

RESTORE Council Activity Description

General Information

Sponsor:

Florida Department of Environmental Protection

Title:

Florida Gulf Coast Resiliency Program

Project Abstract:

The RESTORE Council has approved \$5.6M for planning activities as FPL Category 1 Council-Selected Restoration Component funding for the Florida Gulf Coast Resiliency Program, sponsored by Florida, through the Florida Department of Environmental Protection (FDEP). In addition, the Council is also identifying a separate \$8.4M implementation component as an FPL Category 2 priority for potential future funding. The program will support the primary RESTORE Comprehensive Plan goal to enhance community resilience through activities to identify vulnerabilities and implement sustainable solutions to improve coastal resiliency. Activities include vulnerability assessments to identify strategies to improve resiliency; living shorelines to protect against erosion and reduce wave energy; and coastal and submerged lands management and acquisition activities to protect habitats that enhance resiliency. The FDEP will partner with the Florida Forever Program to identify acquisitions with the Office of Resilience and Coastal Protection on vulnerability assessments and submerged lands management activities. Developing strategies to address resiliency is critical to Florida's ability to adapt to a changing coastline. This program will result in environmental benefits such as resiliency improvements, protections against wave energy and storm surge, habitat protection (e.g., marshes, mangroves, seagrass, coral, and oyster reefs), sustaining healthy wildlife populations, water quality benefits, recreation and tourism opportunities, and fisheries benefits. Program duration is 10 years.

FPL Category: Cat1: Planning/ Cat2: Implementation

Activity Type: Program

Program: Florida Coastal Resiliency Program

Co-sponsoring Agency(ies): N/A

Is this a construction project?: Yes

RESTORE Act Priority Criteria:

(II) Large-scale projects and programs that are projected to substantially contribute to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast ecosystem.

(IV) Projects that restore long-term resiliency of the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands most impacted by the Deepwater Horizon oil spill.

Priority Criteria Justification:

The Florida Gulf Coast Resiliency Program includes a suite of intrinsically-linked activities aimed at improving coastal communities' resiliency to climate change and changing environmental conditions. Program activities will include identifying risks and vulnerabilities, implementing solutions, and

protecting and managing lands to mitigate effects of climate change. The program meets the large-scale and restore long-term resiliency priority criteria.

This program is designed to result in large-scale environmental benefits, particularly in relation to the needs of Florida's coastal communities. Florida is especially susceptible to the effects of climate change, specifically sea level rise. Program activities such as vulnerability assessments will identify areas most susceptible to the effects of climate change and identify strategies to counteract those effects. Program activities will also include projects to improve resiliency, such as planning and implementing living shorelines that protect coastal areas against erosion and acquiring and managing lands, including offshore submerged lands that mitigate effects of climate change (e.g., sequester carbon, protect against flooding and sea level rise). These activities will result in significant environmental benefits to coastal communities, identifying those communities most at risk for future planning and improving protection against erosion, coastal flooding, and sea level rise.

Program activities will help restore long-term resiliency of natural resources most impacted by the Deepwater Horizon oil spill by protecting and enhancing coastal communities and resources that were impacted by the spill. Coastal land protection of marshes, mangroves, seagrass, coral, and oyster beds will help improve coastal community resiliency by protecting communities against sea level rise and storm surge; and improve ecosystem resiliency and sustainability by providing opportunities for coastal wetland migration.

Project Duration (in years): 10

Goals

Primary Comprehensive Plan Goal:

Enhance Community Resilience

Primary Comprehensive Plan Objective:

Promote Community Resilience

Secondary Comprehensive Plan Objectives:

N/A

Secondary Comprehensive Plan Goals:

N/A

PF Restoration Technique(s):

Create, restore, and enhance coastal wetlands, islands, shorelines and headlands: Protect natural shorelines

Improve science-based decision-making processes: Develop tools for planning and evaluation

Protect and conserve coastal, estuarine, and riparian habitats: Land acquisition

Location

Location:

Florida coastlines and estuaries along the Gulf of Mexico.

HUC8 Watershed(s):

South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(Perdido Bay)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Choctawhatchee(Upper Choctawhatchee)
South Atlantic-Gulf Region(Southern Florida) - Southern Florida(Everglades)
South Atlantic-Gulf Region(Southern Florida) - Southern Florida(Florida Bay-Florida Keys)
South Atlantic-Gulf Region(Southern Florida) - Southern Florida(Big Cypress Swamp)
South Atlantic-Gulf Region(Southern Florida) - Southern Florida(Caloosahatchee)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Peace(Peace)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Peace(Myakka)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Peace(Charlotte Harbor)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Sarasota Bay)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Manatee)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Little Manatee)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Alafia)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Hillsborough)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Tampa Bay)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Crystal-Pithlachascotee)
South Atlantic-Gulf Region(Peace-Tampa Bay) - Tampa Bay(Withlacoochee)
South Atlantic-Gulf Region(Suwannee) - Aucilla-Waccasassa(Waccasassa)
South Atlantic-Gulf Region(Suwannee) - Aucilla-Waccasassa(Econfina-Steinhatchee)
South Atlantic-Gulf Region(Suwannee) - Suwannee(Lower Suwannee)
South Atlantic-Gulf Region(Ochlockonee) - Ochlockonee(Lower Ochlockonee)
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(Apalachicola)
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(New)
South Atlantic-Gulf Region(Apalachicola) - Apalachicola(Apalachicola Bay)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(St. Andrew-St. Joseph Bays)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(Choctawhatchee Bay)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(Pensacola Bay)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(Yellow)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Florida Panhandle Coastal(Blackwater)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Choctawhatchee(Lower Choctawhatchee)
South Atlantic-Gulf Region(Choctawhatchee-Escambia) - Escambia(Escambia)
South Atlantic-Gulf Region(Suwannee) - Aucilla-Waccasassa(Aucilla)
South Atlantic-Gulf Region(Ochlockonee) - Ochlockonee(Apalachee Bay-St. Marks)

State(s):

Florida

County/Parish(es):

FL - Escambia

FL - Pasco
FL - Pinellas
FL - Charlotte
FL - Citrus
FL - Collier
FL - Dixie
FL - Franklin
FL - Sarasota
FL - Taylor
FL - Wakulla
FL - Bay
FL - Gulf
FL - Santa Rosa
FL - Walton
FL - Hernando
FL - Hillsborough
FL - Jefferson
FL - Lee
FL - Levy
FL - Manatee
FL - Monroe
FL - Okaloosa

Congressional District(s):

FL - 14
FL - 15
FL - 26
FL - 11
FL - 13
FL - 16
FL - 5
FL - 12
FL - 1
FL - 19
FL - 25
FL - 2
FL - 17

Narratives

Introduction and Overview:

The Florida Gulf Coast Resiliency Program includes planning and implementation activities to identify risks and vulnerabilities and implement sustainable solutions to improve coastal resiliency to the effects of climate change, extreme weather, coastal inundation, and other stressors. Increasing community resilience is a priority for Florida where coastal communities and habitats are at significant risk to rising sea levels (FDEP 2018). The program will consist of a suite of intrinsically linked activities that in combination result in significant improvements in resiliency. Activities may include: vulnerability assessments, construction of living shorelines, and land acquisition and management. All program activities will occur within the 23 counties along the Florida Gulf of Mexico coastline (see Figures 1 through 3) and will address similar environmental stressors resulting from climate change, rising sea levels, and increasing intensity of storms.

FDEP will evaluate proposals submitted by the public and select those that fulfill the program purpose (e.g., enhance resiliency in vulnerable communities, protect natural resources, sustain healthy ecosystems, and allow communities to adapt to changing conditions). The program will enable FDEP to fund critical projects that will make significant, measurable improvements to the long-term resiliency of natural resources, fisheries, marine and wildlife habitats, beaches, coastal habitats, and Florida's coastal communities.

Goals/Objectives: This program meets the Enhance Community Resilience Comprehensive Plan goal and the Promote Community Resilience objective. The program will increase the capacity of the highest risk communities to adapt to short-term changes, such as increased flood risks or storm surge, and long-term changes, such as rising sea levels, by: identifying strategies to address resiliency, which is critical to Florida's ability to adapt to a changing coastline; creating living shorelines to reduce erosion, wave energy, and protect against storms; and acquiring and managing lands in critical areas that will allow habitats and species to adapt or migrate in response to changing climate and coastlines.

Commitments: The program illustrates Florida's commitment to science-based decision making. Vulnerability assessments allow ecological, social, and economic information to be viewed alongside sea level rise and storm surge scenarios to assist in resiliency planning. These efforts allow FDEP to identify science-based strategies to counteract the effects of climate change. For land acquisitions, FDEP will leverage the Florida Forever Program (FF) priority list targeting the Climate Change Lands category (FF 2019); FF utilizes a science-based evaluation process where parcels are ranked based on environmental conditions that include protection of coastal habitat and mitigation of effects of sea level rise.

