Conserving & Managing Natural Resources with Adaptation Action Areas

Planning Guidance for Florida's Local Governments

Florida Coastal Management Program

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Important Note: This report is part of a portfolio of resources being actively developed and updated as part of DEO's Community Resiliency Initiative. The Community Resiliency Initiative is a five year project which started in 2011. During the third and fourth years of the Initiative, all of the draft guidance materials produced will be piloted by three Florida communities. Lessons learned from these pilot projects will be used to update and organize all guidance materials, which will be prepared for distribution and dissemination during the fifth year of the Initiative. Please always refer to the most current version of each resource document.

Cover photo courtesy of the State Library and Archives of Florida via Florida Memory Project

Contents

Acronyms and Abbreviations Used in this Document

AAA: Adaptation Action Area

ADCIRC: A (Parallel) Advanced Circulation Model for Oceanic, Coastal, and Estuarine Waters

CHHA: Coastal High Hazard Area

CRS: Community Rating System

DEO/FDEO: Florida Department of Economic Opportunity

FDEP: Florida Department of Environmental Protection

FDEM: Florida Department of Emergency Management

FNAI: Florida Natural Areas Inventory

FWC: Florida Fish and Wildlife Conservation Commission

IFAS: University of Florida's Institute of Food and Agricultural Sciences

NERR: National Estuarine Research Reserve

NGO: Non-Governmental Organization

SLAMM: Sea Level Affecting Marshes Model

SLOSH Model: Sea, Lake, and Overland Surges from Hurricanes Model

SLR: Sea Level Rise

SWIM Act: Surface Water Improvement and Management Act

Overview

An "Adaptation Action Area" or "Adaptation Area" (abbreviated AAA) *is an optional local comprehensive plan designation for areas that experience coastal flooding and are vulnerable to the related impacts of rising sea levels. This designation can assist local governments in prioritizing funding for infrastructure needs and adaptation planning.*

Florida communities have been actively and increasingly addressing both coastal and inland flooding over the last several decades. This has partly been in response to ever-increasing risk and exposure, but it also reflects a major paradigm shift from a focus on post-disaster recovery to an emphasis on proactive resilience that prevents and mitigates risks. This new awareness has stimulated innovative approaches to floodplain management, including new partnerships and increased public outreach, new risk assessment tools, and forward-thinking planning mechanisms. By addressing current flooding issues with updated policy and design criteria, these communities create co-benefits as they integrate planning and regulatory objectives to effectively address impacts related to sea level rise. Now supported by State Statute, effective strategies promote and support further adaptation initiatives around Florida.

Adopted into the Florida Statute in 2011 through the Community Planning Act, Adaptation Action Areas provide a flexible, voluntary framework that can be applied to the entire State through individual local action. At the request of coastal communities, DEO created this guidance to assist communities in understanding how they can use Adaptation Action Areas to adapt to coastal flooding. The State of Florida requires each local government authority to create, adopt, and maintain a comprehensive land use plan. The local comprehensive plan is a key driver of development and redevelopment because it outlines legally enforceable guidelines and strategies and in this way directly influences the decision-making process. Comprehensive plans can be used to create strategies for reconciling growth and resilience. This creates possibilities for continuously revisiting and updating best practices for sustainable development, post-disaster redevelopment, the implementation of green infrastructure, natural resource management, and the protection of natural resources. In the context of sea level rise, planning today via tools such as Adaptation Action Areas improves the long-term preparedness and resilience of communities.

Communities can use Adaptation Action Areas to conserve and manage natural resources. This guidebook is intended to assist local governments in addressing potential impacts of hazards associated with sea level rise by providing guidance on using Adaptation Action Areas to conserve and manage natural resources while realizing co-benefits.[1] It focuses both on meeting State-mandated requirements and on voluntary policies and strategies that local communities may implement at their discretion.

Conserving and managing our natural resources is essential for maintaining the viability of Florida's coastal communities. Although considering natural resources in an Adaptation Action Area may be a low priority for communities embarking on sea level rise planning, the synergistic benefits accruing to human populations of such an undertaking are numerous and supported by Florida Statute. Natural coastal resources such as mangroves, saltwater marshes, and estuaries can provide ecosystem services such as water filtration, ground water recharge, and wave attenuation. Adaptation Action Areas can also serve to

mitigate the economic consequences of sea level rise (such as the monetary costs and lost productivity associated with losing access to coastal infrastructure) and help preserve and/or improve the livability of a given area. Protecting natural areas can facilitate and possibly even create opportunities for outdoor recreation, lead to increased property values, and provide public health benefits[2].

Adaptation Planning: Overview and Relation to Adaptation Action Areas

This guidebook will position planning for natural resources in Adaptation Action Areas at the center of the adaptation process for communities interested in the relationship between sea level rise and natural resources management. The introduction will explain sea level rise adaptation planning in broad strokes. The following chapters explore, component by component, the adaptation planning process as it pertains specifically to planning for natural resources in Adaptation Action Areas. Relevant current examples from across the State of Florida will be given in each section. Tools and processes to enhance natural resource conservation and management through Adaptation Action Areas will also be presented throughout this guidebook.

Communities are likely to approach Adaptation Action Areas in one of two different ways. Some communities will utilize Adaptation Action Areas as one of multiple adaptation planning activities. Other communities will position Adaptation Action Areas as the focus of their adaptation planning activities. This guidebook has been written to be helpful to both kinds of communities as they begin or continue their efforts to plan for the conservation and management of natural resources in a time of ever-increasing sea level rise and threats from related hazards.

Guidebook Sections

The sections within this guide approach Adaptation Action Areas considering natural resources as a subset of a general adaptation planning process. They elaborate upon the activities tied to natural resource adaptation planning and provide greater detail about potential techniques and tools.

Readers who are new to Adaptation Action Areas and the Adaptation Planning Process may begin with Chapter 1 of this guidebook. For readers who are more familiar with Adaptation Action Areas and/or who are interested in analyzing the way in which pilot communities integrated Adaptation Action Area planning into their community preparedness efforts may find examples provided throughout the text of this guidebook to be illuminating.

[2] The 2013 Workshop Report of the Yale Program on Strategies for the Future of Conservation discusses benefits of natural areas access in terms of physical and mental health, http://environment.yale.edu/publication-series/documents/downloads/a-g/Berkley-2013.pdf#page=14

Chapter 1. Introduction

This document is part of a series of resources intended to support local governments in their adaptation planning efforts. Implementing Adaptation Action Areas while also collaborating with their region and with the State of Florida on other resiliency initiatives creates the best opportunities for local governments to merge growth and resilience. Previous resources have focused on using Adaptation Action Areas to protect the built environment. This paper provides communities with two alternate adaptation focuses: to meet existing and optional regulations or to realize the co-benefits associated with protecting natural systems as they relate to the protection of the built environment and human populations.

Legal Definition of Adaptation Action Areas

An Adaptation Action Area is defined in the Florida Statutes (§163.3164(1), Fla. Stat., 2014):
"A designation in the coastal management element of a local government's comprehensive plan which identifies one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning."

Designation of Adaptation Action Areas represents a new, flexible tool with which a community may incorporate sound science into its efforts to protect the future welfare of its human inhabitants and natural environs.

Communities may also realize economic benefits by participating in adaptation planning. Studies have shown that some investments in resilient infrastructure (of which there are many kinds) can quickly recover monetary expenditures during flood events.[3] The same may be true of natural areas. For example, when communities delineate new conservation wetlands or rehabilitate existing ones, the wave attenuating properties of the wetland can save homeowners millions of dollars in the event of a storm.

This chapter reviews the general statutory framework for preserving and protecting natural resources in the State of Florida. In the next section, the co-benefits of preserving and protecting natural resources are highlighted. The final section of this chapter provides an overview of the recommended components of an adaptation plan. These components allow planners to identify how steps may be different for addressing natural resources than for addressing other considerations (*e.g.,* historic preservation) during the adaptation planning process.

[3] An example put forth by the Hillsborough Adaptation Pilot illustrated the net benefits, in millions of dollars, for "days of disruption" in total car travel avoided by altering (*i.e.*, raising, installing wave-attenuating devices, and drainage improvements) segments of critical transportation infrastructure. Some segments show high return on investment; others may not benefit as greatly. http://www.usfsp.edu/icar/files/2015/10/ICAR-Yeh.pdf

Statutory motivations for creating and implementing Adaptation Action Areas

Many coastal communities in Florida are, through the Coastal Management Element of their comprehensive plans, already engaged in planning efforts that include consideration of the natural processes that influence their coasts. The following table offers eight points within the Statutes (outside of the Adaptation Action Areas clause) that provide communities with the motivation to plan for future coastal flooding.

Table 1: Statutes promoting natural coastal areas, and how to address them through adaptation planning

Florida Statute	**Narrative Description** of the statute, in relation to protecting natural resources **Adaptation Planning Activities** and connections within the document
F.S. §163.3177 6(a)3.f : Ensure the preservation of natural resources.	Tasks communities with knowing what natural resources they have, determining risks to those natural resources, and mitigating the effects of risks on those natural resources. • **Planning Context**: o Create an inventory of natural resources. FNAI, NERR, DEP, and FWC can help with this. • **Impact Analysis**: o Based upon geo-located natural resources, assess their vulnerability to future flood exposure using SLAMM or other SLR tool. • **Adaptation Strategies**: o With DEP, FWC, and IFAS, local biologists, and other local coastal scientists, develop an AAA proposal that can mitigate the pressure of human systems and sea-level rise on resources.
F.S. §163.3177 6(a)3.c : Preserve recreational uses in coastal communities.	Tasks communities with ensuring that the coastline, and the particular recreational opportunities that the local coast offers (*e.g.*, sand beach, boating access, pier fishing, wildlife viewing, swimming, etc.), is protected in the future. • **Motivations and Principles**: o With stakeholders, determine the major recreational opportunities at the coast. • **Planning Context**: o Asses the revenue that current coastal recreation (contingent upon a natural area) generates by locating chamber of commerce, and state and national visitor data.
F.S. §163.3177 6(a)10.c : Ensure future land uses take into account the future location of beaches, shores, estuarine systems, rivers, bays, floodplains, wetlands, and coastal high hazard areas.	Tasks the community with measuring coastal ecosystem and land changes, as those affect natural and man-made environments. • **Exposure Analysis**: o Communities may utilize SLAMM, Hazus-MH, The Geoplan Sketch Tool, or other models to determine how the boundaries of natural

Florida Statute	Narrative Description of the statute, in relation to protecting natural resources Adaptation Planning Activities and connections within the document
	resource areas will change due to the effects of sea level rise. • Integrate into Plans: o Changing natural boundaries will necessitate dynamic legal coastal boundaries, such as the CHHA. Based upon building life expectancy, certain structures may be prohibited according to the exposure analysis.
F.S. §163.3177 6(g)1 : Maintain, restore, and enhance the overall quality of the coastal zone environment, including, but not limited to, its amenities and aesthetic values.	Tasks the community with proactive enhancement of the coastal zone. Beyond recreation, this may include water quality, viewshed quality, and ecosystem quality (measured in terms of species diversity and health). • Schedule of Actors and Activities: o Work with DEP, FWC, NERR, IFAS and other natural resource stewards to integrate them into the schedule of activities that will occur with the Adaptation Action Area.
F.S. §163.3177 6(g)2 : Preserve the continued existence of viable populations of all species of wildlife and marine life.	Tasks the community with assessing all local land and marine species, knowing threats to their existence, and taking measures to mitigate threats. See entries for F.S. §163.3177 6(a)3.f
F.S. §163.3177 6(g)3 : Protect the orderly and balanced utilization and preservation, consistent with sound conservation principles, of all living and nonliving coastal zone resources.	Tasks the community with understanding where land development and resource extraction are occurring, and with ensuring that development and extraction do not exhaust coastal zone resources. • Steering Committee: o Communities may include park rangers and NERR, IFAS, and other marine managers on their steering committees who have the professional expertise to note the long-term effects of hunting, fishing, and other resource extraction on the local environment. Similar to the case of the Florida Keys, sound conservation efforts may actually increase natural resource stocks.
F.S. §163.3177 6(g)4 : Avoid irreversible and irretrievable loss of coastal zone resources.	Tasks the community with protecting the land, species, and minerals that encompass the coastal zone. Includes gathering knowledge about which resources exist, what threats to those resources exist, and how to mitigate threats.

