

# Appendix X

## Adaptation (ADP) Policy Options

### Summary List of Draft Policy Options

Option No.	ADP Policy Option	Level of Support
ADP-1	Advancing Science Data and Analysis for Climate Change	Pending
ADP-2	Comprehensive Planning	Pending
ADP-2.1	Local Government Level	Pending
ADP-2.2	Regional Government Level	Pending
ADP-2.3	State Government Level	Pending
ADP-3	Protection of Ecosystems and Biodiversity	Pending
ADP-3.1	Uplands, Freshwater and Marine Systems	Pending
ADP-3.2	Beaches and Beach Management	Pending
ADP-3.3	Species Protection	Pending
ADP-4	Water Resource Management	Pending
ADP-5	Built Environment, Infrastructure and Community Protection	Pending
ADP-5.1	Building Codes and Regulation	Pending
ADP-5.2	Flood Protection	Pending
ADP-5.3	Beaches as Infrastructure	Pending
ADP-6	Transportation and Other Infrastructure (moved into ADP-5)	Pending
ADP-7	Economic Development	Pending
ADP-7.1	Tourism	Pending
ADP-7.2	Other Resource-based Industries	Pending
ADP-7.2.1	Agriculture	Pending
ADP-7.2.2	Forests	Pending
ADP-7.2.3	Marine	Pending
ADP-7.2.4	Aquaculture	Pending
ADP-7.2.5	Mining	Pending
ADP-7.3	Construction	Pending
ADP-8	Insurance (Property and Casualty)	Pending
ADP-9	Emergency Preparedness and Response (Extreme Events)	Pending
ADP-10	Human Health Concerns	Pending
ADP-10.1	Health Care	Pending
ADP-10.2	Air Quality	Pending
ADP-10.3	Wastewater Treatment	Pending
ADP-10.4	Disaster Response	Pending
ADP-10.5	Medical Treatment and Biomedicine Development	Pending
ADP-11	Social Effects	Pending

ADP-11.1	Social Justice Issues	Pending
ADP-11.2	Food and Water Security	Pending
ADP-11.3	Housing	Pending
ADP-11.4	Intersection of Climate Change and Human Behavior	Pending
ADP-12	Organizing State Government for the Long Haul	Pending
ADP-13	State Funding and Financing	Pending
ADP-14	Coordinating with Other Regulatory and Standards Entities	Pending
ADP-14.1	Federal Government	Pending
ADP-14.2	Professional Societies	Pending
ADP-15	Public Education and Outreach	Pending

ADP = Adaptation; DEP = Department of Environmental Protection; DOT = Department of Transportation; WWF = World Wildlife Fund.

Note: The numbering used to denote the above pending priority policy options is for reference purposes only; it does not reflect prioritization among these important draft policy options.

## ADP-1. Advancing Science Data and Analysis Climate Change

### Description of Issues

Florida is one of the most vulnerable areas in the world to the consequences of climate change, especially sea level rise (SLR), and the possibility of increased hurricane activity.<sup>1</sup> Regardless of the underlying causes of climate change, glacial melting and expansion of warming oceans are causing SLR, although the extent or rate for Florida cannot be predicted with certainty. In addition, hurricane activity in the North Atlantic Basin has increased significantly in recent years, but there is controversy over whether the primary cause is global warming or natural weather cycles, making the long-term trend indeterminate at this time. Not knowing which of Florida's barrier islands, floodplains, and what portions of major cities will be inundated, or when are among the factors that make planning for adaptation to climate change difficult. However, there is sufficient information to justify implementing many adaptations. Climate change and the length of the time needed to implement some adaptations further justify the need for action, in spite of these uncertainties. However, in all cases adaptation should be guided by good science.

### Objectives

Scientific data, analyses, and predictive modeling are needed to understand how Florida's climate is likely to change, the consequences, and possible solutions. Focusing on four key issues will help advance the science.

- Reducing uncertainty in climate projections and enhancing predictive power of climate models for Florida is critical, especially their temporal and spatial resolution. Improving models requires addressing specific Florida considerations: strong marine influence and peninsula effect; the wide climate gradient from the temperate northern region to subtropical southern region of the state; lack of long-term physical climate measurements for historical trends (although some proxies are available); huge climate variability; complicating effects of the interaction of land-use change (e.g., wetland loss) and climate change.
- Given climate-modeling limitations for Florida, the current planning focus on SLR and potential for increasing hurricane strength is appropriate. Scientific data and analyses to predict other potential effects of global warming that could affect Florida are still extremely weak. There is no data available at this time that adequately assesses potential effects, including increased drought, wildfires, flooding, and invasive species. Until models improve, appropriate risk management and adaptive management will be challenging.
- Recognize that adaptability refers to the ability of humans to manage resilience and the capacity of the system (e.g., ecological, economic, social) to absorb the disturbance of climate

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<sup>1</sup> For recent review, see FAU Murley et al. 2008.

change. Our science needs to address three crucial aspects of resilience: the amount of change Florida can withstand before switching over to another state or condition from which it cannot recover its former function, the ease of difficulty making changes, and how close the current system is to a switching threshold (Walter et al. 2004).

- Improving our understanding of socioeconomic responses to alternative climate predictions will better guide public policy and incentive programs. New approaches and tools, such as agent based models (ABMs) will provide a better framework to examine interactions of socioeconomic and climate change.

### Assets at Risk

Not applicable.

### Existing Actions

House Bill (HB) 7135, passed in the 2008 Legislative Session, directly addressed collecting and acquiring better emissions data, as well as ensuring improved analysis of all emissions data. Among other actions, the bill creates the Florida Energy Systems Consortium (FESC) as a “super center of excellence” within the State University System (SUS) to better coordinate energy-related research in support of Florida’s energy and climate change policy objectives. The bill did not address research that can support adaptation.

### Goals and Strategies

**Goal 1:** Each of the goal and strategy outlined in the Adaptation Policy Options need a measurable outcome and scientific evaluation by which to assess whether the goal has been met. Evaluation should be science-based, using the complementary skills of climate scientists, ecologists, hydrologists, social scientists, and economists. Test programs and pilots to measure and assess alternative outcomes are encouraged.

#### Strategy:

**Goal 2:** Foster and support climate-science research agenda for Florida with some broad priorities as outlined below. Consider instituting a new scientific advisory council on climate change to advise state government on this research agenda. Identify and establish long-term funding to support research. Funding should be protected from short-term economic or political cycles.

**Goal 3:** Conduct research needed to support incorporation of climate change into the protection of Florida’s ecosystems and biodiversity.

#### Strategies:

- Calculate the economic value and services provided by Florida’s natural communities and associated species to inform decisions regarding state budget and policy requirements. Disseminate information broadly.

- Define the likely new “states” of Florida ecological systems to determine state budget and policy requirements. Identify species and habitats likely unable to migrate naturally due to geographic constraints, and craft strategies to assist the relocation or re-create habitat elsewhere to facilitate this shift.

**Goal 4:** Enhance support for mapping, monitoring, and modeling. All of these will be necessary to provide information to support policy making. For example, the state is supporting use of Light Detection and Ranging (LIDAR) to improve mapping of Florida’s coastlines. Such mapping should be done for the entire coastline of the state. In addition, effective monitoring programs are needed to detect impacts of climate change, as well as modeling to better project impacts.

**Goal 5:** Support projection of climate change at smaller scales to forecast state and local impacts and to pinpoint risks.

**Goal 6:** Collaborating to a reasonable extent with other similar research efforts such as those being done by the federal government, the private sector, and non-state research institutions and universities.

### **Priorities for Further Research and Analysis**

A number of plans and proposals for research that will support adaptation to climate change, among other things, have been published, including the “Annual Science and Research Plan” prepared by the Florida Oceans and Coastal Research Council and “A Strategic Implementation Plan for Florida COOS: 2008-2010” written by The Florida Coastal Ocean Observing System (FLCOOS). Such plans can be consulted for specific ideas on research that will enhance Florida’s ability to manage marine and coastal resources vulnerable to climate variability and change. It is unknown if there is an integrated-research priority list counterpart to this for Florida’s terrestrial and freshwater systems; a research priority might be to initiate such a process, and to cross-reference these lists for areas of synergy.

In particular, there are a number of cross-cutting priorities for research and analysis, including:

Florida must *emphasize collaborations with international climate scientists, to refine climate predictions for Florida*. The state, in partnership with federal agencies, international efforts, and Florida universities, should (a) undertake review of current studies and models, (b) consider undertaking updating model development to more precisely forecast Florida’s changes in weather patterns, and (c) undertake specific analysis of uncertainties and contingencies in climate scenarios for Florida.

Considering that Florida is so vulnerable to potential impacts of *SLR and hurricane activity*, the state should place a *special emphasis* on establishing or enhancing existing programs to follow developments in this field.

In addition to work on SLR and hurricane activity, *the state needs to establish or enhance existing programs to monitor and determine trends in other climate-related impacts* that could have consequences in Florida including: increased drought, wildfires, flooding and storm water runoff, heat waves, problems with invasive species and insect-borne disease resulting from changes in temperature and rainfall regimes, adverse effects on native terrestrial species, natural communities and marine life, saltwater intrusion into aquifers, more frequent and intense storms, storm surges, tidal regimes, and coastal erosion. Build a decision support structure to guide and prioritize an ongoing Florida-specific research agenda.

*Deploy a “Florida Land and Sea Mesonet”<sup>2</sup> to serve as a world class network of integrated environmental monitoring stations*, drawing from and contributing to existing terrestrial and marine networks, capitalizing and building upon deployed meteorological stations, evapotranspiration (ET) stations, micro-meteorology towers, flow gauges and well/aquifer monitoring, and other critical monitoring networks to meticulously track changes in Florida’s climate and hydrology to fill missing gaps in statewide network coverage. The existing FLCOOS should include climate impacts.

Support scientists working on *methods and availability of remote sensing data for actual continuous statewide coverage* (and associated surrounding oceanographic area of influence), with consistent spatial grids and measurements, for common inputs for climate and hydrologic models.

*Long-term climate proxy data.* Create a new center, or virtual center, to coordinate and align data from available proxy data sets to build a more precise picture of climate change in Florida over last few thousand years, with associated responses in vegetation, sea level, changes in fire regimes, and the need for more proxy work and gaps in knowledge—spatial and temporal.

*Linking climate scientists with ecologists, economists, and social scientists.* Issue a request for proposal (RFP) from interdisciplinary teams of social scientists, economists, and climate scientists to build interactive models, including non-linearities and feedbacks, to better predict Floridian responses to anticipated changes. ABMs are appropriate here because of the complexity of climate change models and responses.

*Build socioeconomic models to evaluate the effectiveness of alternative incentives and policies.* Select pilot areas and locations of the state to test policy programs. Evaluate effectiveness of adaptation strategies at regular intervals

*Build better decision tools to incorporate total cost accounting for local and regional planning decisions*, so that proposed land-use change, agricultural policy shifts, water-use policies, transportation decisions, siting of major new industries, and other changes have a full assessment of all public costs, including likely carbon or greenhouse gas (GHG) footprint and water use. Decision tools should also include assessments of proposals for land-use changes in the light of predicted climate changes.

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<sup>2</sup> See the Oklahoma Mesonet for terrestrial counterpart.