FDEP is committed to public engagement, inclusion, and transparency. Stakeholders were engaged in the development of this program through numerous meetings with local entities. The public will also have the opportunity to propose projects for implementation during the project proposal stage. Vulnerability assessments and implementation of resiliency strategies will have required public engagement elements, particularly targeting vulnerable populations in the community. Products of all program activities will be required to be posted on a publicly available website by the grantee. The program will leverage resources and partnerships to identify and implement activities. When evaluating activities, FDEP will consider whether the project leverages other funding sources. For land acquisitions, the program will coordinate with FF to identify projects. FDEP will also coordinate with local entities to identify projects and program activities; as well as FDEP's Office of Resilience and Coastal Protection (ORCP), which has identified communities that need a vulnerability assessment. Finally, illustrating Florida's commitment to coordinating resources and partnerships, delivering results, and relying on the best available science, Florida's Governor appointed the first Chief Resilience Officer (CRO) in August

2019. The CRO is tasked with preparing for the environmental, physical, and economic impacts of sea level rise. The CRO will coordinate, as needed, with the FDEP and the ORCP to execute this program.

Environmental Benefits: Much of the Florida coast is developed and approximately 80 percent of Florida's population live within 10 miles of the coast (FDEP 2018). Due to low elevations, coastal communities and habitats are at significant risk from the effects of climate change, especially rising sea levels and flooding (FDEP 2018). The program will result in significant environmental benefits to coastal communities by increasing coastal resiliency, specifically through implementation of vulnerability assessments, living shorelines, and conservation or increased protection of natural areas, including offshore submerged lands and riparian buffers.

Efforts to assess a community's vulnerability to projected climate change-related short and long-term changes have become increasingly valuable for planning and implementing appropriate strategies for mitigation and adaptation. Vulnerability assessments help identify communities at risk by evaluating the range and magnitude of impacts based on various scenarios (e.g., sea level rise, temperatures, frequency and duration of fires, drought, and extreme weather events). Understanding what makes a community most vulnerable to climate change allows resource managers to plan and implement corrective measures to mitigate threats (FDEO 2015, FDEP 2018, Stys et al. 2017).

Coastal habitats such as barrier islands, marsh, mangroves, seagrass, oyster reefs, and coral reefs have the capacity to reduce wave energy and erosion, protecting coastal communities from sea level rise and in some cases, storm surge (Beck et al. 2018, Boutwell and Westra 2016, Ferrario et al. 2014, Guannel et al. 2016, Liu et al. 2013, USGCRP 2018, Zhang et al. 2012). Natural vegetation and networks of connected wetlands stabilize shorelines by trapping sediments and filtering excess nutrients from urban runoff, while providing essential habitat for commercially valuable species. Living shorelines enhance shoreline stabilization and coastal protection against sea level rise and wave energy (Bilkovic and Mitchell 2017).

Acquisition, conservation, and regulatory protection of natural areas, including unique, imperiled, and ecologically valuable habitats (e.g., riparian buffers, wildlife corridors, submerged lands), promotes coastal resiliency and strengthens natural resources. Protecting large areas of natural lands preserves the ecosystems that reduce wave energy and erosion. Land conservation protects native biodiversity and ecosystem function, promotes connectivity, increasing genetic diversity and species fitness, and allows for migration or adaptation as climate change induces shifts in species' range of distribution (Damschen et al. 2019, DeFreese 1995, Tewksbury et al. 2002). Land conservation enhances water resource protection by reducing impervious surfaces, allowing water to filter naturally, reducing flooding, and improving water quantity and quality (Shepard et al. 2016).

FDEP has demonstrated success implementing these project types previously across the Gulf Coast of Florida. FDEP, in coordination with other State and Federal partners, has developed guidance on adaptation planning and vulnerability assessments (FDEO 2015, FDEP 2018) and has funded approximately 60 projects that produced vulnerability assessments for more than 20 communities. FDEP has successfully constructed a number of living shoreline projects, notably "Project Greenshores" in Pensacola Bay (FDEP 2019a) and a living shoreline in Panama City that received EPA's Gulf Guardian Award in 2013 (Florida Living Shorelines 2020). Nearly 10 million acres of land has been acquired and managed for conservation in Florida, more than 2.5 million acres of which were purchased under FF and an earlier State program (FNAI 2020).

Environmental Stressors: Comprehensive resource management and planning efforts, such as FF, Florida Gulf Environmental Benefit Fund Restoration Strategy, Basin Management Action Plans, Aquatic preserve Management Plans, and others have identified stressors and threats to Florida's natural resources including habitat loss and fragmentation, and effects of climate change such as sea level rise. This program will directly address habitat loss and fragmentation through acquisitions and land management protections, address the effects of climate change by constructing living shorelines to reduce wave energy and protect coastal lands to enhance resiliency and sustainability.

Costs: \$14,000,000. Funds for this program will leverage resources from FF. Category 1 funds will be used for program management, monitoring and adaptive management, and data management activities, living shoreline planning, design, and environmental compliance; and development of vulnerability assessments. Category 2 funds will be used for implementation of living shorelines, land acquisition, and project monitoring.

Timeline: The duration of program planning and implementation is expected to be 10 years. Land acquisitions identified from the FF priority list could begin as funding is received; lands will be maintained in perpetuity.

Partners: FDEP will partner with FF to leverage FF's science-based approach to conservation and streamline the land acquisition process. Other program partners include the FDEP ORCP on submerged lands stewardship activities and vulnerability assessments. ORCP has awarded more than \$4 million over the last two years to prepare coastal communities for the effects of rising sea levels, flooding, and erosion.

FPL 3 Planning Framework: This program is consistent with the Protect and Conserve Coastal, Estuarine, and Riparian Habitats priority approach identified in the FPL 3 planning framework. The primary goal and objective of this program is to improve coastal resiliency, through techniques such as living shorelines and coastal habitat protection. Identifying strategies to improve coastal resiliency will help ensure Florida's coastal communities are able to adapt to the effects of climate change by conserving Florida's natural resources, reducing wave energy, protecting against storm surge, and providing opportunities for species and habitat migration.

Methods:

The Florida Gulf Coast Resiliency Program consists of a suite of intrinsically linked conservation activities designed to identify risks and vulnerabilities and implement sustainable solutions to improve coastal community resiliency to the effects of climate change, extreme weather, coastal inundation, and other environmental stressors. This program could include various activities such as vulnerability assessments; planning, design, and construction of living shorelines (where needed and viable); acquiring and managing lands for conservation; as well as other activities that improve coastal resiliency such as habitat restoration (e.g., oyster reef, marsh, beach and dune, floodplain, mangrove, coastal forest, coral reef), or restoring flowways to sustain marsh vegetation. As such, the program will rely on a range of methods for the various activities. The methods FDEP will utilize to select projects or activities under this program (i.e., decision criteria) and a description of methods for some of the activities is provided below.

Project or activity selection criteria. The goal of this program is to enhance and promote community resiliency by increasing the capacity of Florida's coastal communities to adapt to short- and long-term changes such as increased flood risks, storm surge, and rising sea levels. The objectives of the program

are to identify communities most vulnerable to the effects of climate change and their resources which are most at risk; identify strategies to address coastal resiliency; and to implement sustainable solutions to improve coastal resiliency, such as constructing living shorelines to reduce wave energy which protects against storms, or acquiring and managing coastal lands, offshore submerged lands, urban riparian buffers, flowways or other habitats that will help mitigate the effects of climate change.

Program activities will be selected from proposals submitted by the public. We anticipate one request for proposals for all three project types. FDEP will utilize an approach similar to the Deepwater Horizon natural resource damage assessment project portals and issue a public notice to solicit proposals. The notice will clearly describe the goal and objectives of the program and the types of activities that will be considered.

In selecting program activities from submitted project proposals, FDEP will screen and evaluate each proposal to ensure it meets the goal and objective of the program. If a proposal meets the screening criteria, FDEP will evaluate the proposal further according to the evaluation criteria. FDEP would then select program activities based on the extent to which the proposals meet the evaluation criteria and those that are likely to benefit coastal community resilience most cost-effectively. Proposals that meet all of the initial screening and evaluation criteria will be further evaluated within the framework outlined below for each of the three project types included in this program. The project selection process for each of the three project types are distinct. Ultimately, the number and type of projects selected for implementation will depend on project proposals and will be scaled to the program budget.

Screening criteria

- 1) Does the proposal have sufficient information to allow for screening and evaluation?
- 2) Is the project proposal consistent with the program goal and objective?
- 3) Is the proposed project feasible (i.e., has not already been completed, does not conflict with any State or Federal regulations, etc.).

Evaluation criteria

- 1) Extent to which the project proposal is cost-effective (i.e., reasonable and comparable to other equivalent activities; low cost compared to likely benefits).
- 2) Extent to which the project proposal is supported by the local community.
- 3) Extent to which the project proposal leverages other funding sources (including in-kind services).
- 4) Extent to which the project proposal provides benefits to multiple communities and/or multiple natural resources.
- 5) Extent to which the project proposal meets the goal and objective of the program.
- 6) Proposed project location (i.e., whether it is located in an area that is vulnerable to current and future risks including flooding, storm surge, erosion, or rising sea levels).
- 7) Sustainability and/or likelihood of long-term success of the proposed project.