Florida Statute	**Narrative Description** of the statute, in relation to protecting natural resources **Adaptation Planning Activities** and connections within the document
	• **Describe the Planning Context:** o The Coastal High Hazard Area, the Coastal Construction Control Line, and Adaptation Action Areas all provide methods by which a community may project future coastal change and use this projection to guide future development. • **Exposure Analysis**: o The tools listed in Table 2 (page 18) may all provide insight into changes on local environments caused by sea level rise and its related effects. • **Adaptation Strategies** o Negative impacts can be avoided by implementing regulations, hard and soft protection strategies, and innovative projects.
F.S. §163.3177 6(g)5 : Use ecological planning principles and assumptions in the determination of the suitability of permitted development.	Tasks the community with integrating coastal resource management (science) with local permit department regulations. • **Integrate into existing plans**: o *e.g.:* While the future land use element of the comprehensive plan may designate future vulnerable areas, work with the local planning department to adopt language into the *current* zoning ordinance that prohibits some development based upon projections of future coastal habitat change.
F.S. §163.3178(2)(f) : Redevelopment component of the Coastal Management Element must take new measures into account to minimize risk of flood damage to property.	In considering the impacts of, and strategies to address, coastal flooding, the community can employ Low Impact Development Strategies[4]. • **Vulnerability Analysis; Adaptation Strategies** o Requires that the redevelopment component of a community's Coastal Management Element include "*development and redevelopment principles, strategies, and engineering solutions that reduce the flood risk in coastal areas which results from high-tide events, storm surge, flash floods, stormwater runoff, and the related impacts of sea-level rise.*"

[4] http://water.epa.gov/polwaste/green/upload/bbfs2terms.pdf

With these statutes in mind, a community may utilize Adaptation Action Areas to meet the statutory requirements of the Coastal Management Element.

Co-Benefits for Human Populations

Healthy natural systems benefit people. Where there are forests and mangroves, people enjoy cleaner air. Where there are healthy estuaries, more marine life exists to be both enjoyed and utilized. Where wetlands and natural coastal features exist, storm waves are attenuated and water is filtered. The table below focuses on the co-benefits that can arise when natural resource Adaptation Action Areas are utilized and implemented as a policy tool.

Table 2: Co-Benefits of Adaptation Action Areas for Natural Resources

Why we want to create natural resource AAAs	Description
Incentives	• Community Rating System (CRS) Credit: A community that implements an Adaptation Action Area for natural resources could be eligible for the following CRS Credits: o 332 Outreach Projects (Elements) o 401 Special Flood-related hazard areas o 412 Floodplain Mapping (Elements) o 422 Open Space Preservation (Elements) o 432 Higher Regulatory Standards (Elements) o 512 Floodplain Management Planning (Elements) • Grants: Funds provided by the state of Florida alleviate costs and increase the benefit-cost-ratio of natural AAAs even further: o DEP State Revolving Fund o DEP Watershed Management Grants o DEP Coastal Partnership Initiative o DEO Technical Assistance Grants o FWC Coastal Wetlands Funding o FWC Wildlife Restoration Program o State Wildlife Grant Program
Benefits of Mangroves, Saltwater	• Carbon Sequestration. • Wave (Storm Surge) Attenuation. • Water Filtration. • Species Diversity o Aesthetic Beauty o Healthy Environment = Healthy People o Hunting and Fishing stocks improve

Marshes, and Estuaries	• Education projects associated with natural areas in AAAs can lead to mitigation activities community-wide. o Wildlife managers who notice 'tipping points' in natural ecosystems near human systems can pass on important information to communities. • Water Filtration: pollutant and bacteria removal. • Natural Floodplain = Less floodwater contact with developed areas. • Precursors, such as the SWIM Act, have had great impacts on community health. • Increased recreational opportunities. • Scenic viewsheds. • Potential for increased property value[5]

Adaptation Action Areas and Environmental Planning

Adaptation planning is comprised of a series of steps that a community takes to become more resilient to the impacts of current and future coastal hazards. When considering natural resources in Adaptation Action Areas, it is important to address the human impacts on natural areas and how those impacts may be minimized.

Several Florida communities that have explored Adaptation Action Areas in their local adaptation planning processes. These communities include: Broward County, City of Fort Lauderdale (Broward County), Miami-Dade County, the City of Satellite Beach (Brevard County). Each of these communities have approached and used Adaptation Action Areas differently. Two University of Florida projects[6] examined Adaptation Action Areas in the Towns of Yankeetown and Inglis and explored how to incorporate natural resource conservation and protection into Adaptation Action Areas. Habitat changes from rising sea levels were analyzed using SLAMM scenarios and several recommendations for adaptation strategies were developed, including dis-incentivizing development in certain "adaptation areas" and protecting or restoring habitat in key natural areas.

Not all adaptation planning efforts in Florida communities use adaptation action areas. For example, the City of Punta Gorda and Palm Beach County have both considered the use of adaptation overlays. These overlays function similarly to adaptation action areas in that they have designated special management areas that accomplish the goals of conserving and managing natural resources.

[5] http://water.epa.gov/polwaste/green/upload/bbfs3cost.pdf

[6] Langston, A. & Kaplan, D. (2014). Rapid Ecological Assessment and Science Plan for a Natural Resource-Based Sea-Level Rise Adaptation Strategy for Yankeetown Florida. University of Florida Watershed Ecology Lab. http://www.watershedecology.org/uploads/1/2/7/3/12731039/science_plan_final_20140521.pdf
Frank et al. (2014). Yankeetown-Inglis Adaptive Design Strategies for Adapting to Coastal Change Report. University of Florida & Florida Sea Grant. https://changinglevycoast.files.wordpress.com/2013/12/yankeetown-inglis-adaptive-design-report.pdf

Adaptation action areas can be, and have been, applied in a variety of ways. Adaptation Action Areas can be used:

- As the focus of the adaptation planning process, wherein the end goal of the process was to adopt Adaptation Action Area language into policy and/or to assign focus areas;
- To spatially delineate areas at risk from coastal hazards and subject to future adaptation strategies and policies;
- As overlay areas; and
- To prioritize areas for adaptation planning efforts and funding opportunities, such as acquisition of conservation lands.

Communities are likely to consider many different approaches and uses for Adaptation Action Areas.

Chapter 2. The Context of Adaptation

This chapter examines the first component and first four sub-components of an adaptation plan, with special consideration given to the unique activities required to develop Adaptation Action Areas for the conservation and management of natural resources. These include engaging steering committee members with wildlife and ecosystem expertise, communication and collaboration with stakeholders and the general public, creating guiding principles for protecting resources, and developing an understanding of the planning context. This chapter also include an examination of how resolutions, Executive Orders, and Memoranda of Understanding can gauge inter-agency consensus on adaptation goals.

Table 3 provides a brief summation of considerations specific to the first component.

Table 3: Adaptation Planning for Natural Resource AAA's - Context Considerations

Adaptation Plan Component		Conservation and Protection-Specific Additions
Context	**Assemble a Steering Committee**	Integrate members who have a strong background in environmental planning, such as: • Species biologists • Conservation biologists • The FWC or one of its acting partners • National and State Resource Managers • National Estuarine (NERR) scientists
	Identify Opportunities for Public Participation	Public Participation and outreach are very important for gaining buy-in for resource protection. The FWC Statewide Adaptation Plan includes recommended approaches for raising public awareness.
	Set Guiding Principles and Motivations	Work with specialists who know the best ways in which natural resources can be conserved and managed. The FWC State Adaptation Plan includes many best-practices.
	Describe the Planning Context	Connect to the studies and databases already available that describe natural areas and their endemic species in your community. A good database of resources is the Florida Natural Areas Inventory

Assemble a Steering Committee

A steering committee providing input on Adaptation Action Areas should be broad and diverse mix of professionals, experts, and those representative of local interests. To ensure that a steering committee considers conservation interests in an Adaptation Action Area, the planning team is encouraged to include the input of coastal scientists, such as coastal engineers, geospatial analysts, environmental planners, and meteorologists. It will likely also include experts who specifically focus on an area's unique species, habitat, hydrology, and geology.

Access to each professional will likely stem from the existence of local or otherwise accessible research institutions, research parks, and other designated conservation and biological management areas. Potential institutions and representatives include:

- University of Florida Institute of Food and Agricultural Sciences (IFAS) County Extension Office Staff
- Florida Sea Grant Faculty, Staff and Extension Agents
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Environmental Protection
- The Florida Climate Institute
- The Natural Conservancy
- National Estuarine Research Reserves (NERRs)
- National and State Forests
- Everglades National Park
- State Parks

Communities may also choose to utilize technical and professional capacity existing within local governmental institutions. For example, the County within which a community is located might have a GIS technician on staff, who may be able to assist the community in the creation of specific GIS maps of interest.

A good example of an adaptation planning process involving a variety of specialists is The University of Florida's collaboration with Yankeetown-Inglis, out of which the *Changing Levy Coast* document was produced. The interdisciplinary team involved in this collaboration included planners, landscape architects, community outreach experts, engineers, and a coastal planning specialist.

Identify Opportunities for Community Participation

The impacts of land-use and wildlife management decisions on the environment often escape the notice of most community stakeholders. The conservation and management of natural resources requires buy-

Florida Fish and Wildlife, on Participation

In its statewide adaptation plan, the Fish and Wildlife Conservation Commission (FWC) reports that **"*conservation of Florida's fish and wildlife ultimately depends upon the commitment of Floridians to their protection*."**

in, as well as participation, from community stakeholders. Communities are encouraged to look into the DEP Coastal Partnership Initiative for opportunities to engage stakeholders.

Messaging

Public Awareness is identified in the FWC State Wildlife Action plan as a Key Conservation Challenge. The transmission of messages about ecological processes, habitats, and species to the general public has encountered barriers stemming from the often opaque connections between human activity and the surrounding environment and natural resources.

One way by which a community may approach messaging is to collaborate with conservation NGOs, universities, and other groups involved in the inventorying and monitoring of wildlife. Through collaboration, a unified message may be directed from multiple groups to stakeholders about the intent to plan for natural resource protection and conservation via Adaptation Action Areas.

Per the Community Rating System Coordinator's Manual, Targeted Outreach is another useful mechanism by which to reach stakeholders. If a particular audience is selected for outreach, is addressed directly by the medium, and has its concerns as the focus of the message, the likelihood of increasing that population's participation in the planning process (or other intended outcomes) may be increased.

Set Guiding Principles and Motivations

Guiding principles and motivations can be drawn from other planning processes the community has previously undertaken or may be developed during the natural resource adaptation planning process and later incorporated (*e.g.*, as one or more goals or objectives) into other community planning documents. They should also relate to principles established for conservation.

The Society for Conservation Biology outlines a hierarchy of conservation principles that may be translated into planning efforts. The following list draws from their principles:

- **Seek to maintain three aspects of life on Earth**:
    - Natural diversity found within living systems (Biological Diversity)
    - Composition, Structure, and Function of living systems
    - The resiliency and ability of living systems to endure over time
- **Rapid changes in biological diversity will likely negatively affect ecological integrity and ecological health**.
    - Ecological integrity is the degree to which a group of organisms maintains its function.
    - Ecological health refers to the resiliency of a living system to stress.
- **Human activity is a subset of natural processes, not vice versa**.
- **Cascading Effects: The extinction of one species may cause extinction of other species, causing a 'ripple effect' through an ecosystem**.
    - Degradation of biological diversity, ecological integrity, and ecological health at one level may have impacts on those functions at other levels

- Extinction or habitat degradation may cause additional impacts that 'cascade' through an ecosystem.

Describe the Planning Context

Adaptation Action Areas considering natural resources may require a good deal of information to be assembled, both in terms of the community's planning capacity and in terms of the natural resource assets that will be integrated into the effort. While the section on Steering Committees discusses expert personnel that may beneficially influence the scope of the plan's engagement with local resources, the planning team is encouraged to determine the **financial, administrative, legal, and infrastructure** capacities already in place that are working to protect natural resources. This may include:

- Financial - *e.g.,* conservation land trust set aside for beach and dune nourishment.
- Administrative – community staff whose work is dedicated to managing and protecting resources.
- Legal – ordinances and other plans already dedicated to conserving and managing natural resources.
- Infrastructure – green and low-impact development as well as traditional gray infrastructure that is currently mitigating the effects of coastal flooding on natural resources. In many cases, however, traditional gray infrastructure (such as jetties, groins, and stormwater drainage infrastructure) may serve to aggravate problems involving natural resource depletion.

This step presents an opportunity to gather data on all pertinent natural resources. As mentioned in Table 3, the Florida Natural Areas Inventory manages extensive geospatial data for species, habitats, and other natural features. The planning team may also see merit in seeking data from its steering committee. 1000 Friends of Florida, the Audubon Society, the Nature Conservancy, the University of Florida, and local institutions, all may be able to provide further resources on species, habitats and other natural features. The Florida Geological Survey maintains maps of mineral resources in the state, which can be important in valuation of conservation lands and can enhance hydrologic understanding of the impact of sea level rise on underground freshwater reserves.

Natural systems consist of many layers of life, elements, and processes both within and outside human habitats. The more data and understanding of local natural resources that the planning team can accumulate, the more informed its assumptions driving the protection of natural areas in adaptation efforts are.

Resolutions, Executive Orders, and MOU's

Resolutions, executive orders, and memoranda of understanding represent ways by which to gauge the inter-agency consensus concerning sea level rise planning. By obtaining a Resolution of Intent from an elected official, the planning team will have a strong ally during the ensuing steps in the process. These documents may be used to guide decision-making regarding how Adaptation Action Areas are to be utilized to protect natural resources. Vision documents can help generate consensus on directions for

sustainable development that protects and conserves natural resources; build knowledge about specific policy opportunities; and inspire individuals and groups to take action.

Inventorying Natural Resources

Identifying natural resources enables municipalities to consider natural resource protection in their planning processes and gain a greater understanding of threats to the local ecosystems. Inventorying natural resources is a special sub-set of data gathering under the larger umbrella of planning context because the quantity of natural features that can be profiled is often overwhelming. It is thus recommended that communities utilize trusted resources, such as state-maintained online databases and the input of local experts, when building their inventories.

