; 100: both present
Disease & Disease Risk	Index based on presence of White Nose Syndrome, Chytrid fungus, and risk of forest disease *(range Gulf-wide: 0-100; across projects: no data)*	0: no data; 100: disease present (any) or forest is at risk of disease
Non-Point Source Pollution	Index based on overlapping threats: 303(d) impaired waters, watershed nutrient loads (nitrogen and phosphorus), and sand & gravel mines *(range Gulf-wide: 0-100; across projects: 26.09-100)*	0: no impairment or mines; 50: nutrient concentrations (either N or P) exceed USEPA thresholds but is not otherwise impaired; 75: both N and P exceed USEPA thresholds but is not otherwise impaired; 100: is impaired and/or near a mine

Ecosystem Stress Indicator	Description	Ecological Threshold & Scoring
Point Source Pollution	Index of cumulative density of National Priority List (superfund) sites, Risk Management Plan facilities, and Treatment, Storage, and Disposal facilities at a census block scale *(range Gulf-wide: 0-100; across projects: 1-3)*	0: no data; 1: Census block characterized by lowest density of hazardous sites within 5km; 100: Census block characterized by highest cumulative density of hazardous sites within 5km
Urban Expansion	Probability of a natural landcover to be converted to urban area by 2060 *(range Gulf-wide: 0-100; across projects: 0-0)*	1: not at risk (already urban); 100: 97.5-100% probability of urbanization by 2060 (continuous scale)
Road Density	Index of stress developed by Haynes et al., (1996) to assess ecosystem stress for aquatic species based on road length per square kilometer *(range Gulf-wide: 0-100; across projects: 0-25.18)*	0: no roads within 564m search radius; 1: 0.01-0.43km road length/km^2 (no/low stress); 34: 0.44-1.06km road length/km^2 (moderate stress); 67: 1.07-2.92km road length/km^2 (high stress); 100: >2.93km road length/km^2 (very high stress)
Impervious Surface	Index of stress developed by Schueler (1994) and refined by Uphoff et al., (2011) for aquatic and estuarine systems based on average percent impervious surface at a watershed scale *(range Gulf-wide: 0-100; across projects: 1-67)*	1: 0-5% average impervious surface (fish habitat generally unimpaired); 34: 6-10% (sensitive/stressed); 67: 11-24% (impacted); 100: >25% (high stress)
Water Hazards	Index based on number of overlapping hazards: high tide flooding, sea level rise (1, 2, 3ft), storm surge (category 1, 2, 3), FEMA flood zone risk (1% and 2% annual risk) *(range Gulf-wide: 0-100; across projects: 75.33-88)*	0: no data; 1: 1 hazard present; 13: 2 hazards present…100: 9 hazards present
Drought	Index of non-consecutive weeks in extreme and exceptional drought (2011-2021) by county based on ecological trend of stress defined by Clark et al., (2016) *(range Gulf-wide: 0-100; across projects: 7-28)*	0: no data; 1: 6-7 non-consecutive weeks in drought; 2: 8-9 non-consecutive weeks;…100: 218 non-consecutive weeks in drought
Wildfire Hazard	Index based on relative potential for wildfire that would be difficult for suppression resources to contain *(range Gulf-wide: 0-100; across projects: 0.33-87.50)*	0: not burnable; 1: very low risk, 26: low risk; 50: moderate risk; 75: high risk; 100: very high risk

Ecosystem Stress Indicator	Description	Ecological Threshold & Scoring
Hydromodification	Inverse of the USEPA Watershed Health geomorphology subindex reflecting stress based on impacts of dams, artificial drainage ditches, near-stream roads, and high intensity land use in riparian zone *(index range: 0-100; range Gulf-wide: 0-61; across projects: 1-6)*	0: lowest potential stress; 100: highest potential stress