Vulnerability assessments. Vulnerability assessments will be conducted specifically to identify sensitive areas (i.e., communities and resources at risk) and assist in resiliency planning for sea level rise and storm surge scenarios. Assessments may include an exposure analysis, a sensitivity analysis, an assessment of adaptive capacity, and selection of focus area for adaptation strategies (FDEO 2015, FDEP 2018). Proposals to conduct vulnerability assessments will be prioritized for coastal areas where hazard evaluations and adaptation planning have not been previously conducted, or where the largest concentration of people and property are at risk. Butler et al. (2016) found that only 49 percent of coastal counties in Florida had conducted some form of hazard assessment or developed some type of plan for sea level rise. Ultimately, the results of any vulnerability assessments conducted may be used to

inform living shoreline and land acquisition project selection, by prioritizing those projects that will improve coastal resiliency in areas deemed to be the most vulnerable or with high adaptive capacity. Participation of stakeholders in the vulnerability assessments will be required when possible.

When planning vulnerability assessments, Florida will utilize a science-based process, coordinate with ORCP staff as needed, and follow state guidance. Specifically, vulnerability assessments will follow guidance outlined in the Florida Adaptation Planning Guidebook (FDEP 2018) and the Sea-Level Rise Vulnerability Assessment Tools and Resources (FDEO 2015), among others. FDEP may also refer to previously conducted local and regional vulnerability assessments (e.g., Beever III et al. 2009, Taylor Engineering, Inc. 2019) which have included sea level rise and storm surge risk models such as the Sea Level Affecting Marshes Model (SLAMM) and an ADvanced CIRCulation Model (ADCIRC).

Living shorelines. Living shoreline proposals may be considered independent of any specific vulnerability assessment or they may be prioritized based on the results of a vulnerability assessment conducted. Selection of individual living shoreline proposals will be based on best available science (Miller 2015, NOAA 2015). Proposal evaluations will consider factors such as ecological resources present and adjacent land use as part of a science-based process to prioritize projects (Taylor Engineering, Inc. 2019). For any living shoreline proposals selected, FDEP will require a professional services contractor to conduct site investigations, complete necessary engineering and design, and regulatory compliance. Any professional services agreement will be drafted and executed in accordance with Florida laws and regulations. The selected professional services contractor will be required to conduct site visits as necessary, develop designs, construction drawings as applicable, and determine the necessary permits required to complete the project. Upon receipt of all needed approvals, an Invitation to Bid for construction will be issued in accordance with Florida State procurement laws.

Land acquisition and management. Each land acquisition or management proposal will be considered independently. However, some land acquisition proposals may be prioritized based on the results of a vulnerability assessment conducted. Land acquisitions may be suggested by the public through project proposals or identified through the FF priority list which is updated annually (FF 2019). Florida will employ a science-based process in selecting lands for acquisition and management. This will involve evaluating a parcel's habitat, location, and the potential benefits related to improving coastal resiliency to the effects of climate change, extreme weather, coastal inundation, and other stressors and increasing coastal community resilience. For parcels on the FF priority list, Florida may consider lands for acquisition from the Climate Change Lands category, or other parcels that drain to the Gulf of Mexico which may help strengthen coastal resiliency or mitigate the effects of climate change including coastal salt marshes, mangroves, oyster reefs, riparian buffers, or flowways. FF utilizes a science-based process including a thorough scientific review and a comprehensive natural resource analysis and scoring process to rank parcels and develop the FF priority list. The goal of the process is to conserve environmentally unique and irreplaceable lands or rare ecosystems, native flora and fauna, important breeding locations, natural areas for recreation, and archaeological or historic sites (Section 259.105, F.S.). A series of geographic data layers including information on various measures used by FF (e.g., rare species habitat conservation priorities, ecological greenways, landscape-sized protection areas, significant surface waters, natural floodplains, functional wetlands) are utilized to help rank the parcels (see FNAI 2018 for additional details on the methods and process). Once a parcel is selected for acquisition, FDEP will follow the land acquisition procedures outlined in the Florida Statutes, Chapter 259, Land Acquisitions for Conservation or Recreation (Section 259.105, F.S.) for parcels within FF. FDEP's Division of State Lands or its local acquisition partners will contract an appraisal of land from an independent private sector appraiser to estimate market value, negotiate with owners to buy the land, conduct any required due diligence such as site environmental assessments, and complete the acquisition. Lands acquired would be titled to the State, a county, or local government and protected in

perpetuity. Land management proposals could include seagrass, coral reef, marsh, and mangrove restoration activities along with other types of stewardship activities identified in land management plans.

Environmental Benefits:

Florida has approximately 1,350 miles of coastline including diverse habitats such as beaches, dunes, estuaries, and more than 10 million acres of wetlands (Beaver 2006, Dahl 2005, FNAI 2010). Much of Florida's coast is developed and approximately 80 percent of the population live within 10 miles of the coast (FDEP 2018). Due to the State's low elevations, coastal communities are at significant risk from the direct and indirect effects of climate change, especially rising sea levels, extreme weather, storm surge, flooding, and erosion (FDEP 2018). Conserving coastal lands can enhance community and ecosystem resiliency to both direct and indirect impacts of climate change (USGCRP 2018). The program will result in significant environmental benefits to coastal communities by increasing community resiliency through vulnerability assessments, living shorelines, and land conservation and management.

As impacts from climate change increase, efforts to assess a community's vulnerability are increasingly valuable for planning and implementing appropriate mitigation and adaptation strategies. Vulnerability assessments help identify those areas most at risk and evaluate the potential range and magnitude of impacts based on various scenarios (e.g., increasing sea levels, temperature, frequency and duration of fires, drought, or extreme weather). Understanding what makes a community most vulnerable to climate change allows resource managers to plan and implement corrective measures to mitigate future threats. Previous regional vulnerability assessments have integrated projected sea level rise with socioeconomic data to identify locations that might be most vulnerable (Emrich et al. 2014, Thatcher et al. 2013), helping communities effectively distribute limited resources.

An understanding of the adverse effects of hardened shorelines and the value of natural shorelines for coastal protection has led to a reprioritization of coastal management policy (Bilkovic and Mitchell 2017, Reguero et al. 2018). Natural communities such as barrier islands, marsh, mangroves, seagrass beds, oyster reefs, and coral reefs can reduce wave energy and erosion, protecting coastal communities from sea level rise and in some cases, storm surge (Beck et al. 2018, Boutwell and Westra 2016, Ferrario et al. 2014, Guannel et al. 2016, Liu et al. 2013, USGCRP 2018, Zhang et al. 2012). Wetland presence has been shown to be negatively correlated with economic damages following hurricanes and storm surge (Boutwell and Westra 2016), providing further evidence that wetlands increase community resilience. Natural vegetation and networks of connected wetlands further stabilize shorelines by trapping sediments and filtering excess nutrients from urban runoff. Living shorelines are constructed to enhance shoreline stabilization and coastal protection to climate change impacts. A review of restoration projects following Hurricane Sandy found that living shorelines were five to eight times more cost-effective than stone revetments for erosion control (Abt Associates 2019).

Florida ranks in the top three states nationally where existing coastal habitat is expected to defend the greatest number of people and property from sea level rise (Arkema et al. 2013). It is estimated that preserving and restoring coastal habitats in the U.S. could reduce the impacts of sea level rise on people and their property by half (Arkema et al. 2013). Conservation of natural lands in Florida, including unique, imperiled, and ecologically valuable habitat (e.g., riparian buffers, wildlife corridors), promotes coastal resiliency. Protecting large areas of natural lands directly protects the communities by reducing wave energy and shoreline erosion and reducing the impacts of future development. Land acquisition conserves native biodiversity, ecosystem function, promotes connectivity, increasing genetic diversity and species fitness, and allows for migration as climate change induces shifts in species' distribution

ranges (Damschen et al. 2019, DeFreese 1995, Tewksbury et al. 2002). Conservation of riparian buffers and natural flowways can help mitigate floods and protect coastal communities susceptible to flood risk (World Bank 2018).

Acquisition or management of coastal areas can protect against “coastal squeeze,” when rising sea levels coupled with urban barriers prevent marsh from migrating to higher elevations (Borchert et al. 2018). Vegetated coastal habitats (e.g., marsh, mangrove, seagrass) contribute one- to two-orders of magnitude greater carbon sequestration per unit area compared to terrestrial forests (Mcleod et al. 2011). Thus, conserving and protecting these coastal ecosystems will contribute positively to offsetting increased atmospheric carbon dioxide that contributes to climate change. Finally, land conservation enhances water resource protection and management, reducing impervious surfaces, allowing water to filter naturally, and reducing flooding (Shepard et al. 2016).

Metrics:

Metric Title: RES003: Community Resilience - # of residential, commercial, and public facilities benefiting

Target: TBD

Narrative: Florida will use this as a program-wide metric to evaluate the success of the program. Program success will be determined as the number of residential, commercial, and public facilities benefited by the program, as applicable. Because specific projects or activities have not been identified as of yet under the program, a target value or range of values cannot be proposed, as it would be purely speculative. As projects or activities are selected for funding a range of values for this program metric can be proposed at that time. Each project or activity funded under this program may not be captured by this metric. Additional metrics will be determined to capture the benefits of each technique utilized under this program; specifically, each project or activity selected under the program will have specific metrics aimed at evaluating the success of the individual project or activity.