Potential resources that may be of assistance with creating an inventory of natural resources include:

- Florida Natural Areas Inventory (FNAI)
- Florida Geodatabase Library (FGDL)

FNAI provides a database of information including boundaries and species statistics for Florida's managed areas. Similarly, FGDL provides several thematic searches that return numerous data layers with environmental features.

- National Estuarine Research Reserve (NERR) System

NERR System "is a network of 28 areas representing different biogeographic regions of the United States that are protected for long-term research, water-quality monitoring, education and coastal stewardship… Reserve staff work with local communities and regional groups to address natural resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education, the reserves help communities develop strategies to deal successfully with these coastal resource issues."[7] There are three System reserves located within the state of Florida: Apalachicola, located in the Panhandle; Guana Tolomato Matanzas, located between Jacksonville and St. Augustine; and Rookery Bay, located south of Naples.

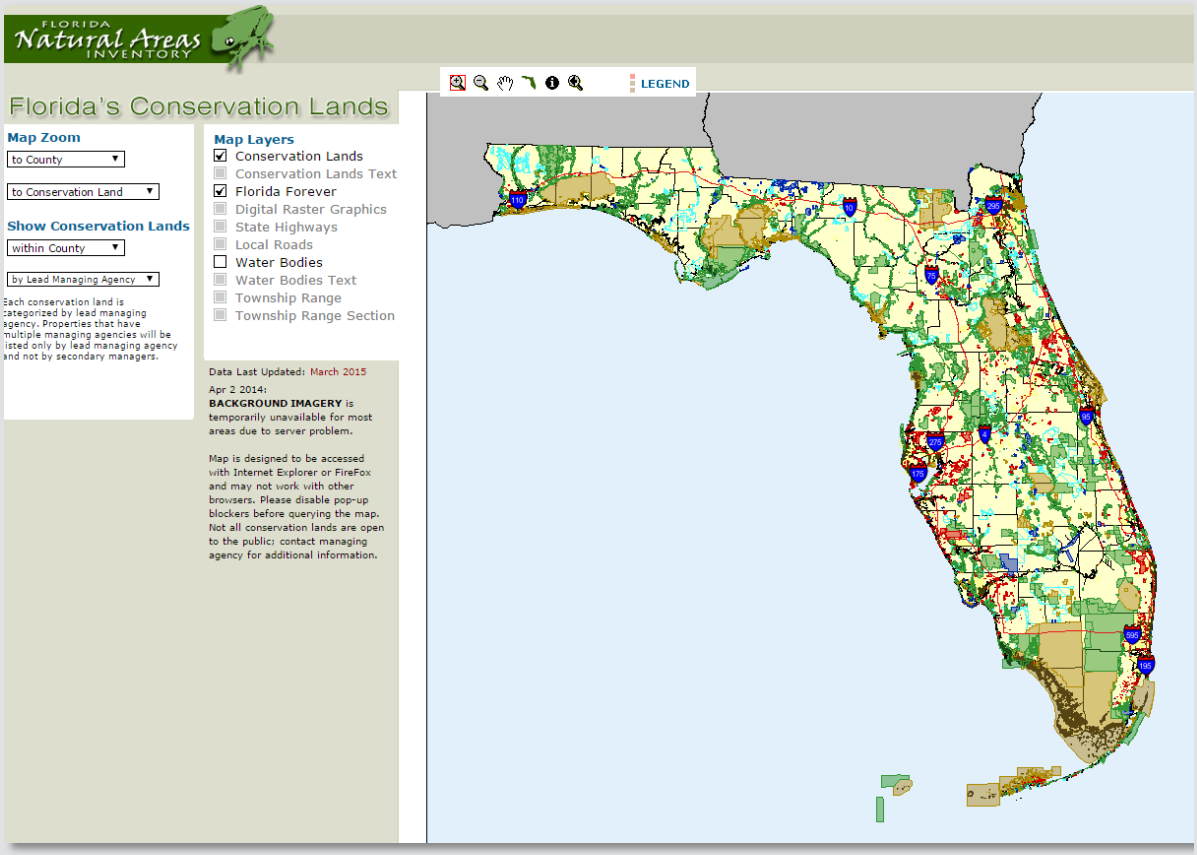
- Florida Department of Environmental Protection (FDEP)
- Florida Fish and Wildlife Conservation Commission (FWCC)

Additional resources may be available through local community colleges, universities, and environmental groups.

[7] http://www.nerrs.noaa.gov/BGDefault.aspx?ID=61

The Florida Natural Areas Inventory (FNAI)

The map in the screen grab below was generated from FNAI and shows all conservation and Florida Forever lands within the state.



FNAI can assist communities in locating and examining existing conservation lands as well as in identifying and examining lands located nearby existing conservation lands on which to implement desired adaptation strategies.

Users are able to zoom to individual properties as well as to see larger-scale maps.

Florida Natural Areas Inventory. (2015). *Florida's Conservation Lands* [Interactive Map]. Taken from http://data.labins.org/imf2/FREAC/FNAI.jsp

Monitoring Natural Resources

Monitoring natural resources is important to determine changes occurring to a resource over time. Is a particular resource becoming depleted or endangered? If so, due to what stressors? Can it adapt? If so, could those characteristics be beneficial to other members of the ecosystem? What changes in the environment might pose a threat to local resources?

Many groups are already involved in monitoring natural resources, although data available from these sources may or may not be able to show changes occurring to a specific resource over time. Resources that have been monitored over time may provide information about previous and ongoing effects of sea level rise on that resource as well as how planning-lead adaptations are likely to affect the resource in the future; such information may prove valuable in the design and implementation of the Monitoring and Evaluation Plan (discussed in Chapter 5).

One win-win example of an adaptation activity that was monitored by and concerned both conservation and economically-minded groups can be seen in the case study of the Florida Keys natural areas protection. Through a collaborative planning process, recreational fishing guides were able to realize gains in catch once conservation areas had been assigned. These types of "no-regrets" strategies will be also be discussed in Chapter 4. Adaptation Strategies.

Chapter 3. Vulnerability Assessment

The third chapter in this guidebook details a crucial element of adaptation planning– the vulnerability assessment. Through an exposure analysis, impact analysis, and adaptive capacity assessment, the community can explore scenarios to determine its vulnerabilities and capability to address adaptation needs. Table 4 below provides a brief overview of each step discussed in this chapter.

Table 4: Natural Resource Adaptation Planning - Vulnerability Analysis Considerations

Adaptation Plan Component		Conservation and Protection-Specific Actions
Vulnerability Analysis	**Exposure Analysis**	An Exposure Analysis is a basic tenet of sea level rise adaptation planning. However, it may be conducted utilizing a variety of tools. Several tools are well-suited to projecting the effect of rising sea levels on the natural environment, including: • SLAMM • Coastal Resilience.org Mapping Tool • InVEST • NatureServe VISTA • LUCIS • For additional tools, see DEO reference: *An Inventory of Sea-Level Rise Adaptation Assessment Tools and Resources*
	Impact Analysis	Impact Analysis may be used to describe the level of impairment that an asset experiences to coastal flooding. There are numerous ways in which sea level rise influences ecological functions and assets, including: • Saltwater intrusion into freshwater resources; • Intersection with threatened and endangered-species habitats; • Conversion of coastal ecosystems to open water; • Loss of acreage of different ecosystems; and • Dollar-value of affected conservation area lands.

Assess Adaptive Capacity	Adaptive Capacity measures ability to adjust to or accommodate impacts of coastal flooding. Components of community capacity to promote to effectively implement natural resource AAA may include the following categories: • Social – Public support levels for natural resources protection; • Technical – Experts who may be involved in the implementation of projects designed to increase natural resiliency; • Administrative – personnel available to manage the AAA, once adopted; • Financial – Funds set aside for conservation, etc.; • Legal – Local ordinances dedicated to heightened protection of natural resources. Asset adaptive capacity can be measured in terms of minerals', species', or ecosystems' likelihood of migration, maintaining population, or sustaining levels of service (such as water filtration/carbon sequestration) in the event of projected flooding.

Exposure Analysis

During this step, the community and planning teams decide how to project potential future coastal flooding. This involves selecting:

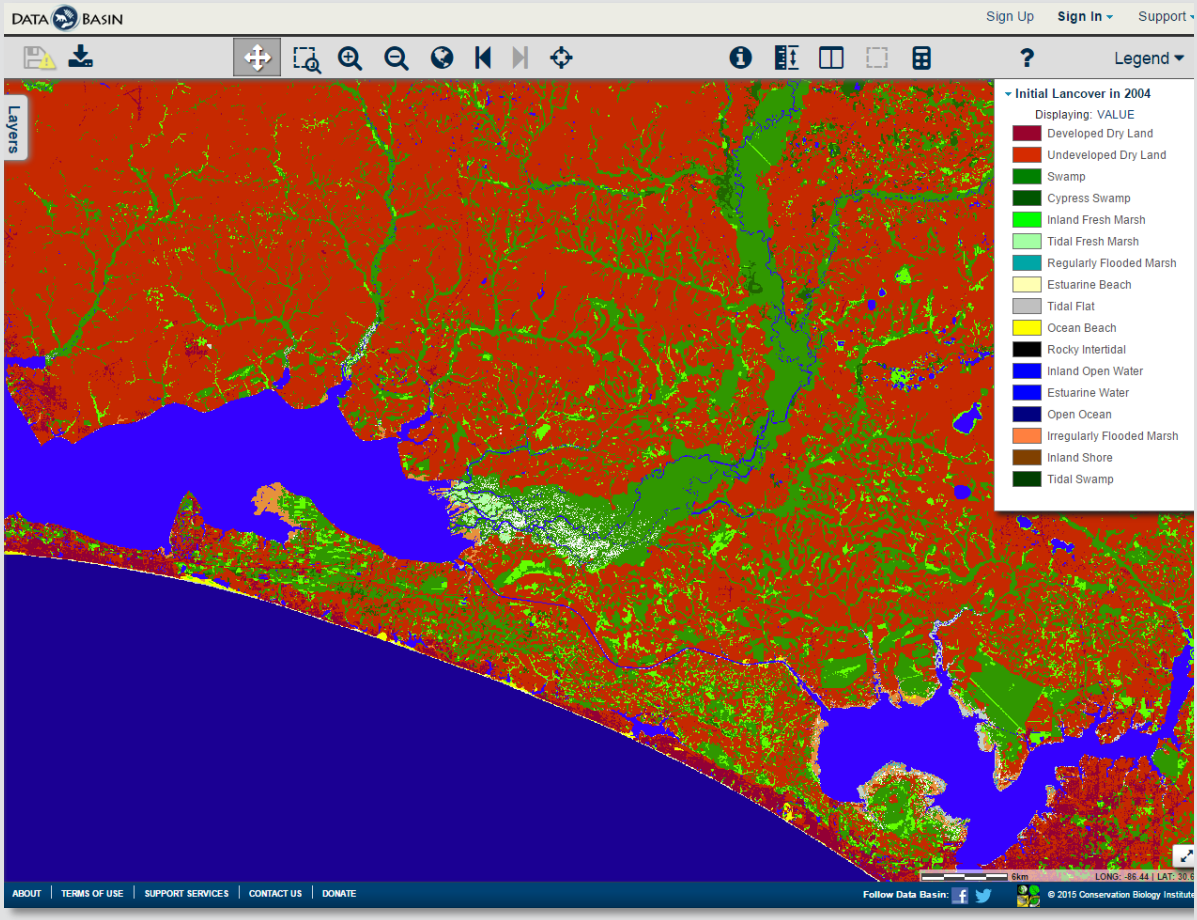
- A tidal datum to be projected (Mean Sea Level, Mean Higher-High Water, etc.);
- A range of possible sea level rise scenarios;
- Other flood hazards that may be modeled; and
- Natural processes – and changes to natural resources – to be modeled.

The third element (other flood hazards) may also play a significant role since it provides information about areas that will be exposed to storm surge or flood events. The last of these - natural process and changes to natural resources to be modeled - applies directly to planning for natural resources because some modeling tools, such as SLAMM, incorporate habitat changes related to rates of sea level rise.

The following boxes contain information regarding four tools communities can use to integrate an assessment of the coastal environment into their vulnerability analysis:

Sea Level Affecting Marshes Model (SLAMM)

This screen capture was taken from a SLAMM Analysis of Choctawhatchee and St. Andrew Bay, FL.



Nature Conservancy. (2014). *Choctawhatchee and St Andrews Bay Florida SLAMM Analysis* [Graphic]. Taken from http://databasin.org/datasets/9096604584da422fa39acaf159a62cc5

Because SLAMM projections can show habitat migration, expansion, or compaction due to sea level rise, communities may consider using SLAMM modeling to:

- Designating future conservation lands landward of current wetlands that are predicted to migrate;
- Decide where intensities of development may lead to crucial wetland and habitat loss; and
- Updating the local Hazard Mitigation Strategy to incorporate Low Impact Development and buffer zones along wetland-urban boundaries.

InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs

This screen capture was taken from the InVEST Coastal Vulnerability Program User Guide.