Social Vulnerability: Social Vulnerability (SoVI) is composed of 37 significant component variables. The methodology was adapted from LA's 2017 Coastal Master Plan and includes updated Census data as well as additional employment categories. The resultant SoVI consists of six key components derived from the initial suite of variables. Due to the nature of the index calculations, direct comparison between the composite SoVI and the sub-layer values is less straightforward, however some insight can be gleaned from the components explaining the most SoVI variation. These components are illustrated in Figure 17C. In total, most of the variance was captured by Economic Status (24%), Educational Professionals (22%), and Elderly Population (21%). Other significant socially vulnerable groupings include Migrant Workers (16%), Rural Population (9%), and locations with high population turnover (Population Stability; 8%). Rural Population, Migrant Workforce, and Elderly Population exhibit the highest raw scores across the summarized projects. Interestingly, individual projects reflecting high Gulf-wide Blueprint priority and low Integrated Ecosystem Stress show slightly higher sub-index values for Social Vulnerability compared to projects with high Gulf-wide Blueprint priority and high Integrated Ecosystem Stress, however no statistical analyses were conducted to determine the significance of those differences.

3.3. IDENTIFYING OPPORTUNITIES FOR SYNERGISTIC GOALS AND PRIORITIES

Protected areas are an important strategy for preserving biodiversity, however adjacent land use can significantly influence the species and ecosystems within them (Hansen & DeFries, 2007). Therefore, it is important to consider a landscape context for ecosystem restoration. There is opportunity to leverage existing protected lands for expansion if planners can demonstrate that adjacent projects could provide co-benefits, by either increasing the area of contiguous habitat or providing/enhancing an existing ecological corridor.

Marsh creation projects from LA's 2017 Coastal Master Plan located alongside LDWF refuges and wildlife management areas (Figure 18). Although many LA Coastal Master Plan marsh creation areas intersect with protected areas, it's important to note that these project polygons are much larger than any individual marsh creation project implemented on the landscape. Many LA Coastal Master Plan projects are implemented through a series of smaller restoration efforts over time as funding and sediment availability allows.