Metric Title: HR012: Shoreline protection - Miles of living shoreline installed

Target: TBD

Narrative: Florida will use this as a project or activity metric. The project or activity metrics may be adjusted as needed once projects or activities are funded. Metrics may be added, removed, or replaced as appropriate at the project work plan application stage. Once a project or activity is selected a target value will be established. Project or activity success will be determined as the number of miles of living shoreline installed. The purpose of this metric will be to verify that the living shoreline had been completed according to plans and designs. The outcome will be an increase in miles of living shoreline.

Metric Title: HC001: Conservation easements - Acres protected under easement

Target: TBD

Narrative: Florida will use this as a project or activity metric. The project or activity metrics may be adjusted as needed once projects or activities are funded. Metrics may be added, removed, or replaced as appropriate at the project work plan application stage. Once a project or activity is selected a target value will be established. Project or activity success will be determined as the total number of acres protected under a conservation easement. The purpose of this metric will be to verify that the conservation easement has been acquired and recorded in property records. The performance measure will be an executed and recorded conservation easement

agreement. Upon receipt of the executed and recorded agreement, this metric will be complete. The outcome will be an increase in acres protected under easement, and lands will be conserved in perpetuity.

Metric Title: HC003: Land acquisition - Acres acquired in fee

Target: TBD

Narrative: Florida will use this as a project or activity metric. The project or activity metrics may be adjusted as needed once projects or activities are funded. Metrics may be added, removed, or replaced as appropriate at the project work plan application stage. Once a project or activity is selected a target value will be established. Project or activity success will be determined as the total number of acres acquired in fee. The purpose of this metric will be to verify that acquisition has been completed, and the performance measure will be an executed and recorded deed. Upon transfer of the parcel to Government ownership, this metric will be complete. The outcome will be an increase in protected acres.

Metric Title: PRM010: Research - # studies used to inform mgmt.

Target: TBD

Narrative: Florida will use this as a project or activity metric. The project or activity metrics may be adjusted as needed once projects or activities are funded. Metrics may be added, removed, or replaced as appropriate at the project work plan application stage. Once a project or activity is selected a target value will be established. Project or activity success will be evaluated and determined as the number of vulnerability assessments completed and used to inform management over the duration of the program. The purpose of this metric will be to verify and track that the vulnerability assessment has been completed, and the performance measure will be a completed vulnerability assessment report.

Risk and Uncertainties:

Florida's coastal communities are at significant risk from the effects of climate change, especially rising sea levels and temperatures, flooding, storm surge, erosion, and drought (Emrich et al. 2014, EPA 2017, FDEP 2018, Neumann et al. 2015, Strzepek et al. 2010). Florida has demonstrated a commitment to coastal resiliency and adaptation planning. In 2009, the first Climate Leadership Summit was convened by Broward, Miami-Dade, Monroe, and Palm Beach Counties. Since that time, FDEP, in coordination with other State and Federal partners, has developed guidance on adaptation planning and vulnerability assessments (FDEO 2015, FDEP 2018). FDEP has funded approximately 60 projects that produced vulnerability assessments for more than 20 communities. In 2019, the Governor appointed the first CRO to help prepare for the impacts of sea level rise in partnership with FDEP. Based on FDEP's experience, and the technical assistance available, there is a strong likelihood of success for executing the climate resiliency activities in this program. Nevertheless, both short- and long-term risks and uncertainties are inherent in planning and implementing this program. There are also risks associated with climate change and uncertainties with climate change projections, both of which require careful consideration in planning for the long-term success of the program. This program will promote long-term coastal resiliency in each activity through an adaptive management approach and site-specific consideration of local and regional risks and uncertainties.

Near-term risks and uncertainties associated with this program are related to planning and implementing program activities (e.g., vulnerability assessments, living shorelines, or acquisitions). Risks include the uncertainty in project budget estimates and potential cost overruns. These risks can be mitigated through careful cost estimation, including reasonable contingencies, effective planning and

design, third-party oversight, and adaptive management. Climate change science remains a source of public debate, thus public controversy is another near-term risk for this program that can be minimized through public engagement and transparency. Entities receiving funding will be required to document strong operation and management capabilities and financial resources to assure long-term project success.

While FDEP has successfully funded vulnerability assessments, funded and implemented living shoreline projects, and conserved natural areas, there may be unexpected issues that arise. In planning living shorelines, unknown aspects of current site conditions, changing conditions, and unanticipated changes to a project's scale can alter plans. For land acquisition projects, near-term risks and uncertainties include the continued availability of properties, the successful negotiation of sales with landowners, and the cost of the land. These can be mitigated through thoughtful discussion with landowners, quality appraisals, and due diligence.

No near-term socioeconomic risks are anticipated from land acquisition or vulnerability assessment projects. Some near-term socioeconomic risks may be associated with construction of living shorelines. Construction activities have the potential to impact aesthetics, increase noise and local traffic, restrict access to recreational or commercial fishing sites, or navigation channels. However, impacts will be mitigated to the extent possible. Further, any impacts will be offset by the socioeconomic benefits of the program overall.

Long-term risks and uncertainties for this program are primarily associated with the uncertainty in making projections of future climate change scenarios for project implementation and design and the potential impact of climate change on the success and sustainability of program activities.

Climate change is projected to have a number of potential impacts in Florida, including but not limited to rising sea levels, warming air and water temperatures, increased frequency and magnitude of extreme weather events, storm surge, floods, drought, wildfires, increased erosion, and increases in invasive species. Florida is especially susceptible to sea level rise due to the overall low elevations and subtle topography (Emrich et al. 2014). Emrich et al. (2014) evaluated potential climate change impacts in Florida using a range of available models. Despite the uncertainties associated with model predictions, the risk associated with sea level rise is clear; every coastal county in Florida was found to be at risk for storm surge and 12 counties had residents at extreme risk to the lowest prediction of sea level rise investigated. As cited in Stys et al. (2017), 25 percent of 1,200 species tracked by the FNAI are expected to lose more than half of their current habitat area due to sea level rise. Studies have demonstrated the direct impact of sea level rise, reducing abundance and distribution of plant and animal species restricted to low elevation habitats in Florida (LaFever et al. 2007, Ross et al. 1994).

Vulnerability assessments rely on the selection and application of appropriate climate change projections. A range of future scenarios currently exist. Climate change modeling and decision support tools will be used to develop scenarios of future conditions, in the development of vulnerability assessments, but also during planning of living shorelines and identification of lands for acquisition. The current state-of-the-art approaches for climate change vulnerability and resilience/adaptation assessments, recognizing the significant uncertainty in projections of climate and sea level rise, includes just such an assessment of robust results across multiple scenarios (Chambwera et al. 2014, Moss et al. 2019). In general, resilience practitioners indicate that a common challenge is that action plans are stalling at the implementation stage, and in cases where uncertainty is considerable, project implementation is often structured as an iterative adaptive process (see Moss et al. 2014). This has led to an interest in alternative risk-based decision-analysis frameworks for adaptation, such as robust

decision-making (Hallegatte et al. 2012), multicriteria analyses, or qualitative risk matrix calibrations when data are scarce. For this program, ensuring robustness of the projected outcomes of project applications across multiple climate scenarios is one way to limit the risk associated with climate science uncertainty.

Assessing the long-term success of living shorelines and land acquisition projects in sustaining climate resiliency may depend on future climate projections. During project planning, accounting for future sea level rise in determining the appropriate depth for a living shoreline will help to effectively reduce wave energy for shoreline protection. Also, for land acquisition, the success of conservation for coastal resiliency depends on the appropriate consideration of climate change impacts on those lands in the future. The sections below summarize some of the risks and uncertainties associated with climate change as well as the risks and uncertainties associated with the program activities and the long-term success of the program. A source for U.S. sea level rise and storm surge scenarios is the U.S. Global Change Research Program's Climate Change Science Report, which includes six sea level rise trajectories for the contiguous U.S. and storm surge return period exceedance curves at all Florida tide gauge locations (Sweet et al. 2017, USGCRP 2017).

Conservation and management of coastal habitats that have the capacity to provide a natural buffer to waves and storm surge (e.g., marshes, mangroves, submerged aquatic vegetation, oyster reef, coral reef, and barrier islands) will increase Florida's resiliency to climate change (Beck et al. 2018, Boutwell and Westra 2016, Ferrario et al. 2014, Guannel et al. 2016, Liu et al. 2013, USGCRP 2018, Zhang et al. 2012). Feagin et al. (2010) suggest that while coastal vegetation is effective in attenuating short-period wave energy, they may be less effective in reducing the impacts of storm surge. Thus, some uncertainty is associated with the ability of coastal habitats to reduce storm surge impacts.

Projects that conserve habitat corridors, riparian buffers, and natural flowways can sequester carbon, promote population and habitat connectivity, and provide protection against floods. However, the degree to which individual conservation lands achieve connectivity is uncertain. The effectiveness of a corridor depends on a variety of factors (e.g., size and shape of the patches connected by the corridor, distance between patches) and may be difficult to quantify (Tewksbury et al. 2002). Mcleod et al. (2011) outline some of the uncertainties associated with the mechanisms that control carbon sequestration; however, there is no doubt that conserving and protecting these vegetated coastal ecosystems will contribute positively to offsetting increased atmospheric carbon dioxide that contributes to climate change.