Table 4.1

Rank	Very Low	Low	Moderate	High	Very High
Variable	1	2	3	4	5
Geomorphology	Rocky; high cliffs; fjord; fiard, seawalls	Medium cliff; indented coast, bulkheads and small seawalls	Low cliff; glacial drift; alluvial plain, revetments, rip-rap walls	Cobble beach; estuary; lagoon; bluff	Barrier beach; sand beach; mud flat; delta
Relief	0 to 20 Percentile	21 to 40 Percentile	41 to 60 Percentile	61 to 80 Percentile	81 to 100 Percentile
Natural Habitats	Coral reef; mangrove; coastal forest	High dune; marsh	Low dune	Seagrass; kelp	No habitat
Sea Level Change	0 to 20 Percentile	21 to 40 Percentile	41 to 60 Percentile	61 to 80 Percentile	81 to 100 Percentile
Wave Exposure	0 to 20 Percentile	21 to 40 Percentile	41 to 60 Percentile	61 to 80 Percentile	81 to 100 Percentile
Surge Potential	0 to 20 Percentile	21 to 40 Percentile	41 to 60 Percentile	61 to 80 Percentile	81 to 100 Percentile

Table 4.1: List of Bio-Geophysical Variables and Ranking System for Coastal Exposure.

The Natural Capital Project. (2015). *List of Bio-Geophysical Variables and Ranking Systems for Coastal Exposure* [Table]. Taken from http://data.naturalcapitalproject.org/invest-releases/documentation/current_release/coastal_vulnerability.html

InVEST is a suite of free software programs designed to aide in decision making involving environmental resources. Questions that can be answered using InVEST include:

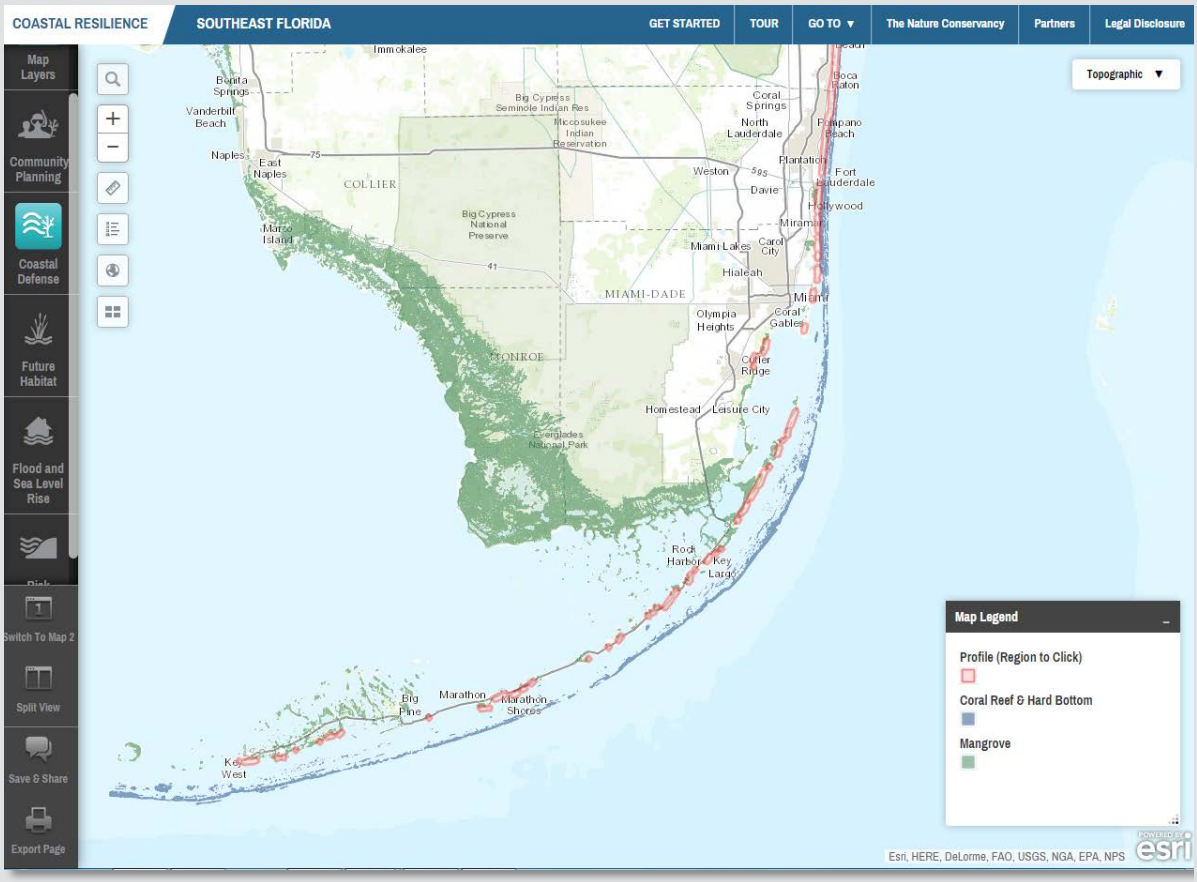
- How will a new coastal management plan impact seafood harvest, renewable energy production, and protection from storms?
- Where would reforestation or protection achieve the greatest downstream water quality benefits?
- Which parts of a watershed provide the greatest carbon sequestration, biodiversity, and tourism values?

There are currently 17 InVEST models available for download, each focusing on different aspects of environmental planning. These include:

- Coastal protection;
- Coastal vulnerability;
- Habitat quality; and
- Marine habitat quality

CoastalResilience.org Mapping Tool

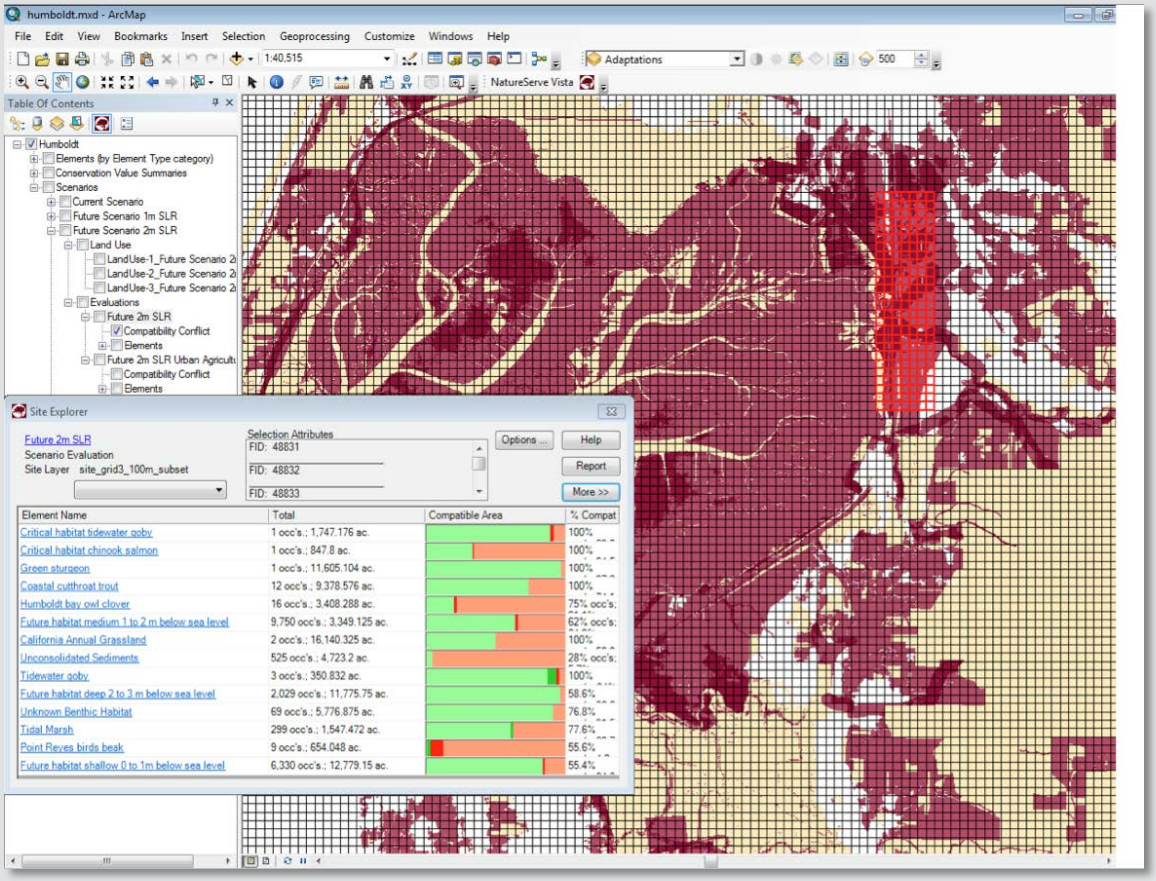
This screen capture was taken from the mapping tool available at CoastalResilience.org.



Coastal Resilience Network. (2015). *Coastal Resilience Mapping Portal* [Interactive Map]. Taken from http://maps.coastalresilience.org/seflorida/

The Coastal Resilience Network connects practitioners interested in applying nature-based solutions to issues of coastal adaptation and hazard mitigation. Among other available tools, the web-based mapping tool provides communities in southeast Florida and the Keys with a variety of layers to visualize issues, information, and data pertaining to sea level rise on a variety of axes: community planning, coastal defense, future habitat, flooding and sea level rise, and risk analysis.

NatureServe VISTA



NatureServe VISTA is a free ArcGIS extension intended to facilitate conservation planning and can also serve as a valuable and powerful tool in planning for sea level rise. It enables the integration of features of interest, expert knowledge, and a variety of planning scenarios and alternatives, among other information, into advanced spatial analyses. It is currently available for free download and unlimited use at http://www.natureserve.org/vista-download-form.

Impact Analysis

Impact analysis measures the degree of impairment an asset will experience as a result of coastal flooding. It accounts for additional layers of asset information not directly addressed in the exposure analysis. It is a method of estimating the impacts to natural resource assets identified during the planning context phase. For example, an exposure analysis may model changes in saltwater marsh habitat, while an impact analysis might add information about flora, fauna, and possibly even subterranean mineral deposits and hydrologic formations that would be affected in concert with the marshland. It can also provide information about what the effects on these additional resources will be.

The following list covers different coastal resources and related areas of potential concern that may be translated into impact layers of analysis.

Beaches:

1) Erosion
2) Existing infrastructure
3) Pollution and runoff

Animal Habitats/Nurseries:

1) Species Habitat Maps
2) Vegetative Species maps
3) Soil Maps
4) Pollution- physical and light
5) Destruction of habitats and nurseries for development purposes
6) Water activity-related disruption of animal behavior

Coastal Aquifers:

1) Saltwater intrusion
2) Unsustainable usage of water supplies
3) Pollution

Wetlands/Marshes/Coastal Timberlands:

1) Saltwater intrusion
2) Pollution
3) Development-related disruption of natural systems

Reefs and Marine Habitats:

1) Ocean acidification
2) Pollution and runoff
3) Human activity-related disruption of animal behaviors
4) Damage to seagrass beds

The following table provides a sample of tools available to conduct these analyses. Refer to DEO's *Inventory of Sea-Level Rise Adaptation Assessment Tools and Resources* for a comprehensive list with detailed descriptions.

Table 5: Sea level rise impact assessment tools

Online Sea-Level Rise Visualizers	
FDOT Sea Level Scenario Sketch Planning Tool	http://sls.geoplan.ufl.edu/
CanVis, Digital Coast: Sea-Level Rise and Coastal Flooding Impacts Viewer	http://www.coast.noaa.gov/digitalcoast/tools/canvis
NOAA Sea-Level Rise and Coastal Impacts Viewer	http://coast.noaa.gov/digitalcoast/tools/slr
Climate Central Surging Seas Viewer	http://sealevel.climatecentral.org/
Nature Conservancy, Keys Map	http://maps.coastalresilience.org/seflorida/
Databases of Resources	
Adaptation Database for Planning Tool (ADAPT)	http://www.icleiusa.org/tools/adapt
Climate Adaptation Knowledge Exchange (CAKE)	http://www.cakex.org/
Georgetown Climate Center	http://www.georgetownclimate.org/
Add-ins for GIS Programs or other Calculators	
HAZUS-MH	https://www.fema.gov/hazus
SimCLIM	http://www.climsystems.com/simclim/
LUCIS	https://www.geoplan.ufl.edu/lucis/lucis.html
Sea Levels Affecting Marshes Model (SLAMM)	http://www.slammview.org/slammview2/
Community Viz	http://placeways.com/communityviz/productinfo.html
NatureServe Vista	http://www.natureserve.org/conservation-tools/natureserve-vista
Open-Source Nonpoint Source Pollution and Erosion Comparison Tool (OpenNSPECT)	http://coast.noaa.gov/digitalcoast/tools/opennspect
Land Use Portfolio Model (by U.S.G.S.)	http://geography.wr.usgs.gov/science/lupm.html
Integrated Valuation of Environmental Services and Tradeoffs (INVEST)	http://www.naturalcapitalproject.org/InVEST.html
U.S.A.C.E. Sea-Level Change Calculator	http://www.corpsclimate.us/ccaceslcurves.cfm
Coastal Adaptation to Sea-Level Rise Tool (COAST)	https://www.bluemarblegeo.com/products/COAST.php
Other Assessment Tools	
The Social Vulnerability Index (SoVI)	http://webra.cas.sc.edu/hvri/products/sovi.aspx
NatureServe Climate Change Vulnerability Index (CCVI)	https://connect.natureserve.org/science/climate-change/ccvi

Sea level rise projection tools can illuminate the interlinkages between sea level rise, development patterns, and natural areas. Some tools, such as OpenNSPECT, InVEST, and LUCIS, can create future scenarios based upon adaptation strategy decisions. Chapter 4 will cover scenario planning in greater detail.