## ADP-2. Comprehensive Planning

### Description of Issues

Florida has an integrated planning process for state, regional, and local governments to prepare plans that direct future growth and development, the conservation of natural resources, and the provision of public facilities. Under state law, planning in Florida is guided by standards that require a consistent policy direction and coordination among plans.

The framework for the integrated planning process starts with Florida’s State Comprehensive Plan (SCP) that contains goals and policies setting broad direction on energy, land use and other issues relevant to future adaptation to climate change. At the state level there is a transportation plan and a water plan. At the regional level there are 11 planning councils, each of which have adopted a strategic policy plan. In addition, at the regional level there are five water-management districts and seven transportation districts, each with planning documents that guide programs and decision making. At the local level each county and municipality in Florida has adopted a comprehensive plan that includes goals, objectives, and policies that address future land use, conservation, coastal management (where applicable), transportation, public facilities, parks and recreation, housing, intergovernmental coordination, and capital improvements. Local land-development regulations and permits must be consistent with the comprehensive plan.

The 2008 Florida Legislature amended the SCP to address GHG-reduction strategies with attention to facilities generating electrical power. The 2008 requirements for local comprehensive plans represent an important initial step, but are oriented more toward energy use and GHG than on adaptation to changing climatic conditions.

### Objectives

Chapter 187 of the Florida Statutes says, “The State Comprehensive Plan shall provide long-range policy guidance for the orderly social, economic, and physical growth of the state.” It also states that the plan is a “direction setting document” that should be “reasonably applied where they are economically and environmentally feasible, not contrary to the public interest, and consistent with the protection of private property rights.”

Florida’s state, regional, and local comprehensive plans should be amended, based on best available data, to include goals, objectives and policies that will prepare the state for adapting to the future impacts of climate change, such as SLR. [Future policies should emphasize incentives to encourage desired actions, including encouragement not to repeat past decisions that will leave new development exposed to sea level rise and other climate change consequences](#)

## Assets at Risk

Florida may be one of the states most at risk to climate change. It is surrounded by water on three sides, and its relatively flat terrain means large areas of the coast are at risk of inundation from SLR or coastal storms exposure (i.e., hurricanes).

SLR will affect Florida's valuable shoreline resources, including the beach, coastal vegetation and habitat, and significant public and private built investment. Decisions will need to be made about relocation, redevelopment, and where appropriate, retreat from the shoreline. Between now and 2030, the state will need to develop residential, commercial, and retail areas to serve twice our current population, as well.

The projected consequences from climate change impacts, such as SLR, may lead to future questions about the rights of private property owners and the police power and trusteeship responsibilities of state and local governments to protect the community at large. These issues will likely be focused on private property adjacent to the beach and in low-lying areas subject to increased flooding.

## Existing Actions

Governor Crist created the Florida Energy and Climate Change Action Team through executive order. That Action Team has appointed Technical Work Groups (TWGs) to address these issues. One TWG is reviewing the state's Transportation And Land-Use (TLU) planning in particular, and the Government Policy (GP) TWG is addressing these issues as well.

The 2008 Florida Legislature passed HB 7135, which created the Florida Energy and Climate Commission (FECC), to continue the work of the Action Team that will consider and coordinate certain recommended Action Team adaptations to the land-use planning process. The bill also amended S. 339.175, F.S., to encourage Metropolitan Planning Organizations (MPO) to consider GHG emissions in their planning processes.

## 2.1 Local Government Level

### Goals and Strategies

**Goal 1:** Ensure that all relevant elements of local government comprehensive plans (e.g., future land use, coastal zone management, and capital facilities) are updated to reflect the best available data and strategies for adapting to future climate change impacts.

**Strategy:**

**Goal 2:** State and regional agencies should provide financial and technical assistance to local governments to ensure timely updates of local plans.

**Strategy:**

**Goal 3:** Counties and municipalities located within each county should collaborate to create working groups (e.g., Miami-Dade County Climate Change Advisory Task Force) to study their comprehensive plans and recommend changes that addressing adaptation to local climate change.

**Goal 4:** Local governments should review their coastal management elements to determine necessary amendments to make their coastal areas (especially the coastal high hazard area) resilient to the future impacts of climate change, including SLR.

**Strategy:** Amend Chapter 163.3178 (8), which calls for coastal counties to prioritize lands for acquisition through state programs to include SLR as a criteria.

## 2.2 Regional Government Level

### Goals and Strategies

**Goal 1:** Regional Planning Councils (RPC) should update their Strategic Regional Policy Plans (SRPP) to reflect important regional issues concerning adaptation to the impacts of climate change.

**Strategy:**

**Goal 2:** Water Management Districts should modify regional water-supply plans and other regional water-management activities to include adaptation measures addressing impacts from climate change.

**Strategy:**

## 2.3 State Government Level

### Goals and Strategies

**Goal 1:** The SCP and relevant state agency’s strategic plans should be updated to reflect future actions to promote adaptation measures addressing the impacts from climate change.

**Strategy:**

**Goal 2:** The FECC should encourage cooperation at all levels of government and recommend additional goals and strategies to ensure adequate measures are taken to adapt to future impacts from climate change.

**Strategy:**

**Goal 3:** Balancing Property Rights and Protecting Communities and Natural Resources

Florida statutes, regulations, policies, rules and Florida Administrative Code (FAC) should be reviewed by the Florida Attorney General to determine potential conflicts with private property rights and the state and local governments' responsibility to protect communities.

**Goal 4:** The SCP, Chapter 187. 201 (8) Coastal and Marine Resources, goal and policies should be amended to address adaptation to the consequences of climate change.

**Goal 5:** Require comprehensive plans, at all jurisdictional levels in Florida, to incorporate climate-change adaptation measures or plans for the built environment that are cost-effective as a requirement for approval of any new development or redevelopment projects in Florida.

## ADP-3. Protection of Ecosystems and Biodiversity

### Description of Issues

Florida's terrestrial, freshwater, and marine systems extend from temperate north Florida to subtropical south Florida. Many tropical species are at their northern range limits in Florida; many temperate species are at their southern limits. The result is a highly diverse, unique assemblage of species, and in terrestrial and freshwater systems high levels of endemism. Florida has 1,350 miles of coast that is home to a diverse array of marine and coastal natural communities and associated species including the world's third largest fringing barrier reef and a barrier island system that is the most morphologically diverse.

The State of Florida has the third highest number of species in the United States (over 5,000), of which approximately 670 are endemic. Its approximately 4,000 native and exotic plant species are distributed over 81 plant communities. According to the Fish and Wildlife Service (FSW), 114 species are listed as endangered or threatened (2008), including the West Indian manatee, green sea turtle, and brown pelican.

Florida's upland ecosystem is characterized by temperate climate, dry soils, and gently sloping, forested hills. The dominant plant species in dry uplands include pines and oaks. Plant species in the wetter uplands include southern magnolia, beech, spruce pine, Shumard oak, Florida maple, and other hardwoods. Coastal uplands feature sandy soils, and its plant communities consist of sea oats, mixed salt-spray tolerant grasses, shrubs, and herbs.

Florida's freshwater ecosystems include wetlands, streams, lakes, and ponds. Vegetation includes mixed hardwoods, sphagnum moss, cypress, hydrophytic shrubs, and grasses. Coastal wetlands and swamps are generally inundated with freshwater, but are subject to tidal cycles and are saltwater tolerant. Typical plant species include cypress, bays, grasses, herbs, and shrubs.

Wetlands cover approximately 30% of the State of Florida, and play an important role in flood protection. Streams can vary from seasonal to permanent waterways, and plant species generally grow around the edges.

Beaches are one of the state's most important economic engines, generating tens of billions of dollars in annual revenues through jobs, tourism, recreation, and taxes. A healthy beach/dune system provides protection for upland property and infrastructure and increases a beach's resiliency (i.e., its ability to recover from storm events). Florida's beach/dune system also provides important habitat for marine turtles, shorebirds, beach mice, invertebrates, and other species. Currently over half of Florida's 825 miles of sandy beaches are experiencing chronic erosion, and about 42% are designated as critically eroding (meaning they need long-term maintenance in order to ensure protection of vulnerable upland properties, recreational interests, wildlife habitat, or important cultural resources).

Reefs are affected by disease and bleaching. In addition, overfishing, polluted runoff, and reduced freshwater inflows also threaten the health of this ecosystem. The state is making an effort to establish marine sanctuaries to protect its marine ecosystem from further damage. Species found here include seabirds, dolphins, whales, and manatees, as well as many types of invertebrates, crustaceans, and fishes (e.g., bony fishes, sharks, skates, rays, and eels). Alligators, crocodiles, and turtles can also be found in this area. Habitats include sea grass beds, sandy bottoms, reefs and open ocean.

These systems provide many economic benefits to Florida. For example, 4.2 million people participated in some form of residential or nonresidential wildlife viewing in Florida in 2006, with related total retail sales estimated at \$3.1 billion (\$2.4 billion by residents and \$653.3 million by nonresidents) for that period.

## Objectives

The Florida Constitution calls for the “management, protection, and conservation of wild animal life and fresh water aquatic life.” Florida law notes that the “State of Florida harbors a wide diversity of fish and wildlife and that it is the policy of this state to conserve and wisely manage these resources” and calls the state to “protect and acquire unique natural habitats and ecological systems...and restore degraded natural systems to a functional condition.” With regard to coastal and marine resources, the “development and marine resource use and beach access improvements in coastal areas do not endanger public safety or important natural resources.”

Managing ecosystems for resilience enhances their ability to naturally adapt to the stresses of climate change and other pervasive threats. Specifically, good management should

- Maximize the resilience of species and habitats to climate change impacts by minimizing other human induced threats;
- Facilitate and maintain the persistence of coastal ecosystems and the ecological and human services they provide;
- Increase understanding of how Florida’s marine and coastal ecosystems may migrate and change because of climate change;
- Identify areas, natural communities, and species of particular ecological vulnerability;
- Protect natural communities vulnerable to SLR from loss resulting from shoreline hardening and other actions that prevent or inhibit natural upslope migration;
- Identify and secure paths for other inland habitats to migrate with changes in temperature, rainfall patterns, and groundwater levels; and
- Protect inland natural communities from competing climate change adaptation pressures, such as the landward relocation of coastal development, human demands for ground and surface water, and engineered solutions for flood mitigation.

Specific objectives for beaches include ensuring the long-term protection of the beach/dune system and preserve its ecological functions.

- Consideration of climate change could be incorporated into all aspects of the beach management and coastal construction regulatory programs.
- Policies to discourage development adjacent to eroding shorelines and encourage the placement of structures and infrastructure away from retreating shorelines may reduce future reliance on coastal bulkheading, which can accelerate beach loss.
- Purchase private coastal lands that have been strategically targeted in order to provide buffers for retreating shorelines, to preserve and protect habitats and ecosystem function, and to increase the resiliency of the shoreline to recover from storm events.
- Enhanced communication on coastal resource protection between and within state regulatory agencies, such as the Florida Department of Community Affairs (DCA) and the Florida Department of Environmental Protection (DEP), can ensure more efficient use of resources and expertise in developing adaptation responses and strategies. Consider developing a coastal commission.