Despite the risks and uncertainties associated with climate change and future scenarios, the program will identify areas most at risk for climate change-induced hazards and implement projects that improve coastal community's resiliency through careful future planning, identifying effective strategies, and conserving habitats that protect against the effects of climate change. While some risks and uncertainties exist for the long-term success of program activities, these may be mitigated through monitoring and adaptive management. Ultimately, any remaining risks and uncertainties will be offset by the long-term environmental benefits of the program.

No long-term socioeconomic risks are anticipated from living shorelines or vulnerability assessments. There may be long-term socioeconomic risks associated with some land acquisition projects, which could limit economic development, also resulting in lost property tax revenues in most areas; however, these are likely offset by the socioeconomic benefit of the program overall in reducing costs associated with storm and flood damage.

Other sources of long-term risk include a range of factors beyond the control of FDEP and program applicants, and include the trajectory and timing of population change and infrastructure development in project areas (which can in turn affect measures of resilience of physical assets and indicators of socioeconomic factors); the impact of natural disasters beyond the range of historical or projected science; or other site-specific factors. While some aspects of these long-term risks could be addressed through scenario analysis and assurances that project performance is robust to these uncertainties, we expect that program applicants will address these factors qualitatively.

Monitoring and Adaptive Management:

Program-wide monitoring for RES003, Community Resilience - # of residential, commercial, and public facilities benefiting will occur for the duration of the program, if applicable to all projects or activities. Program success will be tracked as the number of residential, commercial, and public facilities benefiting under this program; the total number benefiting will be verified using associated program implementation documents.

FDEP will utilize a monitoring and adaptive management framework consistent with the Deepwater Horizon NRDA MAM Manual guidelines (DWH Trustees 2019) and the RESTORE Interim Observational Data Plan (ODP) Guidance (2018). The program will be adaptively managed to ensure the greatest benefits are achieved. For example, as new information on climate change and sea level rise becomes available, the information will be incorporated into planning and implementing vulnerability assessments and living shorelines. Project reports will be utilized to document applicable lessons learned to allow for improvements to be incorporated into future activities.

Project or activity monitoring including the metrics, duration, performance criteria, and adaptive management activities, will vary depending on the technique implemented in each project or activity. FDEP will require the development of adaptive management plans for all funded projects or activities to ensure long-term success.

Monitoring for HR012 - Miles of living shoreline installed will be conducted using surveys or aerial imagery, consistent with methods outlined in the NRDA MAM Manual (DWH Trustees 2019) and ODP Guidance (RESTORE 2018).

Monitoring for HC001: Conservation easements - Acres protected under easement and HC003: Land acquisition - Acres acquired in fee will take place following acquisition and acres will be verified by survey or aerial imagery, consistent with methods in the NRDA MAM Manual (DWH Trustees 2019) and ODP Guidance (RESTORE 2018).

Monitoring for PRM010: Research - # studies used to inform management will be used to verify and track the completion of vulnerability assessments funded; the number of studies (i.e., vulnerability assessments) will be tracked and documented for the duration of the program.

Data Management:

FDEP will develop an ODP and Data Management Plan detailing how data will be collected and managed at the time a project or activity is selected. FDEP will provide a publicly accessible central location to access relevant data.

Depending on the project technique, the following types of data will be collected: number, type, and location of vulnerability assessments conducted; planning and engineering data and miles of living shoreline installed; acreage acquired, location, and property information. For any partnerships with FF, property information will be made available on the FDEP Oculus site. Information on any FF activities are available at at <https://floridadep.gov/lands/environmental-services/content/florida-forever>

To the extent any environmental data are collected, field personnel will utilize standardized datasheets. Handwritten data will be transcribed into standard digital format or scanned to PDF. Transcribed data will be verified and validated prior to being released. After any identified errors are addressed, data will be considered QA/QC'd. Spatial data collected will have properly documented FGDC/ISO metadata, a data dictionary that defines codes and fields used in the dataset, or a Readme file describing how data was collected, QA/QC procedures, and other information such as relationships to other data, origin, usage, and format. FDEP will utilize the RESTORE METadata Records Library and Information Network for metadata records creation.

Collaboration:

FDEP collaborated with numerous State, regional, and local entities and stakeholders to develop and refine this program. Meetings were held with local governments, Water Management Districts, National Estuary Programs (NEP), non-governmental organizations (NGO), Florida's RESTORE Act Center of Excellence (COE), and other RESTORE Council members. At these meetings, NGOs, local entities, State agencies, and NEPs reiterated their support for funding coastal resiliency projects, especially living shorelines and land acquisition.

FDEP also intends to coordinate with FDEP's ORCP which has already identified approximately 120 Florida communities that need a vulnerability assessment to measure the impacts of sea level rise and identify resources at risk. ORCP has awarded more than \$4 million in the last two years to prepare coastal communities for the effects of rising sea levels, including coastal flooding, erosion and ecosystem changes.

Public Engagement, Outreach, and Education:

FDEP collaborated with the public and local entities to develop the original proposal for this program through numerous meetings with local governments, Water Management Districts, NEPs, NOGs, and Florida's COE. FDEP will continue to collaborate with local entities and the public for their assistance in identifying potential program projects and activities. The public will have the opportunity to nominate projects through submitting proposals for funding as activities under this program. Prior to finalizing project screening and selection criteria, FDEP will hold a webinar to solicit and consider public comment and have similar public engagement opportunities associated with draft project lists.

This program will partner with FF to streamline the process of identifying potential lands for acquisition, which incorporates additional opportunities for public engagement, outreach, and education. FF promotes land acquisition on behalf of the public, in part to improve public land management and increase public access to natural areas and public engagement is a critical component of the selection process. Acquisition projects may be nominated by Federal, State and local government agencies, conservation organizations, or private citizens. ARC meetings are publicly noticed, and the public is encouraged to provide comment on the projects. Nonprofit organizations may play a role in helping acquire conservation lands. They advocate for parcels to be placed onto the FF priority list and can act as intermediaries with owners, including assisting them with tax and estate planning issues. FF has

previously collaborated with The Nature Conservancy, the Trust for Public Land, and The Conservation Fund. In addition to providing opportunities for the public to participate in the site selection and land acquisition process, FF provides education and outreach to ensure the public has knowledge of the accessibility of public lands. A publicly available database and mobile application are available to provide the public with information on the location, types of recreational opportunities, access points, facilities, amenities, and restrictions for public lands in Florida (Section 259.105, F.S.).

Leveraging:

Funds: TBD

Type: Bldg on Others

Status: Proposed

Source Type: State

Description: The Florida Gulf Coast Resiliency Program will leverage funds and resources from the Office of Resiliency and Coastal Protection (ORCP) and the Florida Resilient Coastlines Program. The Florida Gulf Coast Resiliency Program will leverage the knowledge and resources of the ORCP when identifying program activities. The ORCP which works to prepare Florida's coastal communities for current and future effects of rising sea levels, coastal flooding, erosion, and ecosystem changes and has identified communities in need of a vulnerability assessment (FDEP 2019b).

Funds: TBD

Type: Bldg on Others

Status: Proposed

Source Type: State

Description: The Florida Gulf Coast Resiliency Program will leverage funds and resources from FF, including leveraging the FF priority list to help identify land acquisitions that might be implemented as part of this program. The FF priority list includes parcels ranked by the ARC as well as parcels in the Climate Change Lands category that when protected will help to improve coastal resiliency.

Environmental Compliance:

As per the RESTORE FPL 3 Proposal Submission Guidelines, this program includes Category 1 planning funds for living shorelines planning and design, and vulnerability assessments, which do not involve any construction or ground-breaking activities, program management, monitoring and adaptive management, and data management activities. Implementation of living shorelines and land acquisition is currently in Category 2. Florida may work with other Council members to secure a categorical exclusion for National Environmental Policy Act requirements for land acquisition projects and activities implemented under this program.

Bibliography:

- Abt Associates. 2019. Evaluation of Hurricane Sandy Coastal Resilience Program. Prepared for National Fish and Wildlife Foundation (NFWF) and U.S. Department of the Interior (DOI). Abt Associates, Rockville, MD.
- Arkema, K.K., Guannel, G., Verutes, G., Wood, S.A., Guerry, A., Ruckelshaus, M., Kareiva, P., Lacayo, M. and J.M. Silver. 2013. Coastal habitats shield people and property from sea-level rise and storms. *Nature Climate Change*, 3: 913–918.
- Beaver, J.C. 2006. U.S. international borders: Brief facts. Library of Congress Washington DC Congressional Research Service.
- Beever III, J.W, Gray, W., Trescott, D., Cobb, D., Utley, J. and L.B. Beever. 2009. Comprehensive Southwest Florida/Charlotte Harbor Climate Change Vulnerability Assessment. Prepared for: Southwest Florida Regional Planning Council and Charlotte Harbor National Estuary Program. Technical Report 09-3.
- Beck, M.W., Losado, I.J., Menedez, P., Reguero, B.G., Diaz-Simal, P. and F. Fernandez. 2018. The global flood protection savings provided by coral reefs. *Nature Communications*, 9: 2186.
- Bilkovic, D.M. and M.M. Mitchell. 2017. Designing Living Shorelines Salt Marsh Ecosystems to Promote Coastal Resilience, Chapter 15 in Bilkovic, D.M., Mitchell, M., LaPeyre, M., & J. Toft (Eds.), *Living Shorelines: The Science and Management of Nature-Based Coastal Protection*, CRC Press.
- Borchert, S.M., Osland, M.J., Enwright, N.M. and K.T. Griffith. 2018. Coastal wetland adaptation to sea level rise: Quantifying potential for landward migration and coastal squeeze. *Journal of Applied Ecology*, 55: 2876-2887.
- Boutwell, J.L. and J.V. Westra. 2016. The role of wetlands for mitigating economic damage from hurricanes. *Journal of the American Water Resources Association*, 52(6): 1472-1481.
- Butler, W.H., Deyle, R.E. and C. Mutnansky. 2016. Low-regrets incrementalism: Land use planning adaptation to accelerating sea level rise in Florida’s coastal communities. *Journal of Planning Education & Research*, 1: 9–10.
- Chambwera, M., Heal, G., Dubeux, C., Hallegatte, S., Leclerc, L., Markandya, A., McCarl, B.A., Mechler, R. and J.E. Neumann. 2014. Economics of adaptation. In Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., MacCracken, S., Mastrandrea, S.R. and L.L. White (Eds.). *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 945-977.
- Dahl, T.E. 2005. Florida's wetlands: an update on status and trends 1985 to 1996. U.S. Fish and Wildlife Service, Washington D.C. Retrieved from <https://www.fws.gov/wetlands/Documents/FloridasWetlands-An-Update-on-Status-and-Trends-1985-to-1996.pdf>