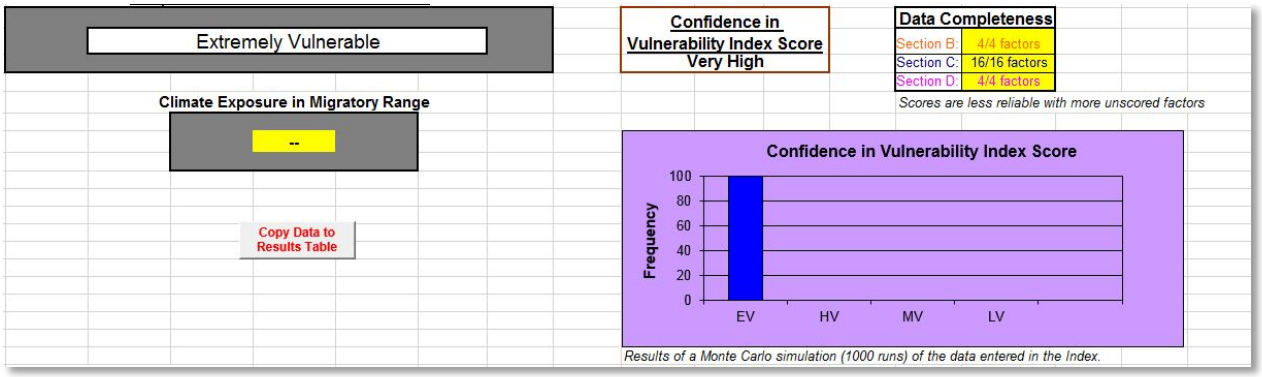
Assess Adaptive Capacity

Adaptive capacity refers to an asset or community's ability to accommodate and adjust to coastal flooding.

Some groups, such as Defenders of Wildlife, have created species-level adaptive capacity assessments. By downloading the tool[8], a planning team may assess Florida species vulnerability to sea level rise, among other factors. The factors are grouped according to the following:

- Temperature Exposure
- Hamon AET:PET Moisture Metric
- Migratory Exposure
- Indirect Exposure (3 factors)
- Sensitivity and Adaptive Capacity (6 factors)
- Documented or Modeled response to climate change

The tool then produces a reading on the species' vulnerability, with a confidence score, as shown in the following image:



For an inquiry into multiple Florida specie's adaptive capacity to changes in climate, planning teams may refer to the Defenders of Wildlife *Integrating Climate Change Vulnerability Assessments into Adaptation Planning* report for guidance.

In order to assess the whole-community adaptive capacity, the planning team and steering committee are encouraged to develop a framework to evaluate the community's capacity to respond to sea level rise. This may include an assessment of:

1. **Regulatory and planning capabilities** (*e.g.,* development restrictions, coastal management regulations, hazard mitigation, sustainability, shoreline management, post-disaster recovery/emergency plans, etc.);
2. **Administrative and technical capabilities** (*e.g.*, the number of sea level rise experts, planners, engineers, GIS and mapping resources and modelling capabilities, etc.);

[8] http://www.natureserve.org/ccvi_3-download

3. **Fiscal capacity** (*e.g.*, taxes, bonds, grants, impact fees, withholding spending in hazard zones and insurance); and
4. **Infrastructure** (*e.g.*, flood and erosion control structures, evacuation routes and redundant water, wastewater, and power systems)" (Russell & Griggs, 2012).

Chapter 4. Adaptation Strategies

Chapter 4 focuses on addressing the impacts of sea level rise through strategy development geared toward natural resource preservation. It also provides guidance for communities on how to develop potential adaptation strategies and then evaluate the efficacy of those strategies according to identified criteria. This chapter will look into the assignment of natural resource focus areas, adaptation strategies, and prioritization of adaptation needs. Table 6 shows some general considerations for each step.

Table 6: Natural Resource Adaptation Planning - Adaptation Strategy Considerations

Adaptation Plan Component		Conservation and Protection-Specific Additions
Adaptation Strategies	Assign Focus Areas	A focus area may interact with species "corridors" and help to reconnect areas rendered disconnected by inundation and human settlement In many cases, these focus area mappings can directly inform conservation and/or migration corridor Adaptation Action Areas.
	Create Adaptation Strategies	Adaptation strategies are the Protection, Accommodation, and Retreat initiatives that accompany and enhance Adaptation Action Area delineation, and may include activities planned for adjacent areas. Natural areas adaptation strategies may include: • Forming a conservation land trust • New building code enforcements in the AAA (such as structures that allow species to travel or nest nearby without encroachment). • Transfer of development rights • New easements • New Impact fees on structures near the AAA • New community outreach campaigns both within and outside of the AAA. • Community Ratings System activities that promote ecological flood mitigation • Wetland restoration • Other habitat restoration • Natural wave attenuation strategies • Living shorelines
	Prioritize Adaptive Needs	Prioritizing Natural Resources adaptation needs may include several activities: • A benefit-cost analysis comparing areas preserved to co-benefits of human property protected.

- An alternatives analysis incorporating other 'benefits' based upon the costs of different natural areas Adaptation Area strategies.
- Stakeholder and expert preferential ranking of each strategy proposed, based upon measurable or intangible criteria (*e.g.* cost, scenic views, public access to natural resources, strategic benefits, etc.)

Assign Focus Areas

Assigning focus areas draws from the impact and exposure analyses and refines stakeholder and expert input. This activity allows a community to narrow its focus to the spatial and categorical assets of greatest concern to the community.

Selecting Focus Areas

A final session concentrated on potential spatial planning options for each species. Using "geodesign" techniques, participants "sketched" various potential management actions on top of base or impact maps under different scenarios. In this way, we were able to identify not only which actions might be required, but also "where" and to some extent "how much." (Flaxman and Vargas-Moreno, 2011, p. 10)

The designing of focus areas thus involves identifying community resources and assets that have the highest protection priority. Data previously gathered and analyzed as part of the Adaptation Action Area design process will likely contribute to this identification. For example, if the protection of Scrub Jays is important to a community, then its local nesting areas will likely have been mapped at a prior point in the process.

Focus areas provide communities with a mechanism for further refine protection priorities if desired.

- Focus area, type 1 – geographic
    - The community and steering committee delineate areas with the most important concentrations of natural resource that will be affected by sea level rise and related flooding.
    - Examples may include:
        - Aquifer recharge zones
        - Estuaries
        - Coastal swamps
        - Mangroves
        - Coastal dunes
        - Endangered species habitats
- Focus area, type 2 – categorical

- The community and steering committee identify vulnerable species, habitats, or other resources that will be affected by sea level rise and related flooding.
- Examples may include:
  - Scrub Jay
  - Gopher Tortoise
  - Red Mangrove
  - Aquifer
  - Phosphate deposit

Once focus areas are assigned, the planning team may use them to design the community's adaptation strategy.

Develop Strategies

This section represents the "bricks and mortar" of the adaptation plan, or what is actually proposed to be done in each adaptation focus area. The strategies may be, but do not necessarily have to be, physical improvements. They can conform to Protection, Accommodation, or Managed Relocation as official policies (such as rolling easements). In addition, communities may want to emphasize "No Regrets" strategies – strategies that are low cost, solvent with existing work programs, or unlikely to need large consensus efforts. It is important for the steering committee and the planning team to prioritize the available strategies in the context of their respective community's needs and desires. Details for each type of strategy are provided below:

Protection – Hard and soft structurally defensive measures to mitigate the impacts of rising seas (*e.g*. seawalls, bulkheads, rip-rap, conservation wetlands, mangrove forests, etc.);

Accommodation – Physical design alterations allowing a structure or land use to remain in place (*e.g*. floodable development, floating structures, and bio swales);

Strategic Relocation – Relocation of existing development / limitation of future development (*e.g*. rolling easements, transfer of development rights, design for dis-assembly); and

Avoidance – Involves anticipatory actions taken to direct new development away from vulnerable lands to safer areas (*e.g.*, land conservation, conservation easements, and transfer of development rights).

ADAPTATION ACTION AREAS

BOTH A FOCUS AREA AND A STRATEGY

Communities are encouraged to incorporate an adaptation action area both as a focus area that establishes criteria for implementing further strategies *and* as a policy strategy itself.

As a policy strategy – The AAA delineates areas of need and identifies how future proposed remedies will be evaluated by the community's implementation mechanism.

As a focus area – The AAA acts as a geographic focus area. It identifies where more work is needed to mitigate impacts.

This section will detail a variety of adaptation strategies, tailored to meet the needs of conserving and managing natural resources.

AAAs as Strategy: Overlay Zone

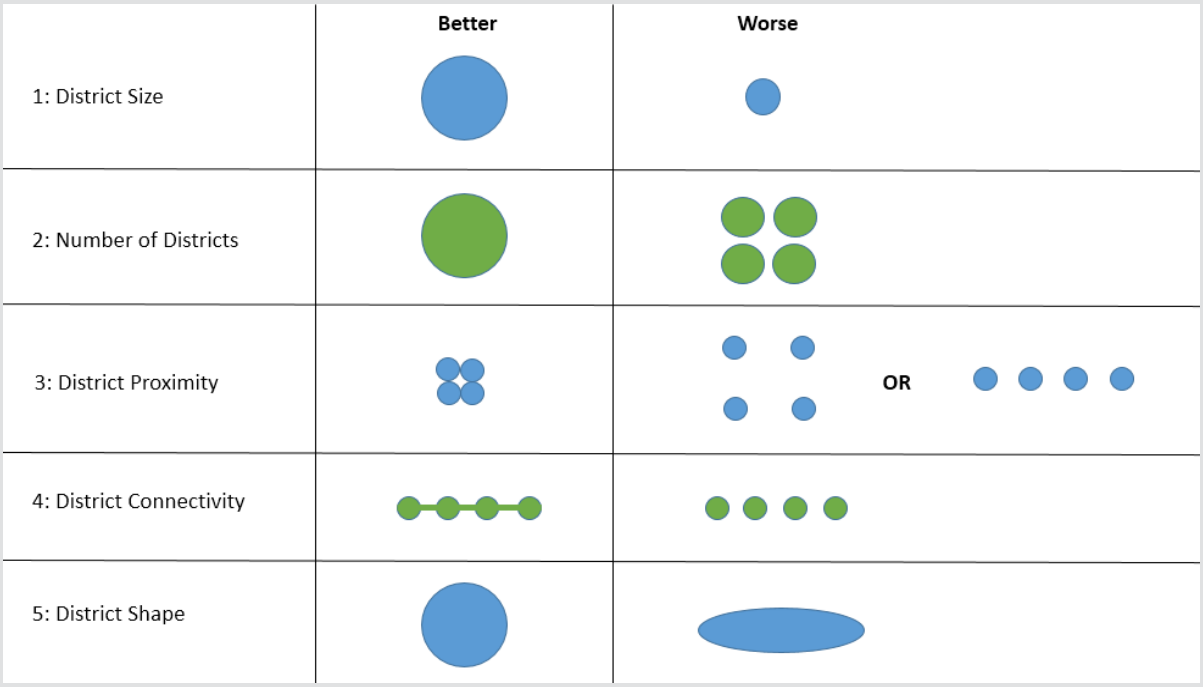
An overlay zone is "a zoning district which is applied over one or more previously established zoning districts, establishing additional or stricter standards and criteria for covered properties in addition to those of the underlying zoning district"[9]. Adaptation Action Area overlays will be similar to environmental overlay areas, the uses of which have included airport noise management; highway corridor management; agricultural areas management; scenic corridor protection; interface overlay management[10]; the protection of parks from residential development; the preservation of natural resources; the protection of groundwater; and the protection of rivers, floodplain areas, and other natural features. If an adaptation action area includes habitat corridors or easements as part of the overlay policy, the local government is encouraged to consider the more effective polygons for conservation, as examined in the following graphic.

[9] https://www.planning.org/divisions/planningandlaw/propertytopics.htm

[10] Used to achieve a compatible buffer zone for points at which heavy impact zoning directly borders upon light impact zoning

Designing Adaptation Action Area Overlays: Habitat-Related Considerations

The design of Adaptation Action Area overlay districts will have consequences for the plant and animal species located within. The following diagram illustrates some habitat-related considerations that may be considered when designing these overlay districts.



1: District size: Large habitats are preferable to small habitats

2: Number of districts: 1 large district is preferable to several smaller districts, even if the total area encompassed remains the same

3: District proximity: Proximate districts are preferable to more separated districts. Clustering of districts is preferable to districts arranged linearly.

4: District connectivity: Districts connected by wildlife corridors are preferable to unconnected districts

5: District shape: A circular district is preferable to an oblong district.