### **Assets at Risk**

Temperature, rainfall, sea level, and ocean chemistry play critical roles in determining where individual species of plants and animals can live, grow, and reproduce. The effects of climate change on species and ecosystems can be direct and indirect. Climate change will change the structure and composition of ecosystems and communities; coastal and estuarine habitats; ocean chemistry (lower pH levels adversely affect growth of corals, shellfish, and some algae); geographic range of species; timing of species' life cycles, which may become out of sync with other species they depend on; plant growth, nutrient composition, plant-animal interactions, and ecosystem nutrient cycles; and the intensity and magnitude of existing stresses, such as invasive species and fire regimes, on biodiversity and ecosystem structures, functions, and processes. In addition, climate change is also projected to result in increased risk of extinction for some species (e.g., those with limited dispersal capabilities or living in specialized habitats) and opportunity for range expansion of invasive species.

SLR and other predicted impacts of climate change (e.g., increases in frequency and intensity of coastal storms and higher storm surges) increase beach erosion, shoreline recession, and barrier migration and have a profound impact on Florida's beaches, the beach-using public, and the tourism industry.

As beaches erode and recede, all these values and benefits are threatened. In addition, public access to lands held in trust for the public, including the wet sand beach and near shore-submerged lands, is greatly diminished. Conflicts over public usage and private property rights will likely increase as beaches recede and the area of dry sand beach decreases.

## Existing Actions

The DEP includes in its annual “Florida Forever Work Plan” a list of lands that sequester carbon, provide habitat, protect coastal lands or barrier islands, and otherwise mitigate and help adapt to the effects of SLR. DEP’s Office of Coastal and Aquatic Managed Areas (CAMA) has 42 aquatic preserves around the state that are managed to protect natural values. CAMA also co-manages with National Oceanic and Atmospheric Administration (NOAA) the Florida Keys National Marine Sanctuary, and three National Estuary Research Reserves. Across Florida’s major terrestrial, freshwater, and marine systems, the Florida Fish and Wildlife Conservation Commission (FWC) oversees the Florida Wildlife Legacy Initiative that strives to keep common species common. In addition, DEP (state parks, Division of Forestry [DOF]), FWC, and other state agencies have ongoing programs to maintain natural systems in a healthy state. On a parallel track, federal and local governments and private organizations, such as The Nature Conservancy and the Audubon Society, maintain parks and natural areas.

## 3.1 Uplands, Freshwater and Marine Systems

### Goals and Strategies

**Goal 1:** A representative portfolio of Florida’s terrestrial, freshwater, and marine natural communities with redundant representation of habitats and species and connecting corridors (e.g., Florida’s Biodiversity Blueprint) is protected and well managed.

**Strategy:**

**Goal 2:** Acquire and appropriately manage lands needed to complete critical south to north migration corridors to accommodate range changes in species and natural communities driven by climate change.

**Goal 3:** Important natural communities vulnerable to SLR (e.g., intertidal and coastal habitats) are buffered or protected (from shoreline stabilization and hardening) to maximize the probability of their persistence into the future.

**Strategies:**

- DEP and other relevant agencies should develop state wetlands conservation and restoration plans that promote designation of wetland migration corridors for wetland migration as SLR. DEP should redouble efforts to reduce nutrient loading and set numeric criteria for nutrients, particularly in estuaries and coastal waters.
- The legislature should place a priority on coastal land acquisition through the Florida Forever program, a separate dedicated-funding source, or through other means. Greater incentives should be provided to local governments and private organizations to acquire and manage ecologically important coastal lands, including upland buffers. Acquisition efforts should be strategically targeted in order to protect coastal resources, reduce

insured risk, and reduce the impacts of climate change on both ecosystems and communities.

**Goal 4:** Areas that may serve as refuges for at risk species are identified, prioritized, protected, and managed in a manner that maximizes the persistence of at-risk species.

**Strategy:**

**Goal 5:** The portfolio of sites identified under Goal 1 above is managed in a manner that maximizes the health and resilience of these systems to climate change impacts.

**Strategy:**

**Goal 6:** Enact legislation to define newly submerged lands contiguous to existing state aquatic preserves, parks, and others as part of the contiguous state managed areas.

**Strategy:**

## 3.2 Beaches and Beach Management

### Goals and Strategies

**Goal 1:** Reduce and discourage future reliance on bulkheading/hardening to stabilize estuarine and beach shorelines. Shoreline hardening should be considered only after a full and cumulative assessment of short- and long-term impacts to coastal resources and coastal ecosystems.

**Strategy:**

**Goal 2:** Estimate the ecological value of beach resources around the state in order to give the highest priority to protecting beach resources with the highest ecological values.

**Strategy:**

**Goal 3:** Minimize conditions inhibiting natural long-shore sand movement so as to reduce coastal erosion, protect existing investment in and reduce the future need for beach re-nourishment, and increase beach system resiliency.

**Strategy:**

**Goal 4:** State and local governments implement a public information campaign that informs owners of coastal shoreline property that they may lose their property and may have to abandon structures damaged by rising seas and increased storm intensity or frequency.

**Strategy:**

**Goal 5:** State and local governments establish policies and regulations that clearly define when, how, where, and under what circumstances emergency beach stabilization is allowed.

**Strategy:**

**Goal 6:** State and local governments establish policies and regulations addressing coastal retreat and at what point vulnerable structures will have to be abandoned.

**Goal 7:** State and local governments establish policies and regulations to protect coastal resources from contamination resulting from inundation, structural failure, or abandonment of residential, industrial, and municipal assets resulting from SLR or storm events.

**Strategy:**

**Goal 8:** Ensure that the beach management program can accomplish its intended goals in an era of climate change and rising seas.

**Goal 9:** Provide incentives to encourage public and local governments to site structures and infrastructure away from areas at high risk from the impacts of climate change and SLR.

**Goal 10:** Ensure the long-term sustainability and resiliency of the beach/dune system.

### 3.3 Species Protection

#### Goals and Strategies

**Goal 1:** The vulnerability of Florida’s fish and wildlife to climate change impacts is assessed, the most vulnerable species are identified and plans are prepared to enhance their chances of persistence where there is a reasonable likelihood that the species will persist over the next 50 years.

**Strategy:**

**Goal 2:** Put in place a system for monitoring how Florida’s natural communities and associated species are responding to climate change impacts, and widely distribute the results of this monitoring to all interested stakeholders.

**Strategy:**

**Goal 3:** Consider how climate change affects the nexus between species and habitat, and act to protect habitat for vulnerable species in light of additional risks posed by climate change.

**Goal 4:** Evaluate likely persistence of Florida’s rare species, natural communities, coastal ecosystem, and parks and protected areas under climate change.

**Strategy:** Conduct a review of state park, state forest, and Wildlife Management Area Management Plans every 10 years to include an analysis of vulnerability to climate change as part of their systematic management planning.

## ADP-4. Water Resource Management

### Description of Issues

The State of Florida is currently facing many water resource management challenges including shortages due to drought, saltwater intrusion, and deterioration in quality and limits on the availability of its groundwater sources. The system is stressed even further due to continued pressures from population growth, development styles, and potential new challenges resulting from climate change. The existence of different water management districts can make it challenging to have consistent and coordinated water policies. Although there are uncertainties about climate change, water managers must nonetheless plan for potential increased variability in precipitation regimes, storm events, and rising sea levels. Significant changes in these phenomena are likely to result in changes to the amount of freshwater resources and land available to sustain life and maintain healthy water-dependent natural systems.

While Florida’s extensive coastline provides a unique ability to tap saltwater as a future water source, primary water-resource concerns revolve around changes to water dependent ecosystems, impacts to and from human activity, and ground and surface water quality. There may be shifts in water demands for agricultural and municipal supply, increased energy consumption for advanced water treatment, transmission and disposal, as well as for changing environmental needs.

The rate of climate change and potential consequences over the next 100 years is uncertain, but the more rapid the rate of change, the more quickly Floridians will have to respond to manage Florida’s water resources effectively. Planning and action now may significantly reduce costs relative to deferring action.

### Objectives

Local, regional, and statewide policies to protect groundwater and other water resources are designed to ensure adequate supplies to meet the needs of humans and the environment. Policies and measures to encourage conservation, protect existing supplies, identify and develop new supplies, and further invest in innovative technologies to treat water will be needed. Florida recognizes four areas of responsibility (AOR) critical to water resource management, as expressed in Chapter 373, F.S.

1. Water Supply—Managing water resources to ensure that there are adequate supplies for current and future Floridians.
2. Water Quality—Implementing measures to ensure that changes to existing landscapes will not cause degradation of existing ground and surface water quality.
3. Flood Protection—Identifying and protecting flood prone areas to minimize the risk of floods to human activities through structural and non-structural means.

4. Natural Systems Protection—Managing water and related land resources to ensure that there are supplies of adequate quantity and quality to protect and maintain healthy natural systems
5. In order for to Floridians to have adequate freshwater supplies available to meet basic reasonable and beneficial needs and the requirements of natural systems, the following principles should be followed.
  - Intensive conservation of all water uses will be essential and alternative water sources will need to play a larger role in meeting Florida’s future water needs.
  - Provide for stakeholder involvement in regional and statewide water-supply planning processes.
  - Incorporating methods to quantify and plan for uncertainties and risks related to population growth, climate change, and environmental regulations will be critical to maintain the quality of life, economic vitality, and environmental sustainability for the state.

## Assets at Risk

The majority of Florida’s population, and the water infrastructure to serve them reside within 50 miles of the coast. The Florida population is projected to increase by an additional 50% by 2030. In addition to new infrastructure required to develop and distribute water supplies to meet the needs of that growing population, existing coastal and groundwater resources may be at risk due to saltwater intrusion and SLR. Additional consumptive use of freshwater will further diminish the head of pressure needed to stave off saltwater intrusion.

Florida could face rising seas, decreased precipitation, and more intense storms. These three currently predicted impacts alone could have serious implications for Florida’s major areas of water resource responsibility. Among the changes needed to address risks posed by climate change are the following:

## Goals and Strategies

**Goal 1:** Identify and quantify the vulnerabilities and reliability of existing water supplies to potential effects of differing climate change scenarios with emphasis on source water availability and quality.

**Goal 2:** Develop regional and statewide water demand projection scenarios that account for potential changes in: (1) agricultural demand due to changes in growing season or impacts on crop production; (2) municipal and industrial demand as temperatures increase and drought (seasonal or intra-annual) persists; and (3) in water demand for energy generation due to possible changes in fuel source over a 100-year planning horizon, with consideration for Florida’s statutory obligation to provide water for the environment.

**Goal 3:** Develop conservation programs that address and incentivize water and energy usage efficiencies.

**Goal 4:** Encourage water reuse.

**Goal 5:** Implement local, regional, and statewide water-supply planning processes that quantify potential changes in existing water supplies and identify potential new water sources including synergies between flood management structures and water supply. Promote coordination across jurisdictions within and across watersheds as appropriate. Incorporate methodologies that use not only historic hydrologic data, but also consider changes that may result from climate change and prioritize water for natural systems.

**Goal 6:** Integrate land-use considerations, flood management, storm-water best management practices (BMPs) designed to protect water quality, water demand/supply management and water reservations for the environment in watershed planning and design standards.

**Goal 7:** Incorporate methods that consider energy, environmental, and economic sustainability when evaluating potential water management strategies (e.g., in developing new surface water supplies or desalination projects).

**Goal 8:** Change monitoring compliance with Minimum Flows and Levels and Water/Consumptive Use Permits, how structures are operated and when alternative supplies sources are needed.