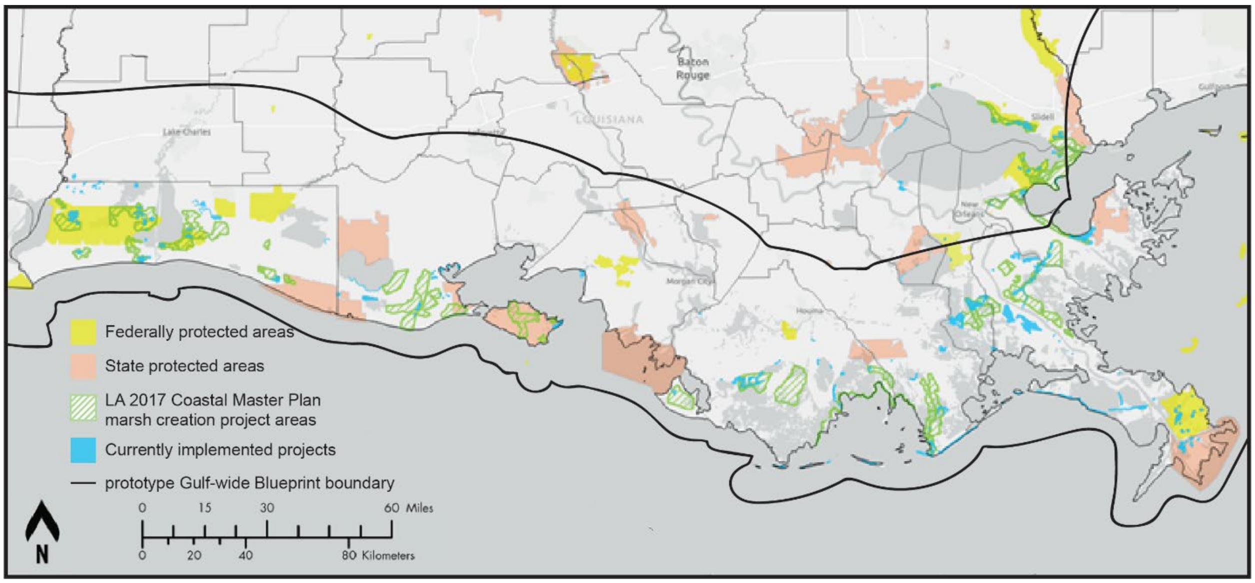

Figure 18. LA's 2017 Coastal Master Plan marsh creation project areas plotted alongside marsh creation projects currently implemented by the state, national wildlife refuges, and state conservation areas. Data from CIMS was used to identify currently implemented projects.

One possible area where state-led marsh creation is underway adjacent to protected areas includes Pecan Island (Vermilion Parish) between Vermilion Bay and White Lake, LA (Figure 19). There are numerous small marsh creation projects currently being implemented around the large marsh creation polygons identified in the LA Coastal Master Plan. A large state-owned wildlife refuge is located in the southwest region of Vermilion Bay intersecting with a marsh creation project area highlighting a potential area of high opportunity: East Rainey Marsh Creation (03b.MC.07). No projects are currently being implemented within that specific marsh creation area, but others have been completed or are in E&D phase (see Table 1). Evaluating against the Gulf-wide Data Suite, East Rainey Marsh Creation area reflects high prototype Gulf-wide Blueprint priority, low ecosystem stress, and low social vulnerability (Figure 16, Figure 19).