Adapted from: Diamond, J. M. (1975). The Island Dilemma: Lessons of Modern Biogeographic Studies for the Design of Nature Reserves. *Biological Conservation, 7*, 129-146.

New or Revised Adaptation Planning Regulations

Adaptation Action Areas are well-suited to work within the Coastal Management Element of comprehensive plans of all of Florida's coastal communities. "The purpose of the Coastal Management Element has always been to plan for, and where appropriate, restrict development activities that would damage or destroy coastal resources… The Element's Goals, Objectives, and Policies should provide for the maintenance, restoration, and enhancement of the coastal environmental zone and recreational uses… Now the Coastal Management Element can play an important role in adaptation planning" through integration of Adaptation Action Areas.[11]

Targeted Land Acquisition Programs

Targeted land acquisition for conservation and environmental protection has a long history in Florida. Programs such as Florida Forever and its predecessor, Preservation 2000, have served as some of the largest scale of such initiatives in the state. Targeted land acquisition programs for the purpose of conservation and environmental protection remains popular in Florida largely due to their voluntary nature and have resulted in the public acquisition of over six million acres. While funds for local efforts of targeted land acquisition are more limited than funds for state efforts, local governments might consider using Adaptation Action Areas to designate and prioritize land acquisitions through an affiliated community land trust. Local governments might also consider using Adaptation Action Areas to coordinate with state land acquisition efforts.

Conservation and Rolling Easements

Conservation easements are another tool available to local governments to protect environmentally sensitive lands through voluntary participation from landowners. Instead of outright acquisition of environmentally sensitive lands, the purchase of conservation easements involves the creation of a legal agreement to permanently limit allowed usages for conservation purposes. Landowners typically receive a tax deduction, the magnitude of which depends upon the size, environmental sensitivity, and restrictions put upon the land that is donated; the largest tax deductions are awarded to large tracts of very environmentally sensitive open land that are under intense development pressure and which are placed under very stringent conservation restrictions. Conservation easements tend to be much less expensive than outright acquisition. Local governments might considering using Adaptation Action Areas to designate and prioritize the purchase of conservation easements on environmentally sensitive lands, either by themselves or in conjunction with state resources.

[11] South Florida Regional Planning Council. (2013). *Adaptation Action Areas: Policy Options for Adaptive Planning for Rising Sea Levels* (DEO Publication #C0905), p.7

Rolling easements are similar. However, rolling easements allow for properties to maintain activities and/or residence on current coastal parcels until conditions along the shoreline change in a specified way (for example, until a certain amount of sea level rise occurs). At this point, the landward edge of the parcel "rolls" away from the shore, and the now-open area near the shore can be used for conservation purposes, to maintain public access to the beach, or for other sea level rise-related purposes.

One major advantage of conservation and rolling easements (or combinations thereof) are that these mitigation strategies can be market-driven and thus voluntary rather than imposed upon property owners. They are also likely to be cost-effective. However, the purchase of these kinds of easements is appropriate only on certain parcels with suitable characteristics (Valerie, 2013, p.16).

Transfer and Purchase of Development Rights

Transfer and purchase of development rights programs involve a structure wherein development rights for a parcel are purchased and then transferred to another parcel, which is then eligible to be developed above the previously allowed density. Typically, a Transfer of Development Rights (TDR) program will define a sending area and a receiving area. A sending area is usually an area set aside for conservation (*e.g.,* natural areas, farmland, and historic districts) and a receiving area is an area designated for more intense development. Growth can then be diverted from the sending area to the receiving area. Transfer and purchase of development rights programs that have only a single district function to limit overall density but cannot direct where development is to occur within the district. Local government might use Adaptation Action Areas to designate areas in which transfer and purchase of development rights programs could be implemented to protect natural resources.

Transfer and purchase of development rights programs are generally cost-effective for most parcel types, although the outright purchase of development rights may be politically infeasible in many communities. Well-designed transfer of development rights programs, by contrast, have great potential to increase the resiliency of most communities.

Other strategies: Species replenishment; recharge zones; desalination projects; natural resource replenishment or re-location; low-impact development; stormwater improvements; pollution control; land-use amortization; and soft armoring.

Prioritize Adaptation Needs

Prioritizing adaptive needs simply refers to comparing the merits and costs of potential adaptation strategies. Which strategies will confer the greatest future benefit? Which strategies are most preferred by stakeholders and experts? Communities have many different options for evaluating potential natural resource conservation and management strategies. Potential areas of consideration when evaluating the feasibility of different strategies include:

Political/stakeholder considerations:

1) Local political temperament and major political players and influences
2) Community attitudes toward land-use management and environmental planning
3) Potential conflicts or synergies with pre-existing, ongoing, or planned planning efforts (Local Mitigation Strategy, Post-Disaster Redevelopment Plan, Comprehensive Plan, Historic Preservation Plan, etc.)
4) Potential conflicts or collaborations with community groups

Resource considerations:

1) Funding
2) Planning time horizon
3) Available human resources
4) Available infrastructure
5) Time available for formulation and implementation of Adaptation Action Areas

Regional Considerations:

1) Pre-existing, ongoing, or planned regional planning efforts
2) Potential conflicts or collaborations with neighboring municipalities

Other considerations:

1) Climate
2) Local planning authority

Incorporating these considerations into the prioritization of the adaptation strategy is intended to ensure three things: holistic response to the problem, stakeholder buy-in, and economic efficiency. These three forces feed into and influence one another. Stakeholder rejection can increase costs; neglecting to consider a facet of future coastal flooding in natural areas may result in unhappy stakeholders and increased costs. It is pivotal for the success of planning efforts to incorporate costs and benefits into the consideration of adaptation strategies. The following two graphics illustrate standardization, and dollar valuation of open space (from FEMA). However, there are some strategies whose costs and benefits can be difficult to quantify. In these cases, stakeholder input is imperative. An example cost-benefit table is shown below:

Adaptation Strategy	Cost	Benefit, in terms of structure protection	Benefit, in terms of natural resource protection	Stakeholder Preference level	Resources Available for Implementation
Sea-wall	$ 1,000,000	$ 10,000,000	0	2	3
Wetland Restoration	$ 400,000	$ 5,000,000	$ 6,000,000	4	2
Low-Impact Neighborhood regulations	$ 350,000	$ 2,000,000	$ 4,000,000	3	4
STANDARDIZATION					
	= -[(C – Min Cost) / Max Cost]	= (B – Min Ben) / Max Ben	= (B – Min Ben) / Max Ben	= (P / Max P)	= (R / Max R)
Sea-wall	-.65	.8	0	.5	.75
Wetland Restoration	-.05	.3	1	1	.5
Low-Impact Neighborhood regulations	0	0	.66	.75	1

For the purpose of calculating open space values, FEMA rendered values for facets of riparian and green open space areas. These values are presented in the following graphic.

Inventory the Open Space and Assign a Value

The table below shows the types and values of environmental benefits included in FEMA's Benefit Cost Analysis (BCA) for acquisition-demolition or acquisition-relocation projects.

Environmental Benefit	Green Open Space	Riparian
Aesthetic Value	$ 1,623	$ 582
Air Quality	$ 204	$ 215
Biological Regulation	——	$ 164
Climate Regulation	$ 13	$ 204
Erosion Control	$ 65	$ 11,447
Flood Hazard Reduction	——	$ 4,007
Food Provisioning	——	$ 609
Habitat	——	$ 835
Pollination	$ 29	——
Recreation/Tourism	$ 5,365	$ 15,178
Storm Water Retention	$ 293	——
Water Filtration	——	$ 4,252
Total Estimated Benefits	$ 7,853	$ 37,493

The table below shows total estimated benefits per acre per year and the total estimated benefits per-square-foot for green open space and riparian land use.

Land Use	Total Estimated Benefits	Total Estimated Benefits (projected for 100 years with 7% discount rate)
Green Open Space	$7,853 per acre per year	$2.57 per square foot
Riparian	$37,493 per acre per year	$12.29 per square foot

Federal Emergency Management Agency [FEMA]. (June 18, 2013). Consideration of Environmental Benefits in the Evaluation of Acquisition Projects under the Hazard Mitigation Assistance (HMA) Programs. Mitigation Policy – FP-108-024-01.

As part of a cost-benefit comparison, the benefits of sea level rise mitigation activities and the costs of not engaging in such activities can be included. For example, in an analysis of forgone tourism and tax revenues stemming from shifting shoreline patterns and loss of access to beach areas, some research estimates up to 30% loss of current revenues by 2050 (Valerie, 2013, 16).

Chapter 5. Implementation Strategies

The final component in the adaptation planning process involves ensuring that findings and solutions are integrated into regulatory documents and/or put into action. It also represents a starting point for monitoring and evaluation. Table 7 examines all four steps from the components guide in relation to natural resource adaptation planning. Survey funding, Integrate into existing plans, and Monitoring and Evaluation will be explained in this chapter.

Table 7: Natural Resource Adaptation Planning - Implementation Considerations

Adaptation Plan Component		Conservation and Protection-Specific Additions
Implementation	**Survey Funding**	Alongside the Florida Forever Program, many opportunities exist for supporting natural resource conservation and management. The RESTORE Act, and EPA funds may apply to natural resource projects within Adaptation Areas. Funding may also be available through the Coastal and Estuarine Land Conservation Program, U.S. Fish and Wildlife Conservation Commission, and FDEP.
	Integrate into Existing Plans	As with other specialty adaptation planning efforts, there are many important opportunities to incorporate the issues discussed in the AAA plan into other mechanisms. Beyond the local comprehensive plan, other plans could include: • Wildlife management plans • Natural areas plans • Federal / State / Local conservation areas plans • Wildfire plans • Easements within the Zoning code
	Create a Schedule of Actors and Activities	The entities and people responsible for carrying out natural resource Adaptation Areas strategies may originate from those already mentioned in one of the plans mentioned above, or they may be specialists such as hydrologists, minerals experts, and wetlands experts. Because the work may involve monitoring done by specialists, members of the Steering Committee may even be programmed as actors within the schedule. New collaborations may also form, such as between a wildlife specialist and the public works department in cases such as habitat restoration,

		plantings and plant-removal, and other natural areas modifications.
	Monitor & Evaluate	Natural resource areas often need specific monitoring efforts in order to determine whether or not adaptation strategies are having a desired effect. For natural resource AAAs, this may include: • Species tracking • Habitat monitoring • Soil / Water testing • Other tests

Survey Available Funding

Potential sources of funding for natural resource Adaptation Action Areas come from numerous sources.

Florida Forever is the state of Florida's successful and popular land acquisition and conservation program. Local governments are eligible to receive Florida Forever Funds for land acquisition through several programs, including the Florida Communities Trust and the Florida Recreation Development Assistance Program.

The RESTORE Act makes funding available "for programs, projects, and activities that restore and protect the environment and economy of the Gulf Coast region."[12] Administration of funding from the Gulf Coast Restoration Fund flows through two grant programs: the Direct Component and the Centers of Excellence Grant Program. Under the Direct Component, 23 Florida counties have been allocated an estimated $56,094,801 as of March 31, 2015 to be directed to eligible restoration projects and programs.[13] The Gulf Coast Ecosystem Restoration Council, consisting of representatives from six Federal agencies or departments and the five Gulf Coast states (Florida, Alabama, Mississippi, Louisiana, and Texas), is responsible for determining the eligibility of project and program proposals to be funded through the Direct Component. More information on the Gulf Coast Restoration Fund may be found at this link.

The United States Environmental Protection Agency (EPA) administers a variety of grant programs. Information about current and ongoing grant programs can be located on the EPA website. EPA funding opportunities of particular interest to communities implementing Adaptation Action Areas to conserve and manage natural resources include:

- Smart Growth Grants: support for projects that improve the quality of development as well as protect public health and the environment
- Brownfield Program Grants: direct support for brownfield assessment, cleanup, revolving loans, and environmental job training
- Diesel Emissions Reduction Act Grants: support for improving local air quality

[12] http://www.treasury.gov/services/restore-act/Pages/default.aspx
[13] http://www.treasury.gov/services/restore-act/Documents/Trust%20Fund%20Allocations%20(09.03.2014%20Revision).pdf

- BEACH Act Grants: support for beach monitoring and notification programs
- Clean Water State Revolving Fund: support for water quality protection projects for wastewater treatment, nonpoint source pollution control, and watershed and estuary management
- Drinking Water State Revolving Fund: support for infrastructure improvements to water systems. Special emphasis is placed on supporting small and disadvantaged communities.
- Federal Funding for Utilities in Natural Disasters: resource for connecting water and wastewater utilities to available federal funds
- Targeted Watershed Grants Program: support for community-based approaches to watershed protection and restoration
- Wetlands Program Development Grants: support for water pollution management
- 5 Star Restoration Program: support for community-based wetlands restoration

The Coastal and Estuarine Land Conservation Program is administered through the National Oceanic and Atmospheric Administration (NOAA). Funding is available for the acquisition of coastal and estuarine properties "that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from a natural or recreational state to other uses."[14] Applicants are eligible to receive up to $3 million per project, which must be matched equally by non-federal funds.

NOAA may also be able to provide additional funding opportunities for natural resource Adaptation Action Areas.