Damschen, E. I., Brudvig, L. A., Burt, M. A., Fletcher, R. J., Haddad, N. M., Levey, D. J., Orrock, J.L., Resasco, J. and J.J. Tewksbury. 2019. Ongoing accumulation of plant diversity through habitat connectivity in an 18-year experiment. *Science*, 365(6460): 1478–1480.

DeFreese, D.E. 1995. Land acquisition: a tool for biological diversity protection in the Indian River Lagoon, Florida. *Bulletin of Marine Science* 57(1): 14-27.

DWH Trustees (Deepwater Horizon Natural Resource Damage Assessment Trustees). 2019. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 1.0. Originally released in December 2017, Updated August 2019. Retrieved from https://www.gulfspillrestoration.noaa.gov/sites/default/files/201908%20MAM_Manual_FULL_Updated%202019.pdf

Emrich, C.T., Morath, D.P., Bowser, G.C. and R. Reeve. 2014. Climate-sensitive hazards in Florida: Identifying and Prioritizing Threats to Build Resilience against Climate Effects. Hazards and Vulnerability Research Institute. EPA 430-F-16-011.

EPA (U.S. Environmental Protection Agency). 2017. Multi-Model Framework for Quantitative Sectoral Impacts Analysis: A technical report for the Fourth National Climate Assessment. U.S. Environmental Protection Agency, EPA 430-R-17-001. Chapter 15: Coastal Property.

FDEO (Florida Department of Economic Opportunity). 2015. Sea level Rise Vulnerability Assessment Tools and Resources: A Guide for Florida’s Local Governments. Tallahassee. Retrieved from https://floridadep.gov/sites/default/files/SLR-VA-tools-extended_1.pdf

FDEP (Florida Department of Environmental Protection). 2018. Florida Adaptation Planning Guidebook. Retrieved from <https://floridadep.gov/sites/default/files/AdaptationPlanningGuidebook.pdf>

FF (Florida Forever). 2019a. 2020 Florida Forever Priority List – ARC Recommended. December. Retrieved from <http://publicfiles.dep.state.fl.us/DSL/FFWeb/ARC%20Recommended%20Florida%20Forever%20Priority%20List.pdf>

FDEP (Florida Department of Environmental Protection). 2019a. Project GreenShores. Retrieved from <https://floridadep.gov/rcp/aquatic-preserve/content/project-greenshores>

FDEP (Florida Department of Environmental Protection). 2019b. Office of Resilience and Coastal Protection and Florida Resilient Coastlines Program. Retrieved from <https://floridadep.gov/RCP> and <https://floridadep.gov/rcp/florida-resilient-coastlines-program>

Feagin, R.A., Mukherjee, N., Shanker, K., Baird, A.H., Cinner, J., Kerr, A.M., Koedam, N., Sridhar, A., Arthur, R., Jayatissa, L.P., Lo Seen, D., Menon, M., Rodriguez, S., Shamsuddoha, M., and F. DahdouhGuebas. 2010. Shelter from the storm? Use and misuse of coastal vegetation bioshields for managing natural disasters. *Conservation Letters*, 3: 1-11.

Ferrario, F., Beck, M.W., Storlazzi, C.D., Micheli, F., Shepard, C.C. and L. Airoidi. 2014. The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. *Nature Communications*, 5(1): 1-9.

FF (Florida Forever). 2019. 2019 Florida Forever Five-year Plan, Summary of Recommendations and Status as of December 2018. Division of State Lands Florida Department of Environmental Protection. May. Retrieved from <http://publicfiles.dep.state.fl.us/DSL/FFWeb/Current%20Florida%20Forever%20Five-Year%20Plan.pdf>

Florida Living Shorelines. 2020. Naval Support Activity. Retrieved from <http://floridalivingshorelines.com/project/820/>

Florida Statutes. 2018. Chapter 259 Land Acquisitions for Conservation or Recreation. Title XVIII Public Lands and Property. The Florida Senate. Retrieved from <https://www.flsenate.gov/Laws/Statutes/2018/Chapter259>

FNAI (Florida Natural Areas Inventory). 2010. Guide to the natural communities of Florida: 2010 edition. Florida Natural Areas Inventory, Tallahassee.

FNAI (Florida Natural Areas Inventory). 2018. Florida Forever Project Ranking Support Analyses Documentation. Florida Natural Areas Inventory. Tallahassee, FL. Retrieved from https://www.fnai.org/PDF/FF_RSA_Report_Nov2018.pdf

FNAI (Florida Natural Areas Inventory). 2020. Summary of Florida Conservation Lands. Retrieved from https://www.fnai.org/PDF/Maacres_202002_FCL_plus_LTF.pdf

Guannel, G., Arkema, K., Ruggiero, P. and G. Verutes. 2016. The power of three: coral reefs, seagrasses and mangroves protect coastal regions and increase their resilience. *PloS one*, 11(7).

Hallegatte, S., Shah, A., Lempert, R., Brown, C. and S. Gill. 2012. Investment Decision Making Under Deep Uncertainty, Application to Climate Change. Policy Research Working Paper 6193. The World Bank, Sustainable Development Network, Office of the Chief Economist, September. <https://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-6193>

LaFever, D.H., Lopez, R.R., Feagin, R.A. and N.J. Silvy. 2007. Predicting the impacts of future sea-level rise on an endangered lagomorph. *Environmental Management*, 40: 430-437.

Liu, H., Zhang, K., Li, Y. and L. Xie. 2013. Numerical study of the sensitivity of mangroves in reducing storm surge and flooding to hurricane characteristics in southern Florida. *Continental Shelf Research*, 64: 51-65.

Mcleod, E., Chmura, G.L., Bouillon, S., Salm, R., Björk, M., Duarte, C.M., Lovelock, C.E., Schlesinger, W.H. and B.R. Silliman. 2011. A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO₂. *Frontiers in Ecology and the Environment*, 9(10): 552–560.

Miller, J.K., Rella, A., Williams, A. and E. Sproule. 2015. Living Shorelines Engineering Guidelines. Prepared for: New Jersey Department of Environmental Protection. Retrieved from <http://floridalivingshorelines.com/wp-content/uploads/2015/04/New-JerseyLivingShorelinesEngineeringGuidelines.pdf>

Moss, R.H., Avery, S., Baja, K., Burkett, M., Chischilly, A.M., Dell, J., Fleming, P.A., Geil, K., Jacobs, K., Jones, A., Knowlton, K. Koh, J., Lemos, M.C., Melillo, J., Pandya, R., Richmond, T.C., Scarlett, L., Snyder, J.

Stults, M., Waple, A., Whitehead, J., Zarrilli, D., Fox, J., Ganguly, A., Joppa, A., Julius, S., Kirshen, P., Kreutter, R., McGovern, A., Meyer, R., Neumann, J., Solecki, W., Smith, J., Tissot, P., Yohe, G. and R. Zimmerman. 2019. Evaluating knowledge to support climate action: A framework for sustained assessment. *Weather, Climate, and Society*, 11: 465-487. Retrieved from <https://doi.org/10.1175/WCASD-18-0134.1>

Moss, R. H., Lynn Scarlett, P., Kenney, M.A., Kunreuther, H., Lempert, R., Manning, J. and B. K. Williams. 2014. Decision support: Connecting science, risk perception, and decisions. In Melillo, J.M., Richmond, T.C. and G.W. Yohe (Eds.), *Climate Change Impacts in the United States: The Third National Climate Assessment*, U.S. Global Change Research Program, 620–647. Retrieved from <https://data.globalchange.gov/report/nca3/chapter/decision-support>

Neumann, J.E., Emanuel, K., Ravela, S., Ludwig, L., Kirshen, P., Bosma, K. and J. Martinich. 2015. Joint effects of storm surge and sea-level rise on U.S. Coasts: New economic estimates of impacts, adaptation, and benefits of mitigation policy. *Climatic Change*, 129(1–2): 337–349. Retrieved from <https://doi.org/10.1007/s10584-014-1304-z>

NOAA (National Oceanic and Atmospheric Administration). 2015. Guidance for Considering the Use of Living Shorelines. Retrieved from https://www.habitatblueprint.noaa.gov/wp-content/uploads/2018/01/NOAA-Guidance-for-Considering-the-Use-of-Living-Shorelines_2015.pdf

Reguero, B.G., Beck, M.W., Bresch, D.N., Calil, J. and I. Meliane. 2018. Comparing the cost effectiveness of nature-based and coastal adaptation: A case study from the Gulf Coast of the United States. *PLoS ONE*, 13(4): e0192132.