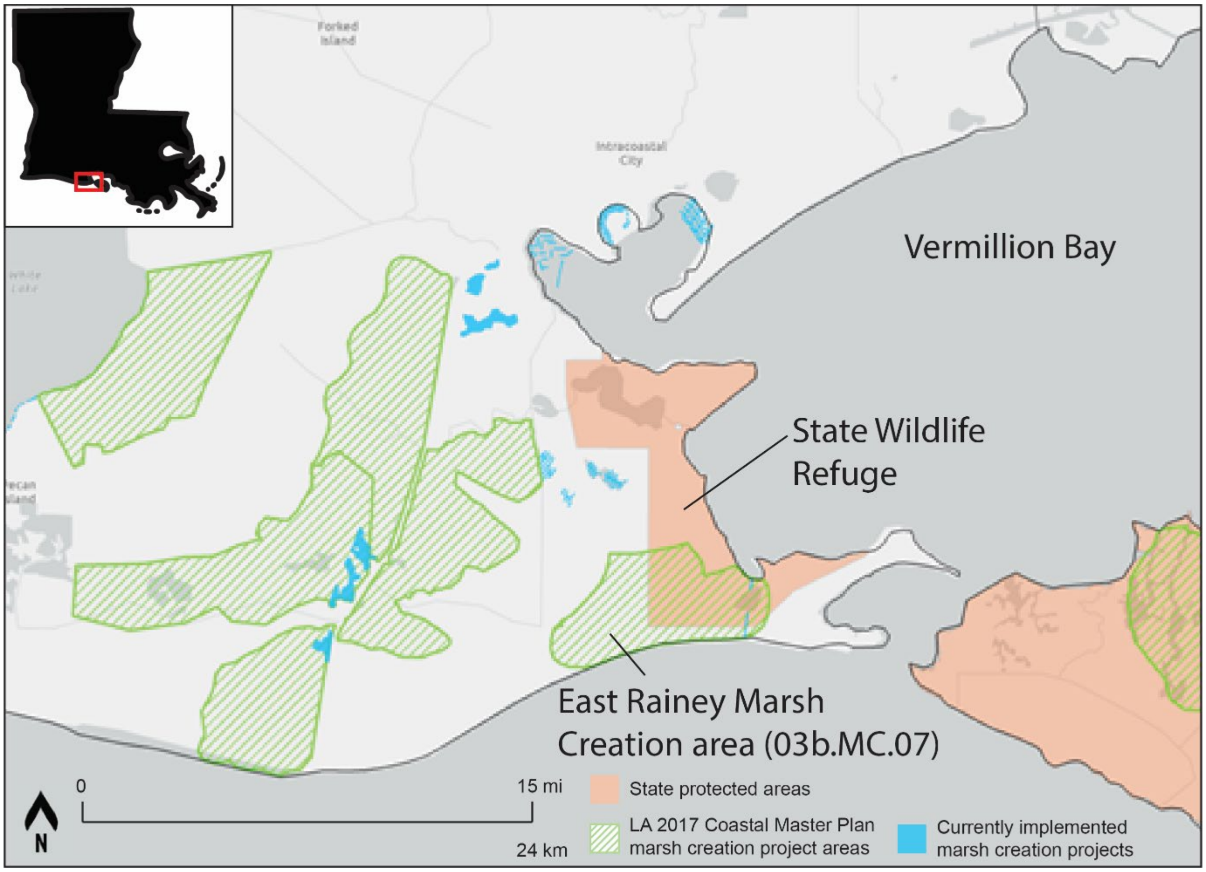

Figure 19. Opportunity for linkage between a state wildlife refuge and East Rainey Marsh Creation project area (LA's 2017 Coastal Master Plan 03b.MC.07) in Vermillion Parish. Currently implemented projects occur as smaller implementation projects within the broader project area and may also reflect opportunities for project prioritization.

Another key area to consider is the Calcasieu Lake area in Cameron Parish, an area with two large national wildlife refuges abutting the southern portion of the lake: Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge (Figure 20). LA's 2017 Coastal Master Plan marsh creation project areas in this area reflect medium and high prototype Gulf-wide Blueprint priority but also high Integrated Ecosystem Stress, highlighting this area as a key candidate for project implementation to mitigate sources of ecosystem stress. An investigation into individual stress indicators for these projects revealed that the highest potential sources for ecosystem stress (where average stress >50 on a scale of 0-100) include Non-Point Source Pollution, Water Hazards (e.g., sea level rise, coastal flood hazard), and Wildfire Hazard.