**Goal 9:** Change the basis for current Environmental Resource Permits (ERPs), watershed and water quality modeling, structural operations, and other flood management methodologies.

**Goal 10:** Address water quality changes and flooding of coastal and tidally influenced bodies of water that may occur due to more intense storms, higher surface water temperatures, and rising sea levels on coastal aquifers.

**Goal 11:** To increase freshwater pressure to offset SLR, retain as much freshwater in natural systems as is reasonable and restore previously drained systems.

**Goal 12:** Coastal recovery strategies that attempt to hold back saltwater intrusion, coastal restoration projects, coastal land acquisition, and others may require redesign to allow for natural adaptations and movement inland.

**Goal 13:** Protect and maintain the natural mosaic of ecosystems, such as upland and lowland interfaces, to ensure the health of water and related natural resources.

**Goal 14:** To allow coastal estuaries, riverine, and other water dependent ecosystems to migrate or adapt to maintain healthy wildlife and fish populations consistent with new climate regimes.

**Goal 15:** Well fields, surface or subsurface storage facilities, and water treatment plants may be vulnerable. Siting new facilities should be closely examined and plans developed to mitigate impacts or locate them to reduce risks from winds and flooding.

## ADP-5. Built Environment, Infrastructure, and Community Protection

### Definition of Issues

The built environment can be defined as the aggregate of all buildings, facilities, and structures designed and built to provide shelter or to house the full breadth of human activity, as well as the infrastructure designed and built to support or protect such human activity.

The conjugation of these factors have resulted in more than 75% of the population living in coastal counties and perhaps close to 85% of the built environment (on the basis of total area of construction) located in coastal counties with a high concentration in large urban areas such as the tri-county (Palm Beach, Broward, and Miami-Dade) corridor in Southeast Florida, the west-central region around Hillsborough and Pinellas counties, and the Jacksonville-St. Augustine region.

U.S. Census Bureau projections and other studies estimate Florida's population will reach close to 29 million by 2030, which means an increase of some 10 million people over the estimated 2007 state population and 7 to 8 million more residents in coastal counties. Should these projected trends continue, it could be concluded that the concentration of built environment will continue along the same parameters currently in place.

Florida is vulnerable to a wide range of natural hazards, including hurricanes, coastal storms, floods, tornadoes, wildfire, drought, extreme heat, winter storms and freezes, erosion, sinkholes, landslides, and tsunamis. Some of these hazards will be exacerbated by climate change, while others will be ameliorated.

Design criteria are part of building codes used to design buildings expected to have a minimum service life of 75–100 years and will withstand extreme events. The Florida Building Code became the single-state building code as of March 1, 2002. The expressed intent of the Florida Building Code is "...to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment..."

One of the most important issues with regard to adapting the built environment to climate change is that buildings and structures are designed on the basis of the minimum requirements established by the building code, which are by and large based on historical data on such forces as wind loads and hydrodynamic pressure from storm surge. As the risks from such natural hazards are exacerbated by climate change, existing buildings and those being designed today may be subjected to impacts that exceed the designed capabilities. This could lead to catastrophic damage. Adapting the built environment to the impact of climate change will require design criteria and building codes that consider potential future impacts in establishing minimum design requirements.

## Objectives

1. Reducing the potential for damage to the built environment from the impact of natural hazards, especially from those hazards caused or exacerbated by climate change, must become a high priority of all levels of government and the private sector in Florida.
2. Make the practice of adaptation of the built environment to the impact of climate change an integral component of comprehensive planning, building codes, life-safety codes, emergency management, land development and zoning regulations, water management, flood control, coastal management, and community development.
3. Make the practice of adaptation of the built environment to the impact of climate change a preferred objective of building design, siting, and construction research funded by public monies in Florida.
4. Foster an environment of communication and shared knowledge about adaptation to climate change and the adaptation/protection of the built environment among the scientific community, lawmakers, various professional sectors (practitioners), and the general public.
5. Promote an environment to connect science with decision making regarding climate change and the need to adapt the built environment to its impacts.
6. Promote an environment to connect scientific research with practical applications that will contribute to the adaptation of the built environment to the impact of climate change.
7. Encourage the search for practical and effective solutions to ensure that existing and future built environment in Florida will remain inhabitable, providing a viable shelter for the full range of human activity, and ensuring continuity of critical and essential functions in the aftermath of impact by climate change exacerbated hazards.
8. Establish educational and professional licensing requirements to ensure that key professional sectors become practitioners of adaptation in support of planning, building design, and construction activities.
9. Require the state, county, and municipal governments throughout Florida to develop and maintain a Local Climate Change Adaptation Plan, to provide a framework for assessing vulnerability, identifying risks, defining and quantifying the value of the built environment that is at risk, and for identifying and implementing effective adaptation measures at each jurisdictional level (i.e., state, county, municipality, and individual facility).

Exercise fiscal responsibility in recognizing not only the magnitude of the problem to be confronted by future generations, but also the need to start implementing and paying for solutions now while also creating reserves to pay for future measures, especially those that may be community-wide or regional in scope.

Objectives for beaches in ADP-3 are relevant to this ADP.

## Assets at Risk

Climate change will modify or exacerbate most of the factors mentioned above, which were used to establish design criteria, during the remaining service life of existing buildings and new buildings just now being built. For example, certain aspects of climate change (specifically, global warming and SLR) have the capacity to exacerbate particular damage components of a hurricane. SLR will have a direct impact on storm surge, perhaps the most destructive component of hurricanes, as they impact the built environment in the coastal region. There will also likely be higher incidence of extreme rain events.

This means that a building created on the basis of current design criteria and the minimum requirements of the Florida Building Code may be subjected to higher loads from storm surge, wave impact, and precipitation during hurricanes than what it was originally designed for, during its remaining service life. It is likely and perhaps highly probable that a building under such conditions will suffer severe damage and even structural failure. Those buildings constructed before the Florida Building Code came into effect are at much higher risk of suffering catastrophic damage under the impact of climate-change exacerbated hazards.

## Existing Actions

HB 7135, passed by the 2008 Florida Legislature, provides certain “lead by example” improvements to local, regional, and state government building and renovation standards, including the use of specified green building standards and energy-efficient design. The bill also creates the FECC within the Executive Office of the Governor to centralize policy development and program implementation for energy and climate change to review and consider recommendations by the Action Team concerning building standards and adaptation. In addition, the bill created the FESC as a “super center of excellence” within the SUS to better coordinate energy-related research in support of Florida’s policy objectives for energy and climate change.

This ADP covers the entire infrastructure and is divided into the following categories: building codes and regulations, flood protection, beaches as infrastructure, and transportation. Many of the issues regarding climate change, goals, and strategies can be applied to other infrastructure, such as communications, electric power production, transmission, supply and distribution, education, and government.

## 5.1 Building Codes and Regulations

### Goals and Strategies

**Goal 1:** Require that the Florida Building Code incorporate design criteria for buildings to resist future loads that may result from the impact of climate change exacerbated hazards during a minimum service life of 50 years.

**Strategy:**

**Goal 2:** Require the Florida Building Commission (FBC) establish a technical committee focusing on vulnerability to climate change, which will recommend updates to the building code as evidence of new trends of risk factors from climate change, arise.

**Strategy:**

**Goal 3:** Encourage that new buildings be built to meet Leadership in Energy and Environmental Design™ (LEED) standards. Reducing energy demand is also an adaptation strategy, as less energy will be demanded during heat waves and the need for water to support energy production will be reduced.

**Goal 4:** Develop a required training program to educate existing professionals in relevant fields (e.g., architecture, engineering, and construction management) on the need to incorporate adaptation to climate change as a basis for establishing design criteria for new infrastructure. Completion of such required training to be a condition for relicensing.

**Strategy:**

**Goal 5:** Empower the Department of Business and Professional Regulation (DBPR) and the various professional licensing boards to incorporate sections on climate change vulnerability and built-environment adaptation methodologies in all licensing examinations.

**Strategy:**

**Goal 6:** Create and fund a Built Environment Climate Change Adaptation Program as a state research initiative charged with engaging the scientific and research community, by way of competitive research projects and annual announcements of funds availability, in the assessment of vulnerability and risk of the built environment to the impact of climate change, with a focus on the development of adaptation methodologies based on new design criteria, methods and materials of construction, and similar initiatives.

**Strategy:**

**Goal 7:** Encourage public universities in Florida to develop educational programs for building design and construction professionals, planners, and other pertinent fields, focusing on vulnerability to climate change and adaptation methodologies.

**Strategy:**

## 5.2 Flood Protection

Goals and Strategies will be developed by the TWG.

## 5.3 Beaches as Infrastructure

### Goals and Strategies

**Goal 1:** Examine where, how, and to what extent coastal ecosystems confer protection to vulnerable human communities. Set priorities as the protection and appropriate management of these systems.

## 5.4 Transportation

Florida has over 83,000 miles of county roads, over 65,000 of which are paved.<sup>3</sup> There are 19 commercial airports, 12 of which are international. In addition, the state has 14 deepwater ports.<sup>4</sup>

Roads, airports, rail, pipelines, ports, beaches, and other infrastructure along and close to Florida's coastline are potentially vulnerable to climate change impacts. Unfortunately, a comprehensive listing of transportation infrastructure at risk in the United States has not been prepared. Improved information about projected climate-change impacts and timing of such events will be needed to identify specifically transportation and other infrastructure at risk.

Potential impacts of climate change to Florida include rising temperatures, increases in more intense heavy rainfalls and hurricanes, and rising sea levels. Because of this, transportation and other infrastructure along the coast and in low-lying areas are susceptible to damage from SLR, storm surge, erosion, flooding, and higher temperatures. However, adaptation, particularly related to transportation, has not yet received as much attention or research as climate change mitigation.

### Goals and Strategies

**Goal 1:** Inventory the critical transportation infrastructure at risk; determine whether, when, and where projected impacts from climate change might be significant; and evaluate the costs and benefits of alternatives of needed actions.

**Strategy:**

**Goal 2:** Ensure the coordination of adaptation efforts on transportation across jurisdictional boundaries and the exchange of information, resources, and best practices among government, the private sector, and other stakeholders.

**Strategy:**

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<sup>3</sup> Florida Highway Patrol. "Road Mileage Statistics." [http://www.flhsmv.gov/fhp/html/fl\\_road\\_mil.html](http://www.flhsmv.gov/fhp/html/fl_road_mil.html). Accessed July 23, 2008.

<sup>4</sup> State of Florida.com. "Florida Quick Facts." <http://www.stateofflorida.com/Portal/DesktopDefault.aspx?tabid=95>. Accessed. July 23, 2008.

**Goal 3:** Ensure that the long-range planning process on transportation addresses adaptation and the protection of critical infrastructure.

**Strategy:**

## ADP-7. Economic Development

### Description of Issues

Florida's gross state product in 2007 was more than \$734.0 billion. Of that, agriculture was \$7.0 billion, mining was \$1.0 billion, and construction was \$45.0 billion. In 2007, Florida had more than 85 million visitors, generating more than \$65.0 billion in revenues.

### Objectives

- To adapt Florida to new economic trends and realities brought on by the powerful drivers of energy and climate change;
- To generate useful economic trend analysis and data to guide economic development decision making; and
- To create policies, programs, and implementation mechanisms which support the adaptation of Florida's economy.