The United State Fish and Wildlife Conservation Commission offers funding opportunities that may be of interest for those communities seeking to implement Adaptation Action Areas for the conservation and management of natural resources. These include North American Wetlands Conservation Act Grants and Wildlife and Sport Fish Restoration Funds.

Florida Department of Emergency Management (FDEM) offers funding for local governments to implement hazard mitigation strategies that reduce the risk of future damage, hardship, loss, or suffering after the declaration of a natural disaster through the Hazard Mitigation Grant Program. Funding may be dedicated toward improving, reinforcing, or rebuilding infrastructure, which may be use to communities interested in implementing Adaptation Action Areas for the conservation and management of natural resources.

Florida Department of Environmental Protection (FDEP) offers various sources of funding for water-resource related projects. Available opportunities may include:

- Low interest State Revolving Fund Loans: provide financial assistance for watershed improvements projects. Over $200 million in annual assistance is provided.
- Disadvantaged Small Community Wastewater Grants: provide financial assistance to small communities in planning, designing, and constructing wastewater management facilities.

[14] http://www.dep.state.fl.us/cmp/programs/celcp.htm

- Federal Section 319(H) Grants: provide financial assistance for stormwater facilities retrofitting and stormwater best practices management. $7-8 million is provided annually, although funds matching is required.
- Total Maximum Daily Load (TMDL) Funding: provides financial assistance primarily for stormwater retrofitting. Aimed at waters that have been identified as "impaired" through FDEP's TMDL Program.
- Beach Management Funding Assistance (BMFA) Program: provides financial assistance for restoration, nourishment, protection, and other beach management activities.
- Other funding may be available through applicable Water Management Districts.

Opportunities for funding for natural resource Adaptation Action Areas may also available through DEO.

- Community Development Block Grant Disaster Recovery Funding: Available to units of local governments in locations designated as disaster areas. Funding is available for a variety of recovery activities, including infrastructure repairs and hazard mitigation efforts. Communities must have significant unmet needs and the ability to successfully carry out a disaster recovery program. Projects must meet certain national objectives and must not have duplicate funding available from other sources.
- Technical Assistance Grants: Funding has previously been awarded to local governments for assistance in meeting the requirements of the Community Planning Act, addressing critical local planning issues, and promoting innovative solutions to local planning problems.

Integrate into Existing Planning Mechanisms

The following section looks at how the Adaptation Action Area can figure into the Comprehensive Plan, Local Mitigation Strategy, Post-Disaster Redevelopment Plan, and Community Ratings System activities.

Comprehensive Plans

Adaptation Action Area policies can be implemented in both required and optional elements of local comprehensive plans.

For local municipalities interested in implementing Adaptation Action Areas for natural resource conservation and management, the consistency requirement (all sections of a comprehensive plan must avoid contradictory policies) presents opportunities to infuse the entire plan with resilient policy. Local governments who adopt Adaptation Action Areas into their comprehensive plan will thus be empowered to revamp their comprehensive planning strategy to facilitate rather than fight against adaptation.

Future Land Use Element

Municipalities may utilize the Future Land Use Element of the comprehensive plan to downzone areas within an Adaptation Action Area overlay, designate future renourishment or soft-armoring areas, and designate sending and receiving zones for a transfer of development rights. The map series could also be used to delineate any overlays identified and/or the Adaptation Action Area itself.

General Sanitary Sewer, Solid Waste, Drainage, Potable Water, and Natural Groundwater Aquifer Element

This Element provides an opportunity for municipalities to integrate fresh, gray, and black water control and treatment strategies addressing sea level rise. The Element mandates that special consideration must be given to the conservation of natural potable water resources and the protection of the function of natural groundwater recharge areas and natural drainage features. A strong example of a community already incorporating sea-level rise into their water supplies plan comes from Miami-Dade County.

This Element also encourages to cooperation among local governments, public and private utilities, regional water supply authorities, special districts, and water management districts in planning for the conservation and management of water resources. Such cross-boundary cooperation is critical when addressing the environmental planning issues natural resource Adaptation Action Areas seek to address, which do not conform to political boundaries and require cross-boundary cooperation and coordination to be effectively targeted. For this reason, the County may be the best level at which to include Adaptation Action Area policies dealing with water.

Transportation Element

Coastal municipalities may utilize the transportation element to address the port-related transportation infrastructure needs of the adaptation strategies they choose to implement. Additionally, it is important to remember the effects that roadways may have on migration corridors and on stormwater drainage when considering transportation near environmentally sensitive coastal areas. As such, the Adaptation Action Area may include language to address migration corridors and stormwater improvements.

Conservation Element

As stated in Florida Statute, §163.3177 (d), the Conservation Element is aimed at "the conservation, use, and protection of natural resources," including water, water recharge areas, wetlands, marine habitats, fisheries, wildlife, and other natural and environmental resources. Many of the components required to be included within this element directly address issues that are likely to reflect local government motivations to implement natural resource Adaptation Action Areas, including:

- A requirement to identify and analyze existing recreational and conservation uses, known pollution problems, and the potential for conservation, recreation, use, or protection of certain natural resources, including rivers, bays, wetlands, groundwater, springs, floodplains, areas known to experience erosion problems, and important marine, vegetative, and wildlife habitats.
- A requirement to contain principles, guidelines, and standards for conservation that provide long-term goals and which conserve, encourage appropriate usage of, and protect the quality and quantity of current and projected water sources and resources.
- A requirement to contain principles, guidelines, and standards for conservation that conserve, encourage appropriate usage of, and protect native vegetative communities, fisheries, and wildlife habitats. Communities are required to co-ordinate the protection of vulnerable vegetative communities across political boundaries when necessary.
- A requirement to contain principles, guidelines, and standards which designate environmentally sensitive lands for protection based on locally-determined criteria.
- A requirement to contain principles, guidelines, and standards which protect and conserve wetlands and the natural functions thereof, including discouraging incompatible future land uses.

Recreation and Open Space Element

Municipalities interested in implementing Adaptation Action Areas for natural resource conservation and management can utilize this Element to design a system of recreational sites that are conducive to the achievement of desired adaptation goals (FS § 163.3177 (e)). For example, municipalities could designate environmentally sensitive lands as recreational park space, thus preventing the encroachment of development on land that needs to remain undeveloped as part of a municipality's adaptation strategies as well as creating outdoor recreational space for the public.

Housing Element

Municipalities can turn to the housing element to locate future housing, along with supporting infrastructure and public facilities, in sites that do not interfere with the ability of the municipality to achieve desired adaptation goals (FS § 163.3177 (6)(f)1). Communities are thus encouraged to create language within their Adaptation Action Area addressing the concepts of retreat and avoidance when the natural benefits are large. If estuaries, swamp marshes, mangroves, or inland riparian features are projected to change and migrate alongside sea-level rise, then the Adaptation Action Area may provide criteria for easements and infrastructure that will aid and abet the health of these systems. These municipalities are also authorized to relocate historically significant housing for the purposes of conservation; guidance can be obtained from DEO's *Historic Preservation for Sea Level Rise Guidebook*.

Coastal Management Element

Although the ability of interested municipalities to design and implement Adaptation Action Areas for natural resource conservation and management is specifically mentioned in the Coastal Management Element (FS § 163.3177 (6)(g)10), nearly all objectives outlined in this Element directly touch on issues related to sea level rise. This Element requires coastal municipalities to:

- Maintain, restore, and enhance the overall quality of the coastal zone environment, including, but not limited to, its amenities and aesthetic values.
- Preserve the continued existence of viable populations of all species of wildlife and marine life.
- Protect the orderly and balanced utilization and preservation, consistent with sound conservation principles, of all living and nonliving coastal zone resources.
- Avoid irreversible and irretrievable loss of coastal zone resources.
- Use ecological planning principles and assumptions in the determination of the suitability of permitted development.
- Limit public expenditures that subsidize development in coastal high-hazard areas.
- Protect human life against the effects of natural disasters.
- Preserve historic and archaeological resources, which include the sensitive adaptive use of these resources.

Thus, the Coastal Management Element can naturally include a discussion of the resources to be affected by sea-level rise and their subsequent protection through the Adaptation Action Area.

Interested municipalities might also include in this Element requirements or incentives for development within Adaptation Action Areas to integrate Community Ratings System activities (further explicated in the Community Ratings System section). Municipalities might also choose to incorporate standards for

tree coverage for stormwater management or erosion and sediment control purposes on coastal or otherwise vulnerable properties located within natural resource Adaptation Action Areas.

Intergovernmental Coordination Element

Municipalities may use this requirement as an opportunity to jointly plan any cross-boundary infrastructure improvements necessary to implement desired adaptation strategies. Municipalities are empowered to engage in interlocal agreements with other localities "to make the most efficient use of their powers" (FS §163.01(2)). As discussed in the Water element above, the County may serve as the central comprehensive plan establishing coordination (or criteria) for community interaction revolving around Adaptation Action Areas.

Capital Improvements Element

Municipalities wishing to implement Adaptation Action Areas for the conservation and management of natural resources should integrate into the Capital Improvements Element of their comprehensive plan provisions for funding, scheduling, and implementation of any necessary infrastructure improvements identified in other sections of the plan.

Optional Elements

Municipalities are authorized to incorporate into their Local Comprehensive Plan elements beyond those that are statutorily required. In addition, a municipality can add elements of their own design. For example, if a community wishes to incorporate all of its Adaptation Action Area strategies into one section of its comprehensive plan, it may add an Adaptation Element.

Local Mitigation Strategies and Plans

Communities interested in adopting Adaptation Action Areas for natural resource conservation and management may utilize the mitigation goals portion of their LMS to articulate goals consistent with the adaptation goals and strategies identified in the comprehensive plan. This will be facilitated if the same risk assessment findings, outreach findings, and community goals are identified and used by local municipalities to design both their comprehensive plan and LMS.

Examples of mitigation goals articulated in LMSs (or the local equivalent thereof) that may be of interest and/or use to municipalities interested in natural resource Adaptation Action Areas:

- Reduce risks and vulnerabilities of facilities and properties in hazard-prone and environmentally sensitive areas (Escambia County, FL)
- Reduce the vulnerabilities of state-owned facilities and infrastructure to natural and manmade hazards (Monroe County, FL)
- Collier County shall make every reasonable effort to protect water resources, unique natural habitats, and ecologically sensitive areas such as wetlands and hardwood hammocks, and restore, to the maximum extent possible, degraded natural systems to their original state (Collier County, FL)

- Minimize future losses from all hazard impacts by reducing the risk to people and property (Miami-Dade County, FL)

Mitigation Actions

The mitigation actions section must identify and analyze a range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP (National Flood Insurance Program) and continued compliance with NFIP requirements, as appropriate.

There are four primary types of mitigation actions, the first three of which may be of particular interest to communities interested in designing and implementing natural resource Adaptation Action Areas:

1. Local plans and regulations, including local comprehensive plans, land use ordinances, capital improvement programs, and open space preservation.
2. Structure and infrastructure projects, including acquisition and elevation of structures in vulnerable areas, floodwalls, retention structures, and culverts.
3. Natural systems protection projects, including sediment and erosion control, stream corridor restoration, forest management, and conservation easements.
4. Education and awareness programs, including radio and TV spots.

Communities interested in implementing Adaptation Action Areas for the conservation and management of natural resources should evaluate each alternative on a variety of criteria, which may include:

- Safety impacts of the alternative;
- Property protected by the alternative;
- Technical feasibility of the alternative;
- Political feasibility of the alternative;
- Legal defensibility and authorization of the alternative;
- Environmental impact of the alternative;
- Social implications of the alternative; and
- Administrative capacity to implement the alternative.

Example Mitigation Actions integrating an Adaptation Action Area can include:

- Overlay wherein repetitive loss properties are tracked and acquired;
- Overlay denoting critical natural storm buffers;
- Mangrove protection and expansion toward wave attenuation;
- Dune restoration abutting human settlement.

Adaptation strategies that may be integrated into PDRPs include, but are not limited to:

Rebuilding Incentives and Restrictions

Within their PDRPs, communities may choose to restrict post-disaster redevelopment in vulnerable areas and incentivize redevelopment in less vulnerable areas by regulating the timing and type of redevelopment allowed. For example, communities might require redevelopment in Adaptation Action Areas to integrate adaptation techniques (*e.g.*, floodproofing measures) into construction, whereas redevelopment outside of the Adaptation Action Area may be under no such restrictions. This may increase the community's resiliency in two ways. First, the increased costs associated with the integration of adaptation techniques into redevelopment may incentivize a larger proportion of redevelopment to occur outside of Adaptation Action Areas (*i.e.*, outside of the most vulnerable areas in the community). Second, redevelopment that occurs within Adaptation Action Areas will be more resilient to the impacts of sea level rise. It should be noted, however, that special consideration may need to be given to the adaptation of historic properties located within Adaptation Action Areas, as these structures have different needs and often have different legal restrictions than non-historic properties. Guidance on this may be obtained from the DEO guidebook *Adaptation Planning for Historic Properties.*

Similarly, communities may choose to impose post-disaster rebuilding moratoria or delayed permitting in Adaptation Action Areas. This will allow communities adequate time to assess damages incurred and to explore further opportunities for hazard mitigation and increased resiliency. For example, a moratorium on redevelopment in an Adaptation Action Area that experienced substantial damage to infrastructure during a disaster may allow the community to plan and rebuild (possibly in a different location) more resilient replacement infrastructure; this moratorium will be useful if replacement or relocation of the damaged infrastructure was not originally incorporated into planning considerations for the Adaptation Action Area.