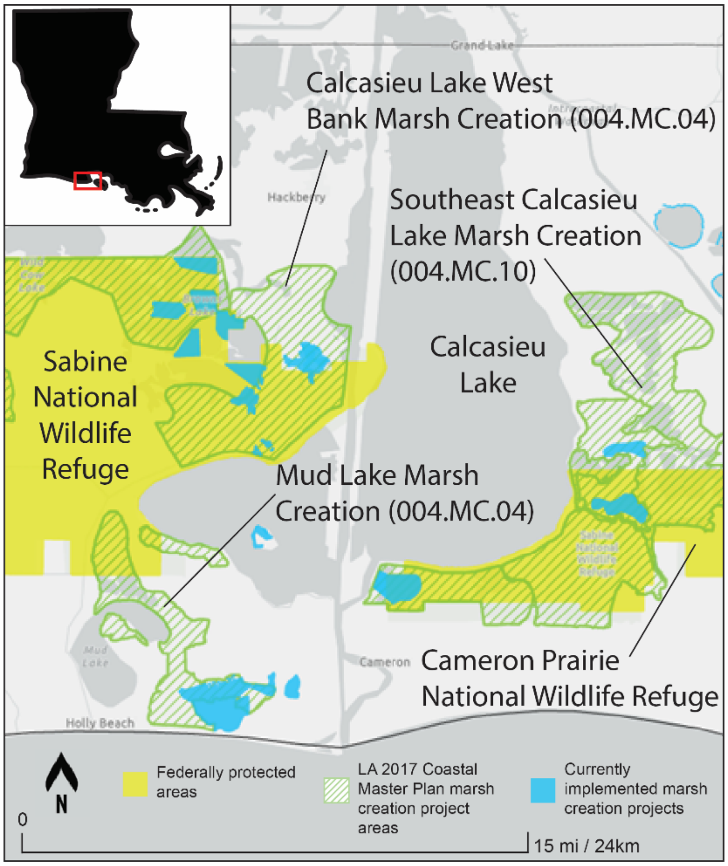

Figure 20. Opportunity for linkage between national wildlife refuges and LA's 2017 Coastal Master Plan marsh creation areas in Cameron Parish. Key areas to consider include Mud Lake Marsh Creation (004.MC.04), Calcasieu Lake West Bank Marsh Creation (004.MC.04), and Southeast Calcasieu Lake Marsh Creation (004.MC.10). Marsh creation projects currently implemented by the state are also indicated.

USFWS may consider prioritizing opportunities to seek additional project implementation in the areas identified. Advancing restoration objectives of the LA Coastal Master Plan by increasing implementation of marsh creation and restoration clearly aligns with the objectives and goals of SECAS and USFWS for expanding total area and connectivity of protected areas across the landscape. These projects present opportunities for synergistic co-benefits.

3.3.1 Areas of Specific Interest within LA: Atchafalaya Basin – SECAS Prototype Gulf-wide Blueprint as an Iterative Support Tool Requiring SME Input

Due to the regional nature of the prototype Gulf-wide Blueprint, certain areas that are prioritized locally (e.g., by individual states) may not be prioritized in the Gulf-wide Blueprint. This is due to the nature of the algorithm (the Zonation software) used to evaluate priority across the entire northern Gulf of Mexico region as well as the input data layers selected for analysis. The prototype Gulf-wide Blueprint relies only on Gulf-wide data layers used in other SECAS sub-regional Blueprints to maintain synergy with SECAS.

One example of a locally prioritized area in LA is the Atchafalaya Basin. The Atchafalaya River is the largest distributary of the Mississippi River and holds "the best example of forested wetlands in Louisiana and the largest remaining floodplain swamp in the country" (Holcomb et al., 2015). However, this basin is only partially prioritized in the prototype Gulf-wide Blueprint (Figure 21). As stated above, investigations of the indicators of the prototype Gulf-wide Blueprint alone cannot provide a quantitative explanation for why this area is not highly prioritized. However, they do provide some key insights. For example, Figure 21C illustrates the high habitat condition (values of 14 in the Habitat Condition Indicator) of the northern basin, an area rich in bottomland hardwoods and forested wetlands, likely driving the medium prioritization value in that mid-basin region. In the lowest portion of the basin, a small area of critical habitat (Critical Habitat Indicator) is likely responsible for the high priority value in that area (Figure 21D). The largest area of medium priority value in the southern portion of the Atchafalaya Basin is likely due to by the presence of large acres of contiguous natural land cover (Intact Habitat Cores Indicator) (Figure 21E) and further prioritized with high values for Riparian Buffers (Figure 21G). However, high values in only a few indicators are not enough to drive high priority scores in a region-wide analysis using Zonation. Application of this method for LA coastal watersheds specifically, using regional as well as local datasets, could offer more precise insight on local conservation priorities.

