CLIMATE READINESS PLANNING AT THE SOUTHWEST FLORIDA REGIONAL PLANNING COUNCIL (SWFRPC) AND CHARLOTTE HARBOR NATIONAL ESTUARY PROGRAM (CHNEP) 2009 TO 2013

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CLIMATE CHANGE PLANNING IN SOUTHWEST FLORIDA IS:

- > A Public Process Driven by Public Input
- Using Public Participation Games, Interviews, Pre and Post Surveys and Other Tools
- Consensus Based and Pragmatic
- Implementable and Currently Being Implemented
- Cost Conscious (Cost/Benefit) and Favoring No Regrets Actions
- Incorporated; Not Separated; From Comprehensive and Transportation Plans
- Using New Language: (Call It What It Is)
 - Redesign (not Accommodation)
 - Managed Relocation (not Retreat)
 - >Armoring/Diking/Filling (not Protection)

13 CHNEP/SWFRPC CRE PROJECTS

- Regional Vulnerability Assessment (CRE 2007-2009)
- Punta Gorda Adaptation Plan (CRE 2008-2009)
- Seagrass Response to Sea Level Rise (CHNEP 2009)
- Vulnerability Assessment CHNEP short version (2009-2010)
- Climate Change Environmental Indicators (CRE 2009-2010)
- Model Ordinances/Comp Plan (CRE 2009-2010)
- Punta Gorda Comp Plan Amendments (PG 2009-2010)
- Climate Change Vulnerability Assessment and Adaptation Opportunities for Salt Marsh Types in Southwest Florida (EPA 2009-2012)
- Lee County Vulnerability Assessment and Lee County Resiliency Plan (Lee 2009-2010)
- Conceptual Ecological Models (CRE 2010-2011)
- Ecosystem Services & Climate Change (Elizabeth Ordway Dunn with SCCF 2012-2013)
- Coastal Resilience Online Tool (with The Nature Conservancy 2013-2013)

- WE ARE PLANNING FOR (EVEN IN THE LEAST IMPACT FUTURE CLIMATE CHANGE SCENARIO):
 - increased climate instability more extreme hot and cold events
 - increased coastal erosion continuous sea-level rise
 - wetter wet seasons and drier dry seasons
 - shifts in fauna and flora
 - increased tropical diseases in plants, wildlife & humans
 - destabilized aquatic food webs including increased Harmful Algae Blooms
 - increasing strains upon and costs in infrastructure
 - increased uncertainty concerning variable risk assessment with uncertain actuarial futures (insurance).

Comprehensive Southwest Florida/Charlotte Harbor Climate Change Vulnerability Assessment



Southwest Florida Regional Planning Council Charlotte Harbor National Estuary Program Technical Report 09-3 September 15, 2009 James W. Beever III, Whitney Gray, Daniel Trescott, Dan Cobb, Jason Utley: SWFRPC

> And Lisa B. Beever: CHNEP



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www.SWFRPC.org and www.CHNEP.org



City of Punta Gorda Adaptation Plan



Southwest Florida Regional Planning Council Charlotte Harbor National Estuary Program Technical Report 09-4 11/18/2009

James W. Beever III, Whitney Gray, Daniel Trescott, Dan Cobb, Jason Utley, David Hutchinson, John Gibbons, Tim Walker, Moji Abimbola: SWFRPC And Lisa B. Beever, Judy Ott: CHNEP



Adopted November 18, 2009









Objective 2.4.2: Address the impacts of sea level rise, and seek strategies to combat its effects on the shoreline of the City. Policy 2.4.2.1: The City will work with the SWFRPC to determine potential sea level rise impacts on the **Coastal Planning Area. Measurement: Completion** and implementation of developed coastal studies or development of model scenarios.

On December 17, 2008, the Punta Gorda City Council voted unanimously to participate in the CHNEP CRE pilot program. This progressive municipality had already included climate change planning in their Comprehensive Plan.

A Citizen-Driven Process

Participants filled out a survey providing demographics and previous experience with Hurricane Charley.

Then, they wrote down the vulnerabilities they thought most important and played a "trading card" game, collaborating to group them into envelopes.









Public participation was key to the project.









Second Public Meeting

Participants labeled areas on maps where vulnerabilities and/or areas for adaptations existed. The labels named specific adaptations from citizen suggestions and from the literature.

Adaptations that were NOT desired were also included.





Photograph 4: Two participants playing the Adaptation Game at the Unchecked or Unmanaged Growth table.