### Assets at Risk

Climate change is likely to have a significant effect on all sectors of Florida's economy. Some sectors will likely face acute challenges, while others will likely enjoy growth opportunities. There could be significant damage to some economic sectors, such as real estate, tourism, agriculture (e.g., productivity and export markets), and other resource-based industries to name some examples.

The state would benefit by early identification of business opportunities (and risks) associated with climate change to increase its global competitive advantage and job creation within the state. An impact assessment is also needed to forecast potential disruption to Florida's major economic sectors due to climate change impacts, such as more frequent tropical storms, SLR, drought, acute flooding events, saltwater intrusion, and possible habitat and species disruption.

Successful economic adaptation will require anticipating and responding to the challenges and opportunities, given such economic trends.

### Existing Actions

To be drafted by DEP staff:

The DEP...

The FWC...

The Florida Department of Agriculture and Consumer Services (FDACS)...

## Goals and Strategies

**Goal 1:** The Office of Tourism, Trade, and Economic Development (OTTED) and Enterprise Florida—in conjunction with the FECC—should undertake an analysis to look at new opportunities and at economic sectors that may be negatively impacted.

**Goal 2:** Establish the economic value and importance of natural resources to the state economy overall and to tourism and other resource-based sectors.

**Goal 3:** Identify policy issues related to habitat and species management, human needs, hunting, fishing, boating, and outdoor recreation.

## 7.1 Tourism

Tourism in Florida constitutes over 10% of the state economy. The state's thriving tourism sector depends on the richness and diversity of Florida's natural resources. Its climate, forests, parks, waterways, beaches, marine systems, habitat, species, flora and fauna, and other attractions bring more than 70 million tourists to the state each year.

SLR, increased hurricane intensity, increased storm intensity, drought, fires, human health risks, and other outcomes of climate change could be threats to Florida's tourism industry. In addition, rising temperatures could make locations further north relatively more attractive to tourists.

## Goals and Strategies

**Goal 1:** Assess the economic impact of climate change on the tourism sector.

**Goal 2:** Given the state's interest in ensuring a healthy tourism sector, assess the level of appropriate investment in the state's natural resources.

## 7.2 Other Resource-Based Industries

Resource-based industries include tourism, but also agriculture, forestry, marine, aquaculture and mining. While these constitute only about 1.0% of the state's economy, such industries are important to Florida's way of life and character. The state should contemplate its interest and role in mitigating the impact of a changing climate on these sectors.

### 7.2.1 Agriculture

The productivity of many crops may be impacted by hotter temperatures, altered precipitation patterns, more intense storms, change in runoff patterns, invasive species, and new pests. Biofuels may present new growth opportunities, however adequate care should be taken not to displace food crops. Planning for adequate water supplies may be important to sustain this sector.

## Goals and Strategies

**Goal 1:** Assess potential changes in the geographic range, climate tolerances, and economic viability of current and potential new annual and perennial crops and livestock.

**Goal 2:** Review land-use, tax, and subsidy policies to encourage appropriate adaptation in the agriculture sector.

**Goal 3:** Assess potential changes due to climate change in the extent and distribution of irrigation demand and supply for agriculture, and incorporate long-term planning on agriculture.

### 7.2.2 Forests

Aside from the inherent value of Florida's forests as habitat for many native species, there is also economic value as recreational areas for eco-tourism activities and in the traditional commercial application as a resource for building products. In addition, Florida's many acres of longleaf pines and bottom hardwoods, on public and private lands, are excellent carbon sinks and could be a source of revenue for landowners, public and private, through a carbon-credit trading system.

Forest resources must be conserved and expanded. Work needs to be done to determine the level and areas of risk from climate change impacts (e.g., drought, pests, storms, saltwater intrusion, and invasive species) for this valuable resource.

## Goals and Strategies

**Goal 1:** Continue existing land acquisition/management programs for forested lands.

**Goal 2:** Adopt land acquisition/management programs with a climate change component.

**Goal 3:** Explore adaptation of forest stocks through genetics to strengthen stocks against risks associated with climate change.

### 7.2.3 Marine

Florida's industries based on living marine resources include commercial and recreational fishing, marine ecotourism (including coastal parks and conservation areas), marine pharmaceuticals, and marine research and education. The direct 2006–2007 value of these industries to Florida's economy was \$4.4 billion (NOEP, 2008) and the indirect value of related infrastructure and support was many times larger. Adaptive responses to protect the core living resources these industries rely on are addressed in ADP-3, "Protection of Ecosystems and Biodiversity." This section addresses threats to the availability and human uses of the resources, beyond considerations made in other adaptation response actions.

The adaptive management of Florida’s marine resources and their sustainable use in a changing climate will be designed to protect the living resources and the social, economic, and cultural systems that form our industries.

The geographic ranges and abundances of living marine resources are likely to change as climate, ocean temperatures and currents, water quality, and related controlling factors change. Likewise, the ranges, abundances, and impacts of marine diseases, invasive species, parasites, and harmful algal blooms could change.

Fisheries, principal fishing grounds, ecotourism destinations, and the land-based operations and facilities that support the industries may “migrate” to different areas in the state as a consequence of these changes. Such changes have the potential to impact the economic viability of industries dependent on living marine resources. The same changes can also have negative effects on the health and safety of industry workers and consumers of industry products and services. Public and private investments in land acquisition for future parks and conservation areas, future working waterfronts for fishing and ecotourism, and future marine research and education facilities will be influenced by climate change, and the effects could be significant. The same processes that may diminish Florida’s existing marine industries may lead to new opportunities for fisheries, ecotourism, and allied economies. Adaptive management will require an ability to detect and exploit such possibilities.

## Goals and Strategies

**Goal 1:** Provide an integrated tracking and reporting system for the ranges, abundances and condition of species valued for their roles in fisheries, ecotourism, aquaculture, pharmaceuticals, and research.

**Goal 2:** Develop and implement an integrated screening and tracking program for species die-offs, marine diseases, invasive species, and parasites, modeled after the state’s harmful algal bloom programs.

**Strategy:** Goals 1 and 2 will be met through the use and expansion of existing state and federal programs and platforms for monitoring, event responses, data management, and public reporting.

**Goal 3:** Implement educational programs to reduce vessel-based conveyances of unwanted species in Florida waters, and to protect industry workers and consumers from novel health and safety challenges.

**Strategy:** Collaborate with the Florida Sea Grant College Program (FSG) to implement the programs.

**Goal 4:** Develop conceptual plans for the co-location of new working waterfronts for activities, such as fishing, ecotourism, and marine research, which employ green infrastructure adapted to emerging challenges of climate change.

**Strategy:** Engage university planning, engineering, and architectural schools in developing the conceptual plans.

#### 7.2.4 Aquaculture

Aquaculture is a rapidly developing industry in Florida. As the state's fisheries become depleted, either through over-harvest or climate change impacts, cultured seafood products will increase in importance. Florida producers sold \$74.9 million of aquaculture products in 2005, ranking Florida seventh in the nation in terms of aquaculture sales. Over 900 Florida aquaculturists produce the greatest variety of aquatic species of any state in the nation. Tropical fish dominate the Florida aquaculture industry as the number one statewide commodity with \$33.0 million in sales in 2005, also making the state the number one producer nationwide. The state is also a leading U.S. producer of farm-raised aquatic plants and an important producer of hard clams.

The industry could be threatened by warmer water temperatures, which may make current breeding grounds unsuitable in the future by exceeding thermal tolerances, reduce dissolved oxygen levels, and allow for introduction of pests and disease. SLR can threaten inundation of facilities, turn freshwaters brackish, and inundate coastal wetlands. Increased intensity of hurricanes and other storms can damage or destroy fisheries and facilities. Drought can reduce freshwater flows and degrade water quality.

#### Goals and Strategies

**Goal 1:** Develop plans for increasing seafood product aquaculture to supplement declining ocean stocks.

**Goal 2:** Encourage expanded and increased leases on submerged state lands for aquaculture.

**Goal 3:** Review existing out-of-state marketing programs with an eye to increasing those sales of Florida aquaculture products.

**Goal 4:** Identify and institute management practices to ensure healthy growth of this industry.

**Goal 5:** Identify innovative and federal funding sources for mitigation and adaptive strategies.

#### 7.2.5 Mining

Nationally, Florida ranks fifth in the production of limestone, sand and gravel, clay, peat, heavy minerals, and phosphate. The state's mines supply one-quarter of the world's and three-quarters of the U.S. domestic needs. Nearly all of the phosphate mined is used for the national and international production of agricultural fertilizer. In 2000, approximately \$1.13 billion worth of fertilizer was exported. Phosphate mines in northern and central Florida have been a valuable resource for the national and international production of agricultural fertilizers, although many of these lands are now considered degraded and disturbed.

After mining operations have ceased, these lands could be used for rotation bioenergy crops, as well as for carbon sequestration. Mining also has implications for aquifers and water supplies and storage that should be noted here.

### Goals and Strategies

- Study soil carbon dynamics to estimate the long-term potential for carbon sequestration in new growth forest and through underground sequestration.
- Determine environmental and cost benefits of developing short-rotation woody crops on formerly mined lands.
- Review and select tree species appropriate for such sites
- Identify management practices to ensure plant survival and maximize growth.

### ADP-7.3 Construction

Construction is more than 6.0% of Florida’s economic output. Construction employment represented approximately 8.5% of total non-agricultural jobs, and more than 210,000 annual building permits were issued as recently as the end of 2006. The industry has recently been affected by change in supply and demand of key building materials (e.g., lumber, cement, reinforcing steel, and plywood) resulting in huge increases in prices that in some cases reached 200%, 300%, or higher in just one year. Climate change has the potential for exerting significant impact on the construction sector through such changes as extreme precipitation, drought, SLR, or the exacerbation of natural hazards such as storm surge and flooding.

Climate-change driven modifications in the construction industry have the potential to significantly impact to the economy of the communities and regions affected and on a much larger scale. Some of the consequences of climate change may include the following, all of which would likely result in increased costs:

- The need to adapt existing and future buildings so that they may withstand the impacts of climate change will require that design professionals carry out additional studies and calculations, or engage other experts as consultants.
- Buildings may need to have deeper and stronger foundations, or to be elevated above a higher “zero flood elevation”, or have much higher insulation values than currently required, or to have much higher roof drainage capacity, or to incorporate green building features.
- Higher temperatures during the work day or higher and more frequent extreme precipitation events have the potential for affecting working conditions, which will increase not only the cost of construction but also the income of construction workers.
- Should the need for adaptation become a requirement for new construction, the demand for adaptation-related practices would increase.

- Retrofitting, demolition, or conversion projects of existing buildings may be needed to adapt them to climate change, or to retreat from hazardous zones.

Retreat may have an adverse effect on the volume of construction in relatively vulnerable areas, leading to economic losses and labor reductions in the construction industry.

## Goals and Strategies

**Goal 1:** Identify the sensitivity of the construction industry in Florida to a range of external, non-climate change-driven, factors that have the potential for affecting the economic aspects of the construction industry.

**Strategy:**

**Goal 2:** Measure the economic impact resulting from climate-change driven consequences on the construction industry and related sectors and from non-climate change factors, with projected scenarios at five-year intervals.