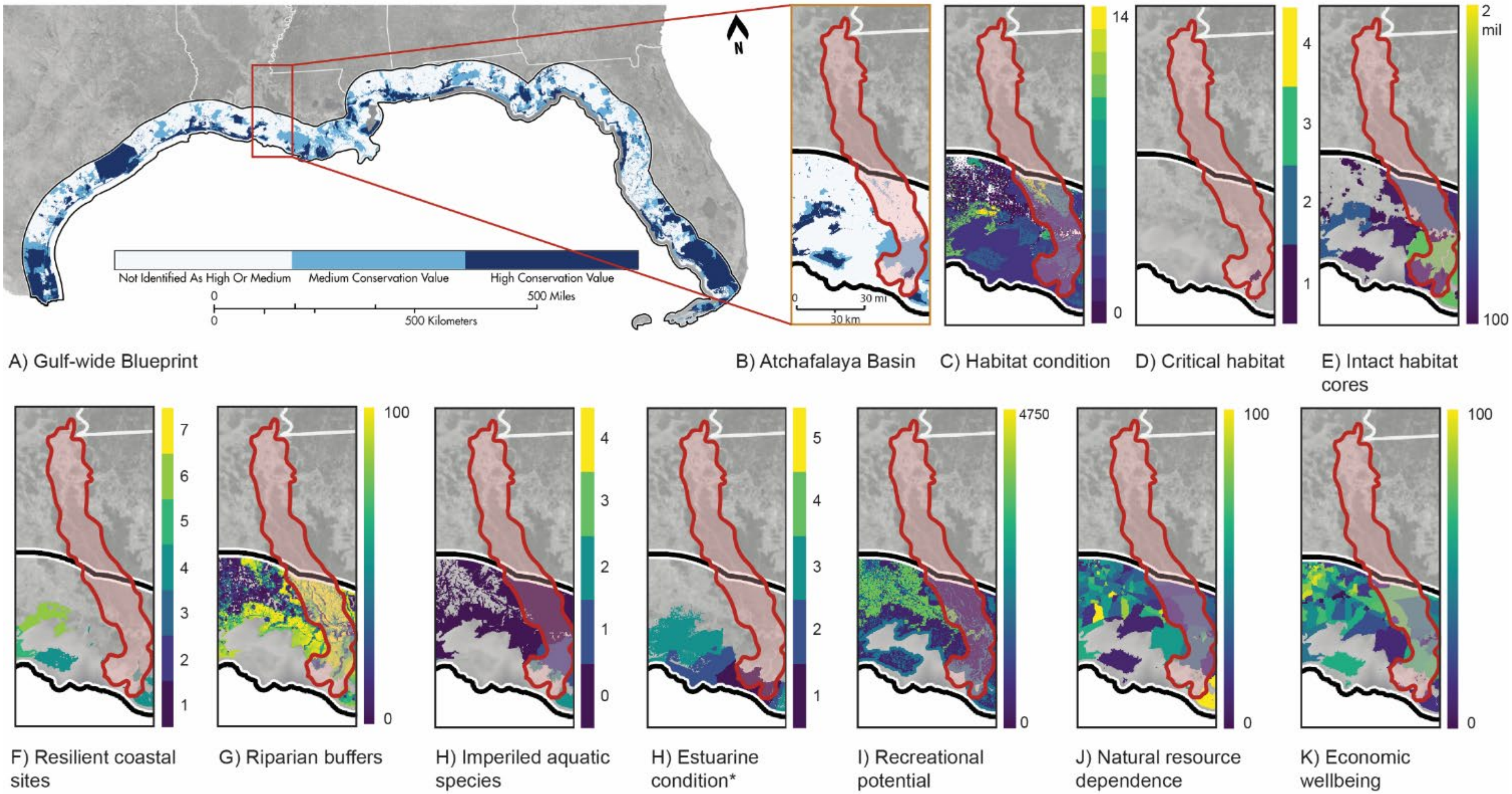

Figure 21. Gulf-wide Data Suite prototype Gulf-wide Blueprint indicator layers for the Atchafalaya Basin. See Kiskaddon et al., (2021) for further detail regarding the metrics for each indicator.

4.0 Recommendations

Based on this assessment of SECAS' proposed Gulf-wide Data Suite in the context of the LA Coastal Master Plan the following recommendations were identified as the opportunities for engagement with the LA restoration planning process in general, and the LA Coastal Master Plan in particular, with the greatest potential for successful synergy and linkage:

- **Recommendation 1: Engage with the LA Coastal Master Plan after initial plan is drafted, but prior to finalization –** The next LA Coastal Master Plan is due for release in 2023, therefore it is expected that the full version of LA's 2023 Coastal Master Plan (including an initial suite of planned restoration projects) will be released for public comment in the third or fourth quarter of 2022. This provides an opportunity for an independent assessment of LA's draft 2023 Coastal Master Plan suite of projects by U.S. Fish and Wildlife Service (USFWS) using the SECAS Southeast Blueprint, Middle Southeast Blueprint, or prototype Gulf-wide Blueprint and associated Gulf-wide Data Suite spatial information.