RESTORE Council. 2018. Observational Data Plan (ODP) Draft Interim Guidance. https://restorethegulf.gov/sites/default/files/20180713_DraftInterimGuidanceObservationalDataPlan_508Compliant.docx

Ross, M.S., O'Brien, J.J. and L. da Silveira Lobo Sternberg. 1994. Sea-level rise and the reduction in pine forests in the Florida Keys. *Ecological Applications*, 4(1): 144-156.

Shepard C., Majka, D., Brody, S., Highfield, W. and J. Fargione. 2016. Protecting Open Space & Ourselves: Reducing Flood Risk in the Gulf of Mexico Through Strategic Land Conservation. Washington D.C.: The Nature Conservancy. Retrieved from https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/TNC_open_spaces_2016.pdf

Strzepak, K., Yohe, G., Neumann, J., and B. Boehlert. 2010. Characterizing Changes in Drought Risk for the United States from Climate Change. *Environmental Research Letters* no. 5:044012. doi: 10.1088/1748-9326/5/4/044012.

Stys, B., Foster, T., Fuentes, M.M.P.B., Glazer, B., Karish, K., Montero, N. and J.S. Reece. 2017. Climate Change Impacts on Florida's Biodiversity and Ecology. Chapter 12 in Chassignet, E. P., Jones, J. W., Misra, V., & J. Obeysekera (Eds.), *Florida's climate: Changes, variations, & impacts*. Gainesville, FL: Florida Climate Institute.

Sweet, W.V., Kopp, R.E., Weaver, C.P., Obeysekera, J., Horton, R.M., Thieler, E.R. and C. Zervas. 2017. Global and Regional Sea Level Rise Scenarios for the United States. NOAA Technical Report, NOS CO-OPS 083.

Taylor Engineering, Inc. 2019. City of Punta Gorda Adaptation Plan Update. Prepared for: City of Punta Gorda. Retrieved from <http://www.ci.punta-gorda.fl.us/government/city-manager/climate-adaptationplan>

Tewksbury, J.J., Levey, D.J., Haddad, N.M., Sargent, S., Orrock, J.L., Weldon, A., Danielson, B.J., Brinkerhoff, J., Damschen, E.I. and P. Townsend. 2002. Corridors affect plants, animals, and their interactions in fragmented landscapes. *Proceedings of the National Academy of Sciences*, 99(20): 12923-12926.

Thatcher, C.A., Brock, J.C. and E.A. Pendleton. 2013. Economic vulnerability to sea-level rise along the northern US Gulf Coast. *Journal of Coastal Research*, 63(sp1), pp.234-243.

USGCRP (U.S. Global Change Research Program). 2018. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Reidmiller, D.R., Avery, C.W., Easterling, D.R., Kunkel, K.E., Lewis, K.L.M., Maycock, T.K. and B.C. Stewart (Eds.). Washington, D.C.: United States Global Change Research Program. Accessed 3/19/2020. Retrieved from <http://dx.doi.org/10.7930/NCA4.2018>

World Bank. 2018. Nature-based Solutions for Disaster Risk Management. Washington, D.C.: World Bank Group (in association with PROFOR and the World Resources Institute).

Zhang, K., Liu, H., Li, Y., Xu, H., Shen, J., Rhome, J. and T.J. Smith. 2012. The role of mangroves in attenuating storm surges. *Estuarine, Coastal and Shelf Science*, 102–103: 11-23.

Budget

Project Budget Narrative:

The budget for this program consists of \$14,000,000, of which the majority (approximately 90%) will be spent on planning or implementation of projects or activities aimed at improving coastal resiliency. The total amount of funding in Category 1 is \$5,600,000 and the total amount of funding in Category 2 is \$8,400,000. The Category 1 funds will be spent on State of Florida program administration and project or activity specific planning, E&D, and permitting. It is assumed that vulnerability assessments will consider a planning activity. Program monitoring and adaptive management activities, and data management activities will also fall under Category 1. Category 2 funds will be used to implement projects or activities such as construction of living shorelines or land acquisition and will include project or activity specific monitoring and adaptive management activities, and data management activities. More detailed budgets will be developed at the project or activity level when projects or activities are selected for funding under this program, including an appropriate contingency. The percentages listed below apply to the entire \$14,000,000 budget.

Total FPL 3 Project/Program Budget:

\$14,000,000.00

Estimated Percent Monitoring and Adaptive Management: 2 %

Estimated Percent Planning: 30 %

Estimated Percent Implementation: 60 %

Estimated Percent Project Management: 7 %

Estimated Percent Data Management: 1 %

Estimated Percent Contingency: 0 %

Environmental Compliance

Environmental Requirement	Has the Requirement Been Addressed?	Compliance Notes (e.g., title and date of document, permit number, weblink etc.)
National Environmental Policy Act	Yes	Section 4(d)(3) of Council NEPA Procedures applies to Category 1 funds for planning.
Endangered Species Act	N/A	
National Historic Preservation Act	N/A	
Magnuson-Stevens Act	N/A	
Fish and Wildlife Conservation Act	N/A	
Coastal Zone Management Act	N/A	
Coastal Barrier Resources Act	N/A	
Farmland Protection Policy Act	N/A	
Clean Water Act (Section 404)	N/A	
River and Harbors Act (Section 10)	N/A	
Marine Protection, Research and Sanctuaries Act	N/A	
Marine Mammal Protection Act	N/A	
National Marine Sanctuaries Act	N/A	
Migratory Bird Treaty Act	N/A	
Bald and Golden Eagle Protection Act	N/A	
Clean Air Act	N/A	
Other Applicable Environmental Compliance Laws or Regulations	N/A	

Maps, Charts, Figures

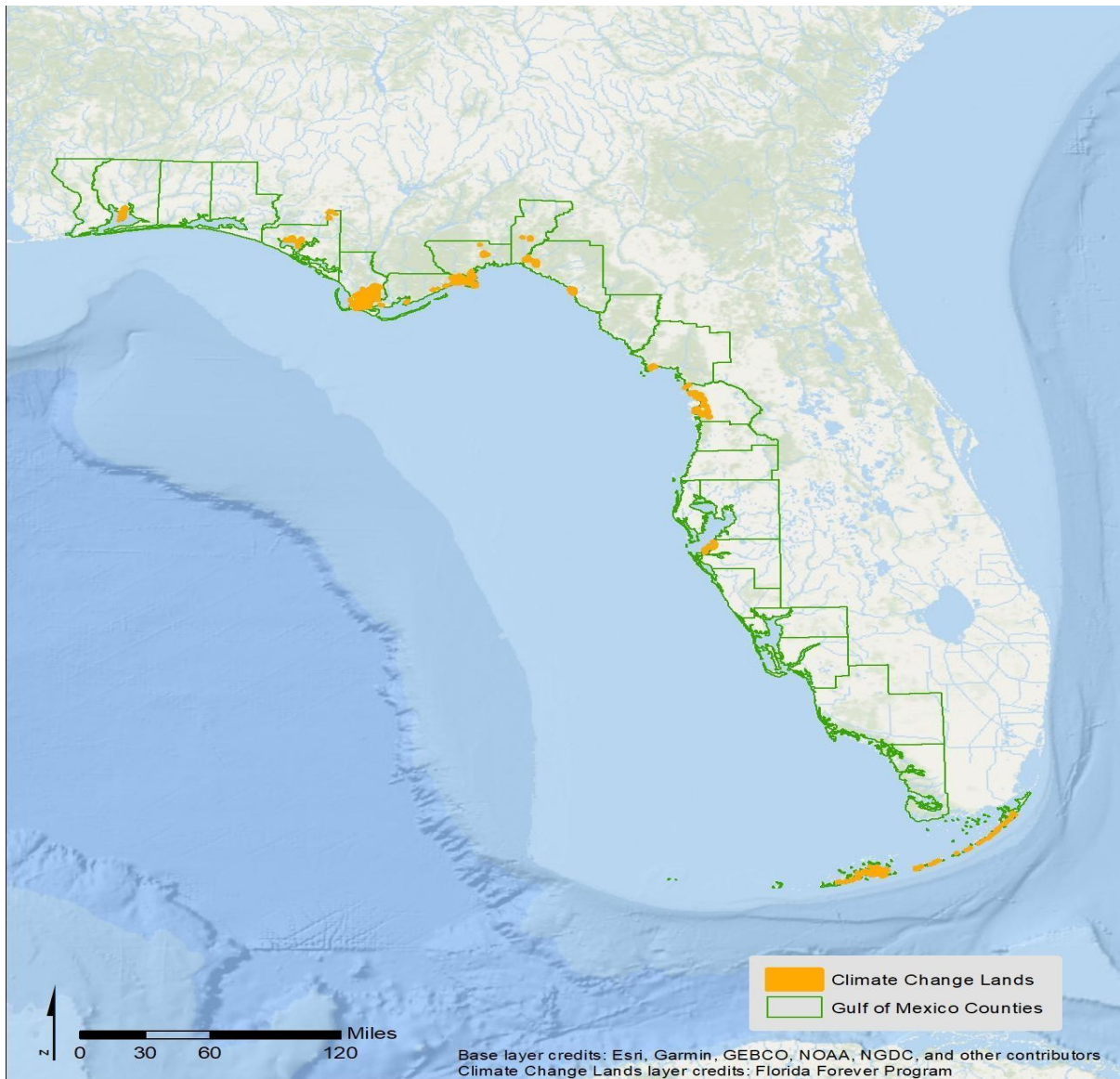


Figure 1: Map illustrating the extent of the Florida Gulf Coast Resiliency Program, including the 23 counties along the Florida Gulf of Mexico coastline. Areas for potential acquisition under this program, identified as Climate Change Lands through the Florida Forever Program, are highlighted.

