

## Climate Change

It is widely accepted in the scientific community that global climate patterns are changing, and that human actions contribute to the changes. Temperatures in the contiguous United States in 2012 were the hottest in more than a century, according to the National Oceanic and Atmospheric Administration (NOAA). The average temperature in 2012 was 55.3 degrees, one full degree above the previous record and 3.2 degrees higher than the 20th-century average. Although scientists legitimately disagree on the magnitude, pace and consequences of these changes, the potential risks to Florida's coastal communities and natural resources mandate responsible action to respond and adapt to our changing climate.

Since 1992, NOAA records show that the rate of global sea level rise measured by satellites has been roughly twice the rate observed over the last century. Nearly five million Americans live within four feet of the local high-tide level.

With its vast shoreline and low elevation, Florida is especially vulnerable to the effects of sea-level rise. Tampa Bay and other large estuarine systems directly connected to the ocean already are experiencing impacts resulting from both expansion of ocean water caused by warming ocean temperature, and melting ice sheets and glaciers worldwide.

Water levels in Tampa Bay have risen an average of one inch per decade since the 1950s, and that rate is expected to double or even triple in coming decades. The most recent estimates predict a probable rise of 20-40 inches worldwide by the year 2100. Such an increase would inundate a substantial portion of low-lying areas such as the Pinellas peninsula, south Tampa and coastal Manatee.

In addition to the obvious impacts to manmade structures and infrastructure such as roads, bridges, and utilities, ecological impacts will be far-reaching and may include:

- Increased shoreline erosion
- Saltwater intrusion into freshwater aquifers
- Increased populations of invasive plants and animals
- Decreased populations of native plants and animals
- Loss of important coastal wetland habitats that support fish and wildlife, filter pollutants and buffer storm intensities

In 2010, the Florida Oceans and Coastal Council, established by the Florida Legislature, published an update of its initial 2009 report identifying the potential effects of climate change on Florida's coastal resources. Reflecting newer data, the report noted that estuaries like Tampa Bay face a host of "probable" impacts, including:

- Loss of upland coastal forests as tidal wetlands expand across low-lying coastal areas and

the retreat of forests is blocked by urban development.

- Conversion of vegetation-lined river and bay shorelines to open water or low-lying, flood-prone systems.
- Replacement of high-diversity freshwater wetlands in the tidal freshwater reaches of coastal rivers with low-diversity salt-tolerant or brackish wetlands.
- Major spatial shifts in wetland communities, including invasions of exotic species.
- Complete “drowning” of tidal wetlands in areas with low freshwater and sediment inflow, increasing the risk of damaging storm surges.
- Redistribution and potential loss of underwater seagrasses as water depths increase and reduce light penetration.

The report further states that it is possible that more than half of the salt marsh, shoals, and mudflats critical to birds and fishes foraging in Florida estuaries could be lost during the 21st century.

Given the severity of the potential impacts, the addition of a specific Action Plan addressing climate change in the Comprehensive Conservation and Management Plan (CCMP) for Tampa Bay -- with particular focus on ensuring the integrity of key bay habitats -- is timely and appropriate.

TBEP’s inclusion in the U.S. Environmental Protection Agency’s “Climate-Ready Estuaries” program has provided an important for highlighting the serious challenges of climate change, and working cooperatively with other NEPs and coastal management organizations to develop innovative climate adaptation strategies.

Among the climate change projects TBEP already has initiated:

- Development of a “Gulf Coast Community Handbook” showcasing case studies from the Gulf of Mexico NEPs, National Estuarine Research Reserves and local communities to illustrate on-the-ground approaches and lessons learned about incorporating climate change resiliency into habitat restoration and protection plans. The handbook is funded by an EPA grant.
- Creation of a digital visualization tool for planners that allows modeling of impacts of sea level rise on coastal habitats such as salt marshes, mangroves and freshwater marshes. The model shows where natural landward migration of habitats is possible and where adaptation is constrained by manmade structures. The project, which includes an interactive, publicly available website, was a partnership of TBEP and the Tampa Bay Regional Planning Council, with funding provided by EPA.
- Participation in the national King Tide Photo-Documentation Project that recruits citizens to submit images of the super-high “King Tides” each year to illustrate how rising seas may affect our region's shores, habitats, buildings, roads and other

infrastructure. TBEP conducts a photo contest with entrants submitting images of low and King tides taken at the same location.