- **Recommendation 2: Employ SECAS and the Gulf-wide Data Suite to assess benefits of multiple restoration project types –** This analysis focused on evaluating LA Coastal Master Plan marsh creation projects using SECAS Gulf-wide datasets as a demonstration, but additional analysis could consider other types of restoration considered in the LA Coastal Master Plan (e.g., ridge restoration projects and barrier island restoration projects). These project types directly create habitat within a defined footprint and can therefore be directly assessed for benefits. Structural and nonstructural risk reduction projects aimed to mitigate flood and surge hazards also have high potential benefits for increasing marsh health through salinity control and reduced erosion in addition to the flood reduction benefits to local communities.

- **Recommendation 3: Focused analysis for the LA Coastal Master Plan boundary and LA –** The Gulf-wide Data Suite was intended for broad comparisons across the northern Gulf of Mexico coastal region and was developed to extend landward 50 miles from the southern boundary established by states under the Coastal Zone Management Act (CZMA). As a result, it does not fully encompass the extent of the LA Coastal Master Plan boundary. Depending on the desired utility of the natural resource prioritization data offered by SECAS (the Southeast Blueprint, the prototype Gulf-wide Blueprint, or the Middle Southeast Blueprint), a reanalysis focused on the LA state boundary covering the inland extent of the LA Coastal Master Plan is recommended. A modified northern boundary could include the full coastal boundary as well as the full Atchafalaya Basin watershed and any other areas of specific interest within LA.

- **Recommendation 4: Investigate other restoration programs in LA –** While the LA Coastal Master Plan guides CPRA and their efforts to protect and restore the LA coast, it is a high-level process for planning restoration. The CPRA Annual Plan includes a range of funding mechanisms that implements smaller scale projects. These programs may also have opportunity for co-benefits through habitat value for wildlife resources. The Gulf-wide Data Suite could be used to support these programs by identifying the greatest return on investment opportunities.

- **Recommendation 5: Investigate future potential wildlife habitat value changes –** The LA Coastal Master Plan provides output data out to 50 years into the future (via the ICM), based on a range of sea level rise and subsidence scenarios. Areas of land loss comparing FWOA to a future with full restoration implementation would provide an indication of the area of coastal land lost for different wildlife values under the range of scenarios tested. The LA Coastal Master Plan alternatives assume full project implementation, so conclusions cannot be drawn about the influence of a subset of projects in isolation. However, areas of LA's coast that may be considered highest priority with respect to wildlife resources, and over what time period, can be identified.

5.0 Conclusion

The Gulf-wide Data Suite is intended as a detailed series of data to inform discussion and decision making with best available science and is in no way intended to replace expert opinion and input from subject matter experts with local expertise and knowledge. The grid cell resolution and spatial extent of the Gulf-wide Data Suite means that it can be applied at multiple geographic scales and across a large range of restoration and conservation planning programs and processes. The SECAS data products and the Gulf-wide Data Suite have strong potential to assist in increasing linkage and attainment of multiple resource priorities from restoration, through recognition and quantification of locations where restoration can provide multiple ancillary co-benefits. For example, the Gulf-wide Data Suite could be used to identify areas of coastal marsh not currently being restored that could complete a wildlife corridor, extend an existing wildlife refuge, or increase ecosystem services provided to highly vulnerable coastal communities. Comparing these benefits to ecosystem stress data can provide an indication of some key threats that may need to be considered to maximize likelihood of projects success, and consideration of social vulnerability may be relevant for synergies with other funding mechanisms or assist in reporting on the broad range of co-benefits from implemented restoration.

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