**Strategy:**

**Goal 3:** Identify those communities, regions, or sectors that may suffer adverse economic consequences as a result of the impact of climate change on the construction industry and related or interlinked sectors, and commission a study to identify effective measures to reduce such potential for adverse consequences.

**Strategy:**

**Goal 4:** Measure how adaptation procedures applied through construction methods, materials, or design criteria, may reduce the risk of damage to the built environment, and link such risk-reduction to insurance reduction in premiums.

**Strategy:**

## ADP-8. Insurance (Property and Casualty)

### Description of Issues

With more than 2,000 miles of coastline, Florida is physically and financially vulnerable to the effects of climate change. Ninety percent of Floridians live within 50 miles of the coast, and Florida's residential exposure is approaching \$2.0 trillion. Additionally, the state's largest insurance company—Citizens Property Insurance Corporation—has 1.3 million policyholders and is financially supported by Florida's insurance consumers.

Insurance from flooding falls under the National Flood Insurance Program (NFIP), which is administered by the federal government, and Floridians account for 40% of NFIP's policyholders. Insurance from damage from wind is typically covered by private insurance policies, which are regulated by state governments. The Citizens Insurance Company is the insuring entity of last resort for hurricane wind coverage.

### Assets at Risk

Insurance companies insure billions of dollars of assets—homes, businesses, agriculture, infrastructure, parks, and beaches—in Florida. All of these assets and more are at risk to the myriad effects of climate change. Florida's current pricing structure does not truly reflect the risk of loss, particularly for Florida's coastal regions.

Science has established that climate change increases the intensity of hurricanes. In addition, SLR will erode shorelines, threatening many properties, and will result in higher storm surge from hurricanes. Other climate outcomes, such as wildfire, intense rain events, and drought can also pose risks to lives and property. Given Florida's geography, coastal density, and a \$65.0 billion dollar tourism economy, plus eight major storms in 2004 and 2005, property insurance and affordability issues are one of Florida's greatest challenges.

### Existing Actions

In 2005, the Florida Legislature passed a law requiring all residential property insurance companies to file with the Office of Insurance Regulation (OIR) a range of premium discounts offered to customers who live in homes of certain construction types or who apply loss mitigation devices (like shutters) to their homes. Beginning on September 5, 2007, all property insurers were required to offer higher discounts in their insurance rates for policyholders who had recognized loss mitigation devices on their homes. Insurers are required to send a list of those discounts with exact dollar savings to all new and renewed policyholders.

### Goals and Strategies

**Goal 1:** Encourage insurance companies to provide policyholders with greater disclosure about climate risk. Insurance companies need to adequately inform their customers and shareholders about the risks climate change poses to the insurance business and the ability of the industry to

pay policyholders' claims. Insurance companies also need to take necessary steps to mitigate against these risks.

**Goal 2:** Understand the relationship between the threats of climate change, SLR, and providing affordable insurance premiums to Florida home and business owners. Address equitable and fair differences in insurance to coastal and inland properties.

**Goal 3:** Florida should develop policies that make coastal communities and infrastructure more resilient to natural disasters through programs such as the My Safe Florida Home program.

**Goal 4:** Fully define the issues surrounding risk-based pricing in the property and casualty insurance industry for Florida.

Goal 5: Insurance pricing and availability can encourage or discourage particular forms of coastal development. Subsidized coastal insurance policies should be consistent with federal and state programs designed to reduce high risk shoreline development, increase coastal system resiliency, and protect important coastal resources vulnerable to risks associated with climate change.

## ADP-9. Emergency Preparedness and Response (Extreme Events)

### Definition of Issues

Throughout the history of settlement in Florida, extreme weather events—particularly in the form of hurricanes—have played a major role in shaping culture, commerce, and community development. As a result, Florida’s state government has developed one of the more robust emergency preparedness and response infrastructures in the nation. This was particularly evident in the depth of aid provided by Florida to Mississippi during the 2006 hurricane season in the aftermath of Hurricane Katrina.

Global climate change is likely to increase Florida’s risk of extreme weather events. While the question of whether hurricane frequency will increase given rising sea-surface temperatures remains uncertain at present, current science does support increased intensity and duration for those storms that do form in the Atlantic and the Gulf of Mexico. When coupled with rising sea levels, future hurricane events may yield greater storm surge effects to put coastal communities at greater risk for damage than is the case today. In addition, there could be more intense rain events, droughts, fires, and heat emergencies.

~~To be prepared, Florida must build upon its current excellence in emergency preparedness and response in order to protect Florida’s people and built environments from the worst possible effects of heightened extreme weather events.~~

~~Extreme weather across the state can~~

- ~~• overtax the emergency response systems and funding for flood response,~~
- ~~• result in major storms and power outages,~~
- ~~• affect buildings or transportation routes, and~~
- ~~• cause drought-related fires.~~

~~Hurricanes, as Florida’s typical extreme weather event, may no longer be the only major threat to Floridians in the future. An analysis of predictable climate change impacts on the state would include projections for other intense rain events, not to mention increased droughts, fires, heat and public health emergencies.~~

~~Additionally, given the many fronts that climate change is expected to present to our emergency infrastructure, there is the possibility that many or several of these impacts might occur simultaneously.~~

~~Delayed emergency response could become more common.~~

## Objectives

Florida's current emergency preparedness and response functions are a coordinated effort between federal, state, and local governmental agencies, as well as nongovernmental organizations. The objective of Florida's future emergency preparedness and response functions must be to build on the excellence gained through past experience to assure sufficient capacity and efficacy in protecting public health and welfare in more severe storm events with increased incidence of storm surge and the associated coastal damage. As impacts such as [sea level rise SLR](#) and higher storm surges become more evident, development patterns must be constrained by the state's ability to increase the resiliency of coastal communities, as well as protect those communities.

[Floridians must be prepared for increased incidence of heat-related illness on large sectors of the public, particularly given Florida's large elderly population. As temperatures rise and the climate becomes more tropical, water- and vector-borne diseases now associated with more equatorial climates might become commonplace in our state. This situation will only be aggravated by increased flooding events and associated impacts on certain public infrastructure such as sewage systems, hospitals and nursing homes.](#)

[Moreover, Florida must be prepared to address the synergistic effects of multiple climate stressors on our emergency response infrastructure and, prior to such occurrences, devise an approach to deal with this by building on our existing skills in emergency preparedness and environmental response. Policy makers in particular need information and data on changes in risks as climate changes and need to know where to get such information.](#)

## Assets at Risk

While all of Florida's counties are subject to extreme weather events, our coastal communities and ecosystems are at particular risk from increased storm surge and increased hurricane intensity. The vast majority (70%) of Florida's population lives in the coastal zone. Likewise, the vast majority of the state's existing building stock is situated near the coast. While many coastal ecosystems have adapted to periodic extreme weather, system resiliency in some cases may be undermined due to the loss of extent, pressures from invasive exotic species, or other perturbations that prevent post-hurricane recovery.

[Aside from the risk to the human population from hurricane events, increases in temperatures may cause the migration of certain water- and vector-borne diseases, normally associated with more southern climates, to our state. Increased flooding conditions and infrastructure damages resulting from the increased heat and flooding could aggravate these situations.](#)

## Existing Actions

Many of the impacts that climate change is projected to bring are already familiar to Floridians. Consequently, programs to address such impacts as increased intensity of hurricanes and major storm events, storm surge and erosion, saltwater intrusion, and the availability of potable drinking water supplies are already up and running. Additionally, Florida's excellent

emergency response infrastructure has proven itself under many scenarios and the planning mechanisms that are a part of that infrastructure are in place to deal with a large variety of catastrophic events. However, it is uncertain to what extent these programs and infrastructure will be affected by future impacts associated with climate change, or to what extent additional financial resources will be needed to meet these future conditions.

## Goals and Strategies

**Goal 1:** Assure sufficient response capability among state, regional, and local first-responders to potential increases in extreme weather events.

**Strategy:**

**Goal 2:** Increase the resiliency of coastal communities to storm surge.

**Strategy:**

**Goal 3:** Increase the resiliency of coastal ecosystems to extreme weather events.

**Strategy:**

**Goal 4:** Plan for other extreme events (e.g., flooding, fire, and heat waves).

**Strategy:**

Goal 5: Develop a process for early detection, evaluation and handling of emerging environmental impacts resulting from climate change. Have effective dissemination of such information to key emergency preparedness and response personnel.

Strategy:

Goal 6: Establish an integrated network of early warning sites on protected lands to track long-term changes in biological communities and processes; establish a Center for Climate Archives for baseline and associated data.

Strategy:

Goal 7: Invest in emergency response and mitigation strategies for extreme environmental events likely to be exacerbated by climate change.

Strategy:

Goal 8: Assess the impact of climate change on microbial communities and processes across all of Florida's ecosystems.

Strategy:

Goal 9: Determine the conditions under which it will be necessary to limit the growth of Florida’s human population.

Strategy:

## ADP-10. Human Health Concerns

### Description of Issues

Florida's current population is over 18 million, and 17% are over 65 years of age (higher than the national average of 12%). By 2030, Florida is projected to be the nation's third most populous state with almost 29 million residents, with 27% of the population projected to be over 65. That keeps Florida as the state with the highest elderly population as a percentage of total population. The elderly have greater vulnerability to impacts of climate change than the population at large, although children under 5, those living in poverty, and those living in coastal areas can also be vulnerable.

### Objectives

The health and wellbeing of the citizens is of prime importance to the State of Florida. Incorporating considerations of climate change into the state's health plan to protect the citizens is as important as designing water treatment infrastructure to reduce harm to human health.

Successful research in this area would identify the increasing risks to human health, which segments of the population are most vulnerable, and how risks to their health can be reduced.

### Assets at Risk

Climate change is expected to have a wide range of impacts on Florida's health systems. The historical range of mosquito- and vector-borne diseases may shift with a changing climate. More intense extreme weather events, such as hurricanes, heat waves, flooding, and wildfires, will directly impact human health in Florida. Equally important are alterations in the moisture content of the atmosphere and wind patterns that will likely affect the concentration of air pollution in a given location.

Climate change may increase the risk of some infectious diseases; particularly those diseases that appear in warm areas and are spread by mosquitoes and other insects. These "vector-borne" diseases include malaria, dengue fever, yellow fever, and encephalitis. Also, algal blooms could occur more frequently as temperatures warm—particularly in areas with polluted waters—in which case diseases (such as cholera) that tend to accompany algal blooms could become more frequent. These diseases can be transmitted to people and can also affect livestock and wildlife, which can indirectly affect people.

### Existing Actions

To be drafted out by DEP staff.

## Goals and Strategies

### ADP-10.1 Health Care

**Goal 1:** Ensure that health codes and policies are adequate to protect against known risks from observed climate and appropriately incorporate potential changes in risk from climate change.

**Goal 2:** Regularly revisit health codes and regulations as evidence of new or altered risks from climate change arises.

**Goal 3:** Strengthen vaccine campaigns.

### ADP-10.2 Air Quality

**Goal 1:** Ensure that air quality polices provide an adequate level of safety to protect against known risks from current climate.

**Goal 2:** Ensure that new air quality policies incorporate potential changes in risks from climate change to ensure appropriate design and mitigation factors.

### ADP-10.3 Wastewater Treatment

**[note to TWG: Goals 3 and 4 were suggested after the 7/28 call. They could replace 1 and 2]**

**Goal 1:** Ensure that wastewater infrastructure provides an adequate level of safety to protect against known risks from current climate.