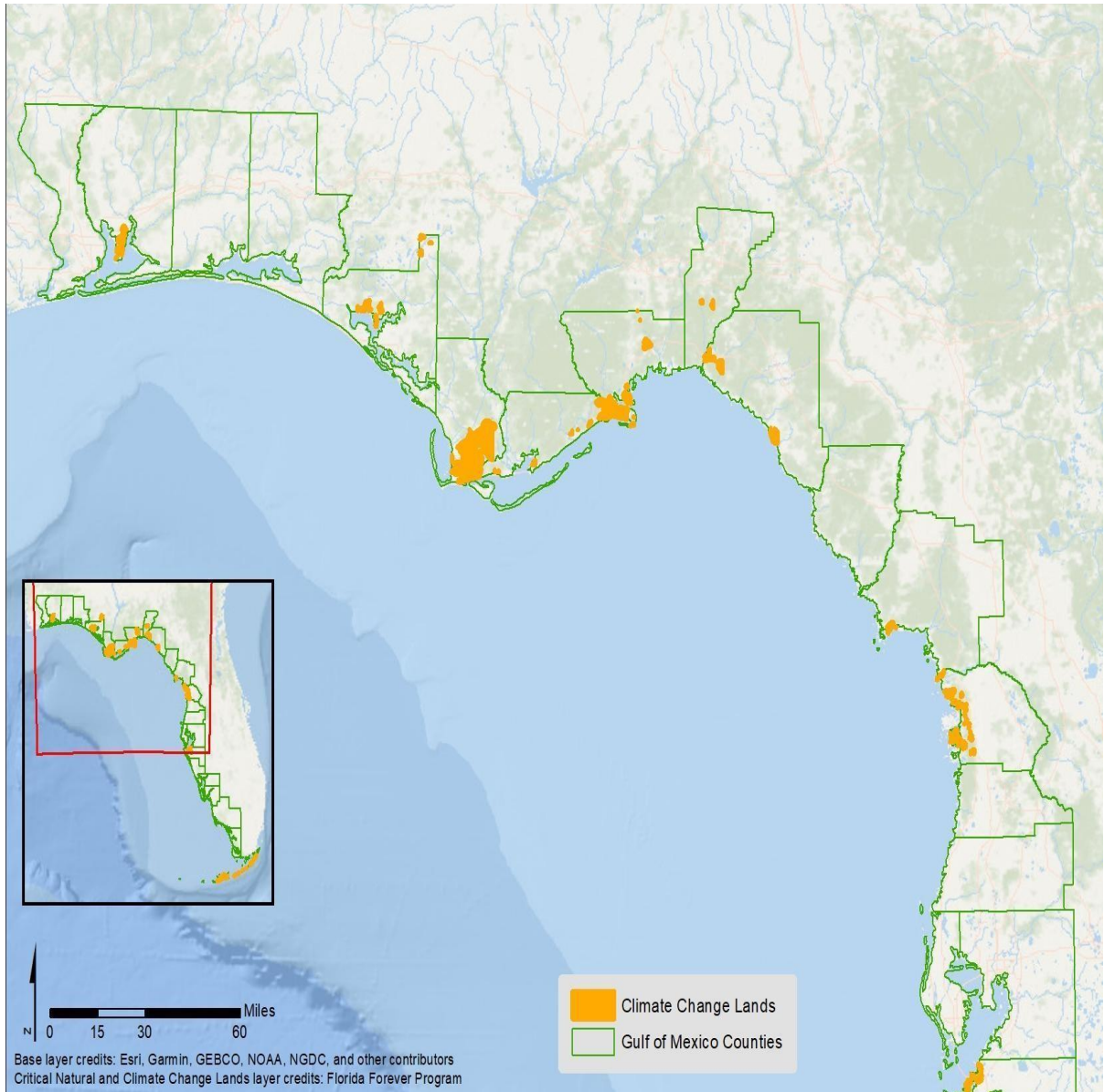


Figure 2: Map illustrating a closer view of the northern extent of the Florida Gulf Coast Resiliency Program and identified Climate Change Lands for northern Florida and the Panhandle.

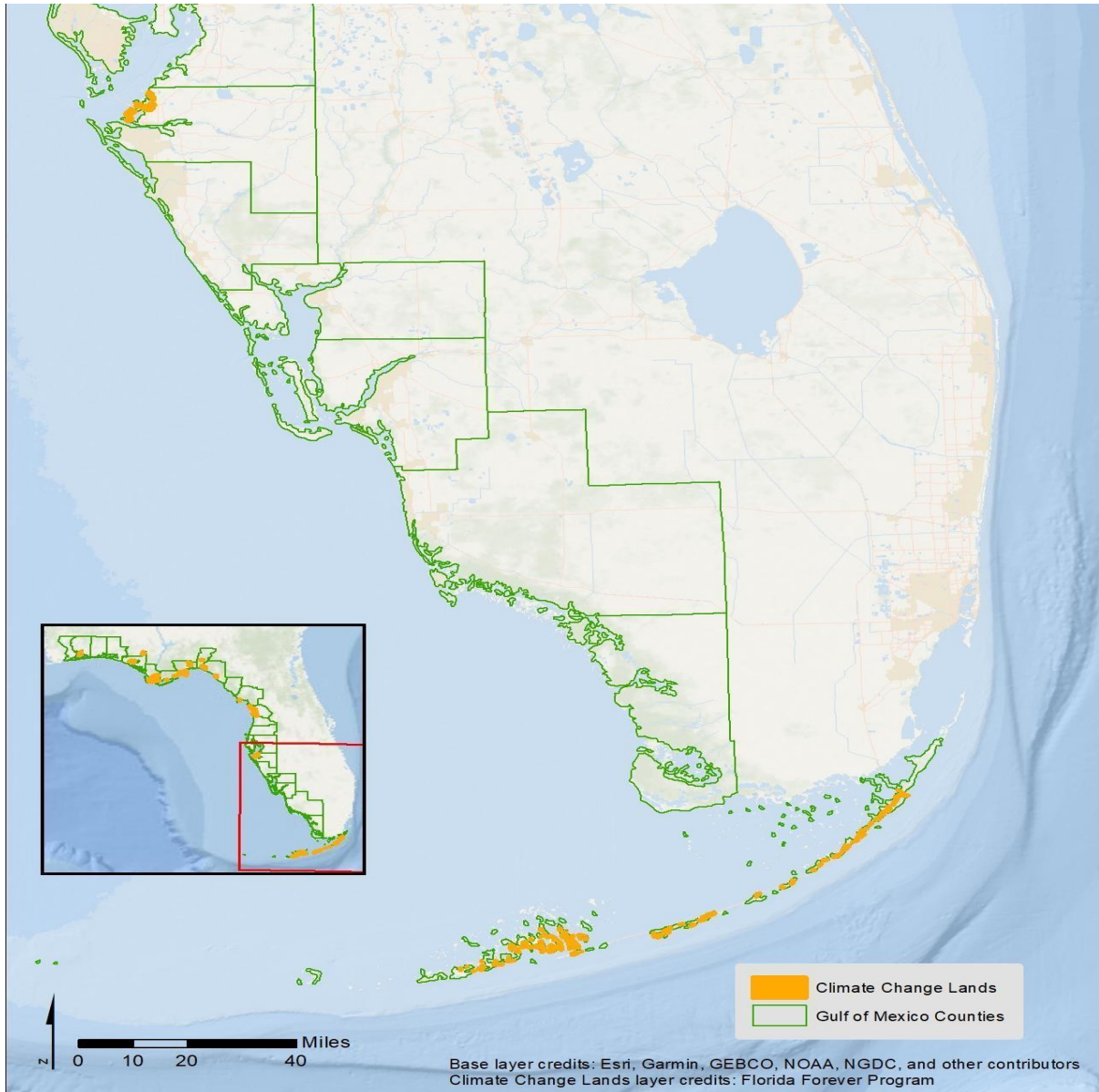


Figure 3: Map illustrating a closer view of the southern extent of the Florida Gulf Coast Resiliency Program and identified Climate Change Lands for southern Florida and the Keys.