Figure 8: Placed Based Adaptation Suggestions for the City of Punta Gorda

Options Examined for Infrastructure Protection From Flooding and Sea Level Rise

- Redesign (Accommodation)
- Armoring/Diking/Filling (Protection)
- Managed Relocation (Retreat)

A hypothetical comparison of relative costs of various sea-level rise adaptations for the City of Punta Gorda (in 2009 dollars)

Alternative	Rolling Easement	Bulkhead with Fill to 6 feet (The Galveston Solution)	Gradual Sand Filling to Keep Pace (Volk 2008)	Elevating the Infrastructure (The Venice Solution)	Armored Dike with 4 Major Pumps (The New Orleans Solution)
Shoreline					
Less than total: set at the boundary between current uplands with freshwater wetlands and tidal coastal wetlands.	\$58,332,852	\$1,530,358,919	\$76,500,000	\$1,269,520,000	\$2,157,450,984
Total: with irregular outer mangrove shoreline without overwash mangrove islands or many convoluted embayments	\$69,770,641	\$1,554,071,794	\$91,500,000	\$1,269,520,000	\$3,773,093,875
Total: with irregular outer mangrove shoreline with convoluted embayments but not the overwash mangrove islands with canals open to navigation	\$77,777,108	\$1,569,436,395	\$102,000,000	\$1,269,520,000	\$3,868,536,601





Explicitly indicate in local master plans, (Comprehensive Plans), which areas will retain natural shorelines.

Wetlands and Uplands of Significance to Wetland-Dependent Listed Species of the City of Punta Gorda





City of Punta Gorda Comprehensive Plan 2025

From 2009 through 2012 progress has been made on 6 of the 8 adaptations.

Prioritized Vulnerabilities	The top consensus adaptations for each area of vulnerability include:
1. Fish and Wildlife Habitat Degradation;	1. Seagrass protection and restoration
2. Inadequate Water Supply;	2. Xeriscaping and native plant landscaping.
3. Flooding;	3. Explicitly indicating in the comprehensive plan which areas will retain natural shorelines.
4. Unchecked or Unmanaged Growth;	4. Constraining locations for certain high risk infrastructure
5. Water Quality Degradation;	5. Restrict fertilizer use.
6. Education and Economy and Lack of Funds;	6. Promote green building alternatives through education, taxing incentives, green lending.
7. Fire;	7. Drought preparedness planning
8. Availability of Insurance.	8. Implementation of the other adaptations, particularly 3 and 4.

Table 70: Adaptation Plan Monitoring Summary for the Primary Initial Adaptation Actions						
Adaptation	Proximal Monitoring Physical Measure	Secondary Measure	Responsible Entity Collecting Data	Primary Target Goal		
Seagrass protection and restoration	Acres of seagrass in the Tidal Peace River segment	Quality of seagrass	SWFWMD/ CHNEP	CHNEP seagrass target (951 acres) for Tidal Peace River segment		
Xeriscaping and native plant landscaping.	Percent of City responsible landscape in xeriscape	Percent of citizen responsible landscape in xeriscape	City of Punta Gorda	25% by 2025		
Explicitly indicating in the comprehensive plan which areas will retain natural shorelines.	% natural shoreline	% natural shoreline restored	City of Punta Gorda	50%		
Constraining locations for certain high risk infrastructure.	Amount of TDR transferred Out of Environmental Sending Locations	amount of high risk infrastructure remaining in the Tropical Storm and Category 1 Storm Surge Zones	City of Punta Gorda	No high risk infrastructure remaining in the Tropical Storm and Category 1 Storm Surge Zones		
Restrict fertilizer use.	Nitrogen concentrations and loads in River and Harbor	Reduction in nitrogen levels and loads in City canals	SWFWMD, Charlotte County, FMRI	Reduction in nitrogen in River and Harbor to achieve non-impairment per TMDL		



The recommended adaptations can easily be incorporated by education programs, ordinance, or comprehensive plan additions/amendments in the normal course of City of Punta Gorda plan reviews and updates.

The identified adaptations do not constitute a cultural change for the City but rather a continuation of a general progressive approach undertaken by the City to improve and enhance its resource base and standard of living.

Model Ordinances/Comprehensive Plan Language (CRE 2009-2010)

- CHNEP organized local land use planners and elected officials and EPA staff to outline comprehensive plan and ordinance language to improve community resiliency.
- Punta Gorda partnered with University of Florida Law School to develop comprehensive plan and ordinance language to implement Adaptation Plan
- Comp Plan GOP language/workshop UF language, DCA consideration, Jim Titus Presentation

Goal 4: [Managed Relocation] To Reduce vulnerability in the built environment and preserve coastal ecosystems through changes in land use and the orderly abandonment and /or landward relocation of structures and associated infrastructure



Lee County Climate Change Vulnerability Assessment

•Characterizes current Lee County climate

•Assesses significant potential climate changes and their effects in Lee County

•Suggests methods for prioritizing vulnerabilities

Lee County Climate Change Vulnerability Assessment



Southwest Florida Regional Planning Council DRAFT March 18, 2010 James W. Beever III, Whitney Gray, Daniel Trescott, Dan Cobb, Jason Utley, David Hutchinson



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Resiliency Strategy

Lee County Climate Change Resiliency Strategy (CCRS)