**Goal 2:** Ensure that new wastewater infrastructure incorporates potential changes in risks from climate change to ensure appropriate design and capacity over the lifetime of projects.

**Goal 3:** Ensure that water treatment facilities are able to safely capture, store, treat and distribute potable water as the climate changes, creating possible subsequent changes in rainfall patterns, sea level rise and flooding. Water treatment systems should anticipate changes in source water quality and availability and plan for corresponding changes needed to ensure effective water treatment.

**Goal 4:** For above ground storage, such as reservoirs, management and operations protocol should account for changes in rainfall patterns and the impacts such changes may have on the adequacy of the storage volume as well as the structural safety of the impoundment.

## ADP-10.4 Disaster Response

**Goal 1:** Establish communication mechanism to coordinate efforts between disaster relief and public health agencies.

**Goal 2:** Communication systems and plans that address health issues associated with low-income and under-served populations and other vulnerable groups.

**Goal 3:** Adequate training for first responder and emergency responder personnel.

**Goal 4:** Limit growth in areas whose evacuation will be challenged by SLR and increased storm frequency or severity.

## ADP-10.5 Medical Treatment and Biomedicine Development

**Goal 1:** Increase the focus of medical schools at state universities to include diseases that can be attributed to climate change.

**Strategy:**

**Goal 2:** Promote the research and development (R&D) of biopharmaceuticals that can treat the diseases be attributed to climate change.

**Strategy:**

## ADP-11. Social Effects

### Description of Issues

Currently Florida's population is over 18 million, and its projected growth is to 29 million by 2030. Additionally, Florida's coasts are home to an estimated 70% of the population. The coastal environment provides diverse habitats for countless marine and terrestrial species. For centuries, humans have lived, worked, and played along the coasts, and the ocean has long been an important component of the economy, from fishing to tourism.

Sea levels are expected to rise in the foreseeable future at an accelerated rate as the earth's climate warms, which makes Florida's coastlines particularly vulnerable. Climate change will likely affect not only the physical coastline, but also the millions of people who live and work in Florida. Understanding the impacts of climate change on Florida's coasts and inland areas therefore requires the perspectives of sociologists, economists, and scientists alike.

Society can deal with slow trends in climate, occurring over the many thousands of years that are characteristic of ice age cycles. But decade-to-century changes (i.e., those that occur on the timescales of a human lifetime) and the ability of societies to evolve are potentially catastrophic.

### Objectives

Climate change has the potential to play a critical role on human behavior over the next century. Even if all human activities that contribute to global change were stopped today, change would continue, as the present surplus of GHG in the atmosphere will remain for centuries. As of yet, the climate system is not well enough understood to "reverse-engineer" the climate to a state that best suits humanity. Therefore, today Floridians must decide what changes they must make in their present behaviors in order to live in the changing climate.

Disaster management can provide some valuable lessons on encouraging changes in behavior. In Florida, we have had to change how we prepare for and respond to hurricanes. The tactics and strategies that people have that either mitigate the effects of climate variability or respond to climate variability are very basic now. Researchers and experts in climate change must understand that if the weather is just more variability, then people will make decisions based on what they know and how they have operated in the past. If climate change is dramatic and sudden and causes large disturbances then it is more difficult for people to make changes that will make a difference. Education and outreach (see ADP-15) will be an important component of adaptation.

### Assets at Risk

Increased development to accommodate Florida's projected population growth will most likely increase climate exposure and risks to Florida's citizens and their current way of life. Florida must recognize that all regions of the state will encounter socioeconomic changes including

- Increased housing and insurance costs, especially related to storm events and SLR;
- Increased charges for energy consumption and transportation changes; and
- Increased cost of infrastructure improvements including roads, sewer systems, wastewater treatment facilities, water control structures, and property protection.

An additional concern is the migration of people. Florida could attract people migrating from the Caribbean and elsewhere as a result of climate change impacts. In addition, it is possible that some Floridians will migrate from the coast inland.

### Existing Actions

To be drafted out by DEP staff.

### ADP-11.1 Social Justice

**Goal 1:** Promote social and economic equity, reduce poverty, increase consumption efficiencies, decrease the discharges of wastes, environmental management, and increase the quality of life of the vulnerable.

**Strategy:**

**Goal 2:** Assess potential social impacts of climate change on incomes, and other measures of wellbeing in vulnerable communities.

**Strategy:**

### ADP-11.2 Food and Water Security

**Goal 1:** Ensure that access to safe food supply and water considers variations in risks from climate change such as SLR, increased hurricane intensity, inland flooding, fire, drought, changes in water quality and other potential impacts

**Strategy:**

### ADP-11.3 Housing Security

**Goal 1:** Consider potential impacts of climate change on housing. In particular, plan for SLR threatening homes and apartment buildings located on the coast. Also consider other impacts of climate change and their risks to housing, such as more severe hurricanes, flooding, and fire.

**Strategy:**

## ADP-11.4 Intersection of Climate Change and Human Behavior

~~Goals and Strategies will be developed by the TWG~~

Goal 1: Create incentives to use the latest technologies to adapt to climate change

Goal 2: Improve tracking of national and global trends on modifying human behavior and adopt the best management practices applicable to the State of Florida

## ADP-12. Organizing State Government for the Long Haul

### Description of Issues

The range of adaptation planning issues outlined in this document are testament to the number of issue areas and concerns to be adequately addressed in order to assure that Florida successfully adapts to impacts caused by global climate change over the next century. In developing and implementing such a wide-ranging adaptation plan for the state, Florida will require a single point of focus within state government.

During the 2008 regular session of the Florida Legislature, HB 7135 created the FECC and imbued the commission with a broad range of duties and powers, including the responsibility for coordinating adaptation planning development and implementation within state government. The FECC is appropriately housed within the Executive Office of the Governor, thus elevating the issue and enabling cross-agency coordination of efforts.

### Objectives

The principal objective is to assure the creation of a single point of focus within state government that can continue assessing the risks posed to Florida by global climate change, develop increasingly informed adaptation planning over many decades, and learn from prior implementation to adjust adaptation planning in Florida as events on the ground change.

### Assets at Risk

Florida is a state with more than 1,300 miles of coastline and mostly low elevations. It is within the historic pathway of destructive weather events and particularly vulnerable to SLR, tidal surge, saltwater intrusion, and flooding. Coastal infrastructure (e.g., roads and bridges, utilities) as well as town and cities are also at risk. Florida has already felt the effects of mass human migrations for storm events alone. These conditions are expected to worsen in the future and be less temporary in nature. Freshwater resources are increasingly precious in the state and already pressured by Florida's growing population. Climate change poses risks to terrestrial and aquatic ecosystems, agriculture, forestry, and fisheries as well. All of these can add to existing stresses, such as population growth, land-use change, and pollution. The state of Florida will be affected by climate change through impacts on its physical assets, changes in revenues and expenditures, and changes in activities it regulates.

### Existing Actions

The legislature created the FECC, which appears at present to have the sufficient scope, powers, and resources to accomplish the intent of this element of adaptation planning. However, it will be important to assess the effectiveness of the commission in addressing adaptation.

## Goals and Strategies

**Goal 1:** It may no longer make sense to allow land, transportation, habitat, fish and wildlife protection, and water planning and management to be considered separately at all levels of government. To manage these elements effectively, planning and implementation efforts will need to be better integrated.

**Goal 2:** Create and fund a State Climate Change Adaptation Plan Advisory Team charged with drafting a State Climate Change Adaptation Plan that is periodically revised and to be officially adopted by the state subject to legislative approval.

**Goal 3:** Create and fund a State Climate Adaptation Commission charged with identifying management, engineering, and technical solutions; developing design concepts for preferred solutions; and with conducting initial feasibility studies relative to the scope, budgets, regulatory compliance, and timelines for the implementation of specific proposed adaptation solutions on regional scales.

## ADP-13. State Funding and Financing

### Description of Issues

Adequate adaptation funding for Florida would include funds made available to address the impacts of climate change. Many programs are already intact and intended to deal with some of these impacts. Some of these programs are already funded and may even have dedicated financing streams, but most existing programs are subject to political and economic cycles and disruption. Climate change impacts can be expected to intensify in the future and might also occur simultaneously, on all fronts, as opposed to the isolated incidences that are customary to Floridians and program resources. If and when this happens, it can be expected to greatly increase the pressure on the funding and financing infrastructure.

### Objectives

Florida should be prepared to fund the protection of human health and critical infrastructure, as well as address other impacts of climate change, where feasible, within a framework of protection, accommodation and, in some cases, retreat.

### Assets at Risk

Florida is a state with more than 1,300 miles of coastline and mostly low elevations. It is within the historic pathway of destructive weather events and particularly vulnerable to SLR, tidal surge saltwater intrusion and flooding. Coastal infrastructure (e.g., roads and bridges, utilities), as well as town and cities are also at risk. Under certain historic climatic conditions, Florida has already felt the effects of mass human migrations for storm events alone, these conditions are expected to worsen in the future and be less temporary in nature. Freshwater resources are increasingly precious in the state and already pressured by Florida's growing population. Climate change poses risks to terrestrial and aquatic ecosystems, agriculture, forestry, and fisheries as well. All of these stresses can add to existing stresses, such as population growth, land-use change, and pollution, further straining any existing funding and financial resources intended to address these impacts.

### Existing Actions

HB 7135, passed by the 2008 Florida Legislature, provided for the Florida Energy and Climate Commission. That commission is already preparing to explore funding and financing options with regard to adaptation issues in its deliberations.

Many of the expected impacts that climate change might bring are already familiar to Floridians. Consequently, programs to address such things as hurricanes and major storm events, storm surge and erosion, saltwater intrusion and the availability of potable drinking water supplies are already up and running. Additionally, Florida's excellent emergency response infrastructure has proven itself under many scenarios and the planning mechanisms that are a part of that infrastructure are in place to deal with a large variety of

catastrophic events. However, it is not known to what extent these programs and infrastructure will be pressured by future climate change-associated impacts or to what extent the funding will continue to be adequate under those future conditions.

## Goals and Strategies

Many of the goals and strategies in other ADPs will require financial and staff resources. Florida will need to consider the financial implications of the adaptation goals and strategies.

**Goal 1:** Examine existing funding and financing infrastructure to determine adequacy for meeting increased demands of climate change impacts.

**Goal 2:** Examine alternative financing methods to meet climate change demands and consider protecting these from short-term economic and political cycles by dedicating funding.

**Goal 3:** Consider strategies for emergency funding or financing mechanisms for unforeseen and unplanned consequences of climate change.

**Goal 4:** Consider carbon credit revenues as an adaptation financing resource.

**Goal 5:** Examine opportunities for other sources of fund such as federal funds from emerging federal climate change legislation. In addition, opportunities to coordinate with private financing, including foundation resources, should be examined.

**Goal 6:** Encourage investment of state employee pension funds.

## ADP-14. Coordinating with Other Regulatory and Standards Entities

### Description of Issues

The federal government is participating in a wide range of climate activities nationwide. They also fund state and regional entities that provide climate services. Activities include data collection, interpretation and product dissemination. Primary agencies involved include NOAA, U.S. Geological Survey (USGS), Environmental Protection Agency (EPA), Natural Resources Conservation Service (NRCS) and U.S. Department of Agriculture (USDA). Several products developed by federal agencies (e.g., drought severity categories and river flood forecasts) trigger a variety of Florida emergency and economic relief activities. Additional federal entities to be considered include the U.S. Energy Information Administration (EIA), U.S. Department of Energy (US DOE) (including the ENERGY STAR Program), National Science Foundation (NSF), and others.