Soft Armoring Permits

Within their PDRPs, local governments may choose to create permitting programs for soft armoring techniques, such as beach renourishment and the creation of living shorelines. Post-disaster redevelopment in Adaptation Action Areas could potentially be required to integrate some form of sort armoring. The increased cost associated with implementation of these techniques may incentive redevelopment to occur outside of the Adaptation Action Area and thus outside of the community's most vulnerable areas. Any redevelopment that does occur within the Adaptation Action Area will be more resilient to the effects of sea level rise. Communities may also choose to issue permits for hard armoring techniques such as the construction of a seawall, but, as previously discussed, hard armoring techniques, while sometimes necessary, tend to create negative impacts on shoreline ecosystems and are thus less preferable to soft armoring techniques.

Changes in Land Use Designations and Other Land Use Strategies

Communities may choose to integrate changes to land use designations in areas affected by disasters to better reflect changed community conditions. Post-disaster land use changes in Adaptation Action Areas may include converting lands to inundation-friendly and/or water-dependent usage. Communities may also choose to convert land in Adaptation Action Areas to conservation lands or other open space.

Communities may also choose to integrate Transfer of Development Rights (TDR) Programs, which are further described elsewhere in this guide.

Establishment of Site Design Requirements that Encourage and Increase Resiliency
Communities may choose to implement post-disaster site design requirements in Adaptation Action Areas that encourage and increase resiliency. This may include:

- Reduced intensity or density of use;
- Special permitting requirements;
- Increased setbacks from hazard sources;
- Hazard-specific site design requirements; and
- Increased structural mitigation requirements.

Environmental Strategies
In addition to strategies intended to make the built environment within Adaptation Action Areas more resilient to sea level rise-related hazards directly, communities may choose to integrate into their PDRPs environmental planning strategies that work to increase the resiliency of the natural environment. Ultimately, however, increasing the resiliency of the natural environment will also function to increase the resiliency of the built environment. Potential strategies include, but are not limited to:

- Restoration of beaches and dunes;
- Cleanup of environmental contaminants;
- Procedures and guidance aimed at ensuring that environmental integrity and resiliency is not negatively impacted by post-disaster redevelopment;
- Restoration of natural land and habitats; and
- Restoration of parks and urban forests.

Community Ratings System Activities

The National Flood Insurance Program (NFIP) provides affordable flood insurance to communities that comply with minimum standards for floodplain management. Under NFIP's Community Ratings System (CRS), interested communities may implement additional floodplain management activities and in doing so potentially lower flood insurance premiums for the community's property owners. The following CRS activities, assembled by University of Florida's Levin College of Law, incorporate natural resource conservation and protection:

- Activities 510, 345 (Floodplain management planning, Related activities under the Community Rating System) – **The Adaptation Action Area itself is one example**
- Activity 542.f (Coastal Erosion Protection) – ***e.g.,*** **Beach nourishment**

- Activities 452.a, 452.b, 432.a (Stormwater management regulations, Watershed master plan, Development limitations) – ***e.g.,*** **Increase stormwater storage**
- Activities 420, 410CE, 430CE (Open Space Preservation, Additional flood Data for Coastal Erosion Areas, Higher Regulatory Standards) – ***e.g.,*** **Public acquisition of land for preservation purposes**
- Activities 322.g, 422.g (Natural floodplain functions, Natural shoreline protection) – ***e.g.,*** **Design and implement living shoreline**
- Activities 430CE, 322.g (Prohibition of hardened structure, Natural floodplain functions) – ***e.g.,*** **Oyster reef restoration**
- Activity 322.e (Special flood-related hazards) – ***e.g.,*** **Sharing information about potential effects of sea level rise and related flooding with buyers potentially interested in purchasing property within the community**
- Activities 331.a, 332.c, 332.d (Activity Description, Program for Public Information, Stakeholder delivery) – ***e.g.,*** **Outreach Projects**
- Activities 432.i, 452.a(3) (Local drainage protection, Low-impact development) – ***e.g.,*** **Implementation of low-impact development standards**
- Activity 422.e (Open Space incentives) – ***e.g.,*** **Implementation of low-intensity zoning**
- Activities 322.g, 422.a, 410CE, 430CE (Natural floodplain functions, Open space preservation, Additional flood data for coastal erosion areas, Higher regulatory standards) – ***e.g.,*** Design and implementation of **riparian/littoral buffers**
- Activity 430CE (Higher Regulatory Standards) – ***e.g.,*** **Implementation of rolling easements**

Monitoring, Evaluation, and Ongoing Management

Post-implementation monitoring and evaluation of adaptation strategies is essential because it ensures that 1) strategies have been implemented as intended; 2) implemented strategies are having the desired effects; and 3) adjustments can be made to integrate into the plan of actions considerations stemming from 1) and 2) above.

When managing natural resources, it is important to recognize that environmental conditions can and often do change over time due to both human-related and non-human related activities. It is therefore advisable to continuously monitor and evaluate these conditions to determine if and when adaptation strategies and plans should be altered, abandoned, or replaced (Martin et al., 2011). This may be particularly important in adaptation to sea level rise, as the effects of rising sea levels will likely cause fairly rapid, permanent changes to local environmental conditions. For communities interested in designing and implementing natural resource Adaptation Action Areas, this means that strategies chosen for implementation at the onset of the adaptation planning process may need to be altered or replaced, perhaps more than once, as the effects of sea level rise on the local area change over time. For example, during the initial design and implementation of an Adaptation Action Area, a community might choose to require that new structures built in the Adaptation Action Area integrate wet floodproofing measures into their construction. However, over time the community's monitoring efforts may reveal that increased storm surge and erosion caused by increased sea level rise have rendered those wet floodproofing measures gradually less effective at preventing damage to coastal properties during storm events. The community might then choose to amend its comprehensive plan and other planning mechanisms during the next update to require even more proactive protective measures on new structures, or severely restrict new development altogether, within the Adaptation Action Area.

Guidance, historical data, and other resources pertaining to the monitoring and ongoing management of environmental resources may be available from the following sources.

Water Monitoring, Evaluation, and Ongoing Management Resources

- FDEP's Watershed Monitoring Program continually collects and analyzes samples taken from a variety of freshwater sources around the State.
- Historical monitoring data is available in the form of Interactive Water Quality Report Cards.
- Surface-water data can be located in the FDEP STORET database and U.S. Environmental Protection Agency's (EPA) Water Quality Assessment and Total Maximum Daily Loads Information Tool.
- Historical groundwater data may be located in the EPA STORET Legacy Data Center.
- Information about State water quality standards may be obtained from FDEP's website.
- EPA's benchmarks for harmful aquatic pesticide concentrations may be located on the Office of Pesticide Programs' Aquatic Life Benchmarks page.
- EPA's Nonpoint Source Outreach Toolbox contains a variety of resources for educating the public on nonpoint source pollution and stormwater runoff.
- Adaptation resources and tools, including monitoring tools, can be located on EPA's website.
- Opportunities for financial assistance for watershed protection projects may be found using the Catalog of Federal Funding Sources for Watershed Protection.

- Information about and tools for the development and implementation of watershed management plans can be found in the Handbook for Developing Watershed Plans to Restore and Protect Our Waters and the Watershed Plan Builder.
- Tools for the management of watersheds with suspended or bedded sediment problems may be located on the Watershed Assessment of River Stability and Sediment Supply site.
- Additional technical tools for watershed management are available through the EPA.
- Training resources for watershed management are available through EPA's Watershed Academy.
- EPA also provides a suite of resources for wetlands management and watershed management funding.

Air Monitoring, Evaluation, and Ongoing Management Resources

- Florida's Air Quality System (FLAQS) provides up-to-date information about ambient air quality. Data is provided by 19 state, local, and private environmental programs.
- AIRNow provides information about ozone and particular pollution in different localities. Information is submitted by various Federal agencies, news media, and tribal, state, and local agencies.
- The Centers for Disease Control and Prevention offers a suite of information and historical data, including map-building tools, pertaining to air quality monitoring.

Beach Monitoring, Evaluation, and Ongoing Management Resources

- Financial assistance for projects for the restoration, protection, and preservation of sandy coastal beach resources may be available through the Beach Management Funding Assistance Program.
- FDEP's Historic Shorelines Database provides historical data about Florida's coastlines.
- FDEP provides free informational GIS data pertaining to beach erosion and monitoring.
- FDEP's Regional Coastal Monitoring Data includes regional-scale management data for Florida's sandy coastal regions.
- The Regional Offshore Sand Source Inventory provides geological and geotechnical information on potential offshore sand suitable for beach nourishment.
- Funding, guidance, and other resources to aid in the conservation of native wildlife may be available from the Florida Fish and Wildlife Commission.

Chapter 6. Conclusion

This guide has examined a flexible new policy tool – the Adaptation Action Area – as it applies to the conservation and management of natural resources. Readers have been exposed to the general adaptation planning components as developed by DEO, and greater detail has been provided related to each of the sub-components related to natural resource adaptation planning.

Using the process and strategies described here, communities will be better equipped to provide a resilient future for their natural resources as well as their community at large. As dunes, mangroves, coastal ecosystems, coastal freshwater reserves, and other natural resources play a vital role to Florida's economy and societal well-being, efforts to weave natural asset conservation and management strategies into adaptation practices can foster healthier, more resilient communities.

With proper management, inlcuding the use of natural resource Adaptation Action Areas, Florida's natural resources will be preserved and protected for generations to come.

Photo courtesy of the Florida Memory Project.

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Definitions

Benefit-Cost Analysis: A quantitative procedure that assesses the cost effectiveness of a hazard mitigation measure by taking a long-term view of avoided future damages as compared to the cost of a project.

Benefit-Cost Ratio (BCR): A numerical expression of the cost effectiveness of a project calculated as the net present value of total project benefits divided by the net present value of total project costs.

Co-Benefits:

Coastal Construction Control Line (CCCL): A line of jurisdiction defining the landward limit of Florida Department of Environmental Protection's authority to regulate construction on coastal parcels (§161.053, Fla. Stat., 2015).

Coastal High Hazard Area (CHHA): an area particularly vulnerable to the effects of coastal flooding from tropical storm events. Defined by section 163.3178(2)(h)9, Florida Statutes, as the area below the elevation of the category 1 storm surge line as established by a Sea, Lake, and Overland Surges from Hurricanes (SLOSH) computerized storm surge model.

Environmental Benefits: Environmental benefits are direct or indirect contributions that ecosystems make to the environment and human populations. For FEMA BCA, certain types of environmental benefits may be realized when homes are removed and land is returned to open space uses. Benefits may include flood hazard reduction; an increase in recreation and tourism; enhanced aesthetic value; and improved erosion control, air quality, and water filtration.

Floodproofing (Measures): Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures, and their contents.

Greatest Savings to the Fund (GSTF) Methodology: The GSTF methodology measures the expected savings of a mitigation project over a specific time period, such as 30 years. This methodology is based on actual National Flood Insurance Fund (NFIF) losses for severe repetitive loss properties.

Green Open Space: Green open space is land that does not directly touch a natural body of water such as a river, lake, stream, creek, or coastal body of water.

HMGP 5-percent Initiative: Some mitigation activities are difficult to evaluate using FEMA BCA methodologies. Up to 5 percent of the total HMGP funds may be set aside by the Grantee to pay for such activities.

Low-Impact Development: An approach to land (re)development that works with nature to manage storm water as close to its source as possible. Low-impact development emphasizes conservation and the use of existing natural site features by integrating them with distributed, small-scale storm water controls to mimic natural hydrological patterns.

Property Acquisition and Structure Demolition: The voluntary acquisition of an existing at risk structure and, typically, the underlying land, and conversion of the land to open space after the demolition of the structure. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions.

Property Acquisition and Structure Relocation: The voluntary physical relocation of an existing structure to an area outside of a hazard-prone area, such as the Special Flood Hazard Area (SFHA) or a regulatory erosion zone and, typically, the acquisition of the underlying land. Relocations must conform to all applicable state and local regulations. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions.

Riparian Area: The land that directly abuts a natural body of water such as a river, lake, stream, creek, or coastal body of water.

Special Flood Hazard Areas (SFHAs): The land in the floodplain within a community subject to a 1-percent or greater chance of flooding in a given year. An area having special flood, mudflow, or flood-related erosion hazards, and shown on a Flood Hazard Boundary Map or a Flood Insurance Rate Map (FIRM) (e.g., Zones A and V).

Substantial Damage Waiver Policy: For acquisition and structure demolition or relocation projects only, structures identified in a riverine SFHA on the current effective FIRM and declared by a local authority having such jurisdiction to be substantially damaged by flooding, property acquisition, and structure demolition or relocation is considered cost effective and a BCA is not required to be submitted for the structure.

Viewshed: The locations visible from one or more specified points.

Definitions adapted from FEMA, FDEP, EPA, and DEO