Southwest Florida Regional Planning Council DRAFT July 30, 2010 James W. Beever III, Whitney Gray, Jason Utley, David Hutchinson, Tim Walker, Dan Cobb

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- Outlines the essential elements of the resiliency strategy
- * Summarizes vulnerabilities
- * Summarizes input received from Lee County leadership and constitutional officers
- Identifies strategies that Lee County could pursue to increase resiliency to the identified vulnerabilities
- Identifies ways to incorporate climate change resiliency into the LeePlan
- Outlines monitoring and evaluation strategies

Implementation in Lee County

- Resiliency strategies incorporated into EAR and Comprehensive Plan revisions
- Development of LEED certified county facilities
- Development of biofuels
- Major energy efficiency effort in county facilities
- Establishment of an Office of Sustainability



Lee County Public Safety Building with solar array

Climate Change Vulnerability Assessment and Adaptation Opportunities For Salt Marsh Types in Southwest Florida

Jim Beever, Whitney Gray, Dan Cobb, Tim Walker, SWFRPC and Lisa Beever, CHNEP: June 30, 2012

AMMA:

Avoidance Minimization

Mitigation

Adaptation

- Inventory and determine the areal extent of twelve types of salt marsh in the study area.
- Determine the vulnerability of the salt marsh types to climate change.
- Identify opportunities/needs for AMMA.
- Develop strategies to implement AMMA options.



Coastal Shoreline Continuum & Typical "Living Shorelines" Treatments TIDAL MARSH LIVING BREAKWATER Upland Buffer Bankface Coastal Wetlands & Beach Strand Subtidal Waters Deep Rooted Native Wetlands Plants Matched to Tidal Hydrology 8 Submerged Aquatic Vegetation Decideous Native Grasses Salinty Trees in Butter & Shrubs on Artificial Oyster Reefs - Marl Stone with Oyster Spat Banks Sills, Stone Surface Groins, Marsh Toe Revetments, Marshy Islands etc. Matched to Wave Climate & Shoreline Environment

9" of sea level rise locally since 1910

Salt Marshes Mapped to 12 Types

First Salt Marsh Map of the 12 Types Atlas of Maps By Section Species Lists Water Quality







Climate Change Vulnerability Assessment and Adaptation Opportunities For Salt Marsh Types in Southwest Florida June 30, 2012

Observed Effects of Climate Change on Salt Marsh in the CHNEP

- Migration Landward (on average the length of a football field)
- Conversion to Another Marsh Type
- Drowning in Place
- Freezing (Leather Fern Marshes)
- Expansion of Invasive Plants and Animals







Ten (10)Potential adaptations and recommended strategies to implement the AMMA options

- Maintain the existing marsh migration corridors that have been established on Cape Haze, Eastern Charlotte Harbor shoreline, and Estero Bay Buffer.
- Identify the highest priority marsh migration corridors so that they can protect these areas from future development. Followed by acquisition of inland buffer zones to provide an opportunity for habitats and wildlife to migrate inland.
- Support restoration of existing salt marshes by removal of exotic vegetation, removal of barriers to tidal connection, and degradation of exotic dominated adjacent uplands
- Discourage or stop shoreline hardening including seawalls, bulkheads, rip-rap, and "living shorelines" backed by rip-rap.
- Re-engineer existing vertical shoreline infrastructure to a sloped soil based shoreline with GeoWeb or other permeable stabilization.
- Restore impaired water flows to enhance sediment supply for marsh deposition
- Elevate roadway berms by bridging and culver ting or abandon coastal road corridors with associated beamed road beds..
- Back-fill mosquito control ditches to reduce depth and sediment loss
- Back fill borrow pits, agricultural pits, and spreader waterways to allow salt marsh establishment and establishment of marsh migration corridors
- Sediment-slurry addition to assist in marsh building processes

ECOSERVE

Estimating and Forecasting **Ecosystem** Services within Pine Island Sound, Sanibel Island, Captiva Island, North Captiva Island, **Cayo Costa** Island, Useppa Island, Other Islands of the Sound, and the **Near shore Gulf** of Mexico



Funded by Elizabeth Ordway Dunn, Charlotte Harbor National Estuary Program and the Sanibel-Captiva Conservation Foundation





1 Foot of Sea Level Rise



1 Foot of Sea Level Rise

TEV Comparison in 2012 Dollars

Year	TEV	Difference
2012	\$7,033,362,634.63	
Future Land Use Map 2030	\$5,146,537,673.59	26.83% loss
Future Land Use with 1 foot of Sea Level Rise	\$4,184,956,813.96	42.85% loss



3 meters Sea Level Rise Source of Graphic: New York Times 2012

2012

2100: 1% Probability IPPC 3 2200: 5% Probability IPPC 3 2153: IPCC 4 A1FI "worst case" 3324: At the current empirical measured rate

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