In addition, a number of professional societies and other organizations are actively involved in activities to better understand the potential impacts of climate change on the members they serve. These societies often represent fundamental public service providers (e.g., water utilities [[American Water Works Association](#)], coastal states [[Coastal States Organization](#)]) or are organizations such as the Heinz Center that have examined climate change risks and adaptation. ~~and These organizations~~ need early involvement in decision making, and will require sufficient data to make informed decisions regarding risk and reliability, public health and safety, and financial management. Collectively, they represent a broad base of the population, possess unmatched knowledge of the industry they represent, and offer tremendous opportunities for technology transfer, public education, and widespread reach.

### Objectives

There is considerable research, data, potentially impacted end users, and other interested parties involved with climate change, directly affected by climate change, or have the ability to impact funding, research priorities, communications or other aspects of the climate change community.

- Develop functional relationships between selected federal government agencies, departments, and entities, the State of Florida, and key professional societies to collaborate on climate change issues of mutual interest.
- Develop a research agenda to address shared interests and priorities.
- Identify and align with funding sources and allocation decisions essential to Florida's future as it relates to climate change.

## Assets at Risk

The federal government has the lead and is central to most of the significant climate change and related programs, research, funding, and information dissemination. Failing to actively engage with the various agencies will result in missed opportunities to ensure that Florida’s needs are expressed, understood, and addressed. Additionally, working in a vacuum will result in waste and inefficient use of the limited financial, intellectual, and physical resources and will under leverage the vast pool of resources that have been working on climate change and related issues for years. Lastly, Florida must actively engage with the federal process and work as a cohesive unit (a state with numerous needs, challenges and sometimes competing objectives) to ensure that the concerned parties are not competing with each other for limited dollars and research priorities.

## Existing Actions

HB 7135, passed during the 2008 Legislative Session, requires the DEP and the Florida Department of Education (DOE), in coordination with the business, environmental, and energy communities, to develop an awards program to recognize efforts or achievements concerning conservation, energy and water reduction, green cleaning solutions, green pest management, recycling efforts, and curriculum development that enhances the quality of education while preserving the environment. The legislature encourages DOE and DEP to form partnerships with the private sector to help fund the program. The provision would implement an environmental and educational award/recognition program that encourages district school boards, teachers, classes, and students to actively participate in strategies leading to environmental preservation.

## 14.1 Federal Government

### Goals and Strategies

**Goal 1:** Develop a clear understanding of the functions and information available (needed) of key federal agencies.

**Goal 2:** Identify data gaps and prioritize research needs to establish an agreed-upon research agenda representing Florida’s collective needs.

**Goal 3:** Prioritize funding needs and develop a strategy to secure federal and federal flow-down funding to meet strategic needs in Florida.

**Goal 4:** Request and engage the support of federal agencies, such as NOAA, USGS, Federal Emergency Management Agency (FEMA), and the U.S. Army Corps of Engineers (USACE), that can provide technological and logistical support and work with RPCs and other state, county, and local planning bodies, in developing regional scenarios of climate change and analyzing potential changes in vulnerability.

The appendix includes the name and summarizes the function of key federal agencies (by category) involved with, or who have a stake in climate change.

## 14.2 Professional Societies

### Goals and Strategies

**Goal 1:** Engage professional societies and other organizations to establish industry priorities for research and funding, and work with state and federal officials to promote priorities.

**Goal 2:** Develop training and technology transfer tools and engage professional societies to reach members.

**Goal 3:** Establish a “cross functional” task force of members of professional societies and other appropriate organizations, who will be responsible for coordinating climate change issues within their respective industries.

The appendix includes the name and summarizes the function of key professional societies involved with or who have a stake in climate change.

## ADP-15. Public Education and Outreach

### Description of Issues

Public education and outreach about climate change in Florida is needed to support necessary mitigation and adaptation actions. Florida is “ground zero” for climate change impacts in the United States with its low lying and densely populated coastal zones, susceptibility to hurricanes, and vulnerable natural resources. It seems that few people realize Florida’s vulnerability, but these few are crying out for detailed and accurate information and solutions. A focused and comprehensive stakeholder education and outreach program is a key component in building support for the mitigation and adaptation policy changes that will become critical issues in Florida.

### Objectives

Florida can become a national and international leader in the dissemination of climate change information, educating a broad diversity of constituents with a cutting-edge and successful public education program. The success of any climate change adaptation demands full participation of the stakeholders (i.e., the citizens of Florida). The objectives of a successful public education outreach program would be fourfold:

1. To educate all of the stakeholders including state leadership, state and regional government who implement adaptations, citizens of Florida (including retirees, families, work force, and students K-16), ~~and~~ the broader business community and faith-based and community organizations within and outside of Florida who are important stakeholders in Florida’s adaptation actions. Create incentives to encourage involvement of the public and key stakeholders Share not only current knowledge of the impacts already occurring and expected in Florida, but also short and long-term solutions.
2. To design an overarching program that could be quickly and effectively disseminated to the stakeholders listed above, in clear, concise, and simple terms so all Floridians can embrace the knowledge. Use media such as the internet that are widely and easily accessible.
3. Train, engage, and coordinate practitioners of climate change adaptation, and needed technical support, to help Florida plan for climate change. Climate-change adaptation science and related policy improvements are developing fields requiring specific conceptual and technical skills, which exist independently in the expert community but require facilitation and training to bring together in an support group comprised of adaptation experts.

4. Link outreach programs in public education to the best climate change science, so that issues relating to adaptation and risk management create positive solutions to the environmental challenges of the future.

### **Assets at Risk**

Principal risks include misunderstood and failed policy actions resulting in political stalemate and inaction. The best climate change adaptation programs will be at risk if not embraced by the stakeholders. The best policies might be approved in Tallahassee, but the full understanding and education of citizens will insure their timely implementation and endorsement. A good example is Sarasota County, which has excellent sustainability policies in force with local leadership, but very little comprehension of the issues or constituent “buy-in,” as witnessed by the fact that Sarasota County was recently “awarded” last place in a statewide carbon-footprint audit.

Additionally, adaptation only “buys time.” Rapid and significant GHG mitigation is the only long-term solution. Understanding that the two must go hand-in-hand is crucial.

### **Existing Actions**

HB 7135, passed during the 2008 Florida Legislative Session, addressed public outreach and education by requiring the DEP and the DOE, in coordination with the business, environmental, and energy communities, to develop an awards program to recognize efforts or achievements concerning conservation, energy and water reduction, green cleaning solutions, green pest management, recycling efforts, and curriculum development that enhances the quality of education while preserving the environment. The legislature encourages DOE and DEP to form partnerships with the private sector to help fund the program. The provision would implement an environmental and educational award/recognition program that encourages district school boards, teachers, classes, and students to actively participate in strategies leading to environmental preservation.

### **Goals and Strategies**

#### **Goal 1: Train Immediate Training on Climate Change Adaptation**

##### **Strategy:**

- Short (2-day) executive seminars for Chief Executive Officers (CEOs) and state legislators, designed for policy makers, conducted by scientists trained in public education outreach
- A follow-up series of comprehensive workshops (4–6 days) mixing business and civic leaders from public and private sectors. Local teachers should be included in all sessions.

#### **Goal 2: Educate the Public**

**Strategy:** Initiate major public education campaign

- Use high profile media and other appropriate outlets to raise general awareness on climate change in Florida. Make connections between mitigation and adaptation solutions and policy changes. Educate about the expected costs of inaction and delayed action compared with the costs of acting proactively. Focal topics may include: heat waves and associated health risks; SLR and associated infrastructure and property risks; wildfire risks; species disturbances and habitat loss or change and associated ecosystem services losses (impacts to valuable and highly visible resources such as coral bleaching); and risks to water supplies. Focus groups may include: the public; policy makers; media; business leaders; developers; and land owners, buyers and sellers.

**Goal 3:** Create adaptation training and collaboration opportunities

**Strategy:** Create opportunities for government agencies to work together and with experts in climate change adaptation to develop needed skills in applying adaptation concepts to their every day management and planning. Adaptation focus areas would be natural resources and ecosystem services, infrastructure and development, financial markets, job markets, and human health and welfare. Technical expert focus groups would include Florida’s policy makers, research institutions, nongovernmental organizations (NGOs), water boards, state agencies, and the media.

**Goal 4:** Develop education programs on climate change adaptation for primary and secondary schools.

**Strategy:** Revise the state Sunshine Standards for K12 education so that vulnerability to climate change and the practice of adaptation become required subject matter in the curricula of public schools in Florida. In conjunction with the state standards, a team of professional educators and scientists should be funded to develop effective units of learning for all grade levels to insure that all students are educated about climate change adaptation, and most importantly, on mechanisms for families to conserve energy and live more sustainably.

**Goal 5:** Encourage research and training on adaptation in Florida’s public universities and research centers. Encourage public universities and research centers in Florida to develop educational programs in disciplines and professions affected by climate change to focus on developing adaptation methodologies.

## Abbreviations and Acronyms

ABM	agent based models
ADP	Adaptation
AOR	areas of responsibility
BMP	best management practice
CAMA	[Florida Office of] Coastal and Aquatic Managed Areas
CEO	Chief Executive Officer
DCA	[Florida] Department of Community Affairs
DBPR	[Florida] Department of Business and Professional Regulation
DEP	[Florida] Department of Environmental Protection
DOE	[Florida] Department of Education
DOF	[Florida] Division of Forestry
DOT	[Florida] Department of Transportation
EIA	[U.S.] Energy Information Administration
EPA	[U.S.] Environmental Protection Agency
ERP	Environmental Resource Permits
ET	evapotranspiration
FAC	Florida Administrative Code
FBC	Florida Building Commission
FDACS	Florida Department of Agriculture and Consumer Services
FECC	Florida Energy and Climate Commission
FEMA	[U.S.] Federal Emergency Management Agency
FESC	Florida Energy Systems Consortium
FLCOOS	Florida Coastal Ocean Observing System
FSG	Florida Sea Grant College Program
FWC	[Florida] Fish and Wildlife Conservation Commission
GHG	greenhouse gas
GP	Government Policy [TWG]
HB	House Bill
LEED	Leadership in Energy and Environmental Design™
LIDAR	Light Detection and Ranging
MPO	Metropolitan Planning Organizations
NFIP	National Flood Insurance Program
NGO	nongovernmental organizations
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NSF	National Science Foundation
OIR	[Florida] Office of Insurance Regulation
OTTED	Office of Tourism, Trade, and Economic Development

R&D	research and development
RFP	Request for Proposal
RPC	Regional Planning Council
SCP	[Florida’s] State Comprehensive Plan
SLR	sea level rise
SRPP	Strategic Regional Policy Plans
SUS	State University System
TLU	Transportation and Land Use [TWG]
TWG	Technical Work Groups
USACE	U.S. Army Corp of Engineers
USDA	U.S. Department of Agriculture
US DOE	Department of Energy
US FWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WWF	World Wildlife Fund