- Participation in the “Resilient Tampa Bay” information and technology exchange with planners and water managers from the Netherlands. This series of conferences brings Dutch experts to the University of South Florida to share lessons learned in addressing sea level rise.

## **CC-1**

### **Improve Ability of Bay Habitats to Adapt to Climate Change**

#### **ACTION:**

Improve the resiliency of vulnerable bay habitats to sea level rise.

#### **STATUS:**

New action to support ongoing and future research and restoration/mitigation of sea level rise and other predicted climate change impacts on coastal habitats.

#### **BACKGROUND:**

Estuaries like Tampa Bay are particularly vulnerable to many of the projected effects of climate change, such as sea level rise, warming temperatures, and changes in precipitation and storm intensity. Coastal habitats are among the first to experience these impacts, and have an important role to play in mitigating their effects.

Maintaining the diversity of coastal habitats in Tampa Bay as water levels rise and threaten to inundate them requires making room for these habitats to naturally migrate, through such strategies as rolling easements, requiring wetland conservation as part of new infrastructure development, or prohibiting construction of hardened shorelines . Where sediment transport is desired to protect wetlands, removal of barriers may be recommend. Protection of beaches may be accomplished through renourishment projects or construction of groins.

Already, sea level rise is being addressed in habitat restoration projects conducted by SWFWMD’s Surface Water Improvement and Management (SWIM) program. In designing these projects, SWIM biologists are building in space for vulnerable coastal habitats to migrate landward as water levels rise. These efforts should be expanded baywide to identify and protect bay habitats critically important to fish and wildlife, and ensure their continued viability in the face of an altered climate.

#### **STRATEGY:**

- STEP 1 Identify coastal habitats most vulnerable to impacts of climate change.
- Responsible parties:*** TBEP, TBRPC, FWC, Tampa Bay Habitat Restoration Partnership  
***Schedule:*** 2016, following completion of a habitat vulnerability assessment.
- STEP 2 Develop and encourage use of planning tools to incorporate climate-related impacts to coastal habitats.
- Responsible parties:*** TBEP, TBRPC, NOAA  
***Schedule:*** Ongoing. TBEP has developed a digital Sea Level Rise Visualization Mapping Tool that illustrates the scale of potential sea level rise and mapping tool illustrates the scale of potential sea level rise and transitions of critical coastal habitats that may occur in the Tampa Bay area within this century due to current trends in climate change. This interactive map is hosted on the Tampa Bay Water Atlas website.
- STEP 3 Develop a long-term monitoring plan that tracks climate-related changes to coastal habitats.
- Responsible parties:*** Tampa Bay Habitat Restoration Partnership  
***Schedule:*** A Critical Coastal Habitat Assessment is now underway to identify and track changes in vulnerable coastal habitats. A baseline assessment is slated for completion in Spring 2014, following development of a framework and methodology for detecting both large-scale and fine-scale habitat changes at selected study sites.
- STEP 4 Support and assist with purchase, protection and/or restoration of priority sites to serve as climate change refuges for critically important habitats and species
- Responsible parties:*** Tampa Bay Habitat Restoration Partnership  
***Schedule:*** Ongoing. Priority list of environmental lands initially developed by TBEP is used to guide land acquisition by other agencies. The list is updated every 10 years as part of the update to the Tampa Bay Habitat Master Plan.

## Enhance Ecosystem Values of Tidal Tributaries

### **ACTION:**

Improve the ecosystem value of tidal tributaries of Tampa Bay.

### **STATUS:**

New action to support ongoing and future research and restoration of the more than 100 tidal streams flowing to the bay.

### **BACKGROUND:**

Tidal tributaries are an important, diverse and often-neglected ecosystem in the bay watershed. Distinctly different from freshwater systems and the open bay, these variable-salinity streams serve an important niche in fisheries production, nutrient cycling, wading bird foraging and flood prevention/detention. Most of the bay's tidal creeks are less than six miles long and narrow, averaging about 75-150 feet wide. Despite water quality often characterized by low dissolved oxygen levels and higher relative nutrient and chlorophyll levels, these systems have been shown to support high densities of many juvenile fish and baitfish species. Research conducted by TBEP found that juvenile snook -- a premier sport fish -- were up to 36 times more abundant inside the sampled tributaries than outside.

Many of the bay's tidal creeks have been significantly altered by dredging, road construction, shoreline development and channelization to facilitate flood control. These impacts have affected water flow, circulation, fish and invertebrate populations, and shoreline vegetation. In some cases, the connections between these important feeder systems and the bay itself have been severely diminished.

TBEP research completed within the past five years has highlighted the importance of tidal tributaries to the overall health of Tampa Bay, and pointed to the need for better management and/or restoration of these systems. Specific goals adopted for these habitats are:

- Maintaining connectivity between open bay waters, large tidal rivers and smaller tidal streams to improve movement of fish, water flow and nutrients among the systems.
- Reducing large fluctuations in water flow from storm events, known as "flashiness," to mimic more natural hydrologic flows and foster production of benthic microalgae and the animals that eat it.
- Tracking conditions in tidal tributaries by monitoring freshwater inflow, watershed development, water quality and fisheries use. Development of specific Numeric Nutrient Criteria for tidal tributaries is an important component of assessing the health of tidal creeks and efforts to enhance them.

- Improving public awareness of the value of tidal tributaries as vital nurseries for popular recreational fish, foraging grounds for wading birds, and natural stormwater treatment areas.

## **STRATEGY:**

STEP 1 Identify streams where salinity barriers impede water exchange:

- Assess and document tributaries where water flow is impacted by structures such as culverts, dams or road beds.
- Implement pilot barrier removal projects and monitor results in priority tributaries.

*Responsible parties:* TBEP, SWFWMD, USFWS

*Schedule:* Initial pilot project to be conducted in 2012-2103

STEP 2 Evaluate benefits of hydrologic restoration in Channels A, G and 5.

*Responsible parties:* SWFWMD, TBEP, NOAA, USFWS

*Schedule:* Evaluation to take place in 2012-2013

STEP 3 Pursue additional habitat and/or hydrologic restoration opportunities for tidal tributaries in the bay watershed.

*Responsible parties:* TBEP, SWFWMD, NOAA, FDEP, USFWS

*Schedule:* 2013-2015

STEP 4 Continue to develop environmental indicators of tidal tributary health and nursery function:

- Participate in collaborative effort to develop specific Numeric Nutrient Criteria for tidal tributaries in Southwest Florida estuaries
- Continue to track amount of oligohaline habitat restored, protected or enhanced as part of the Tampa Bay Habitat Master Plan.
- Continue to support the Fisheries Independent Monitoring (FIM) Program conducted by the Florida Fish and Wildlife Research Institute and other research initiatives focused on determining which tidal creeks provide the best habitats for fisheries resources.

***Responsible parties:*** TBEP, SBEP, CHNEP, FDEP, EPA, USGS, FWC

***Schedule:*** Numeric Nutrient Criteria development initiated in 2013 with expected completion of 2014; Bay Habitat Master Plan revised in 2010, with acreage estimates updated every 10 years; FIM program conducted annually.

STEP 5 Improve awareness of the importance of tidal tributaries and enlist citizens in protecting them:

- Provide and distribute summaries of TBEP-led research on tidal tributaries in a citizen-friendly format.
- Support and encourage expansion of existing citizen monitoring programs such as Stream WaterWatch, the Frog Listening Network and a new Sierra Club effort to train citizens to sample basic water quality parameters in Manatee County streams.
- Support local government outreach efforts to focus attention on tributaries, such as Pinellas County's "Watershed, Where We LiveWorkPlay" campaign launched in 2012.

***Responsible parties:*** TBEP, local governments, Sierra Club

***Schedule:*** Ongoing.

## **SW-12**

### **Reduce Nitrogen Loading from Urban Landscapes**

#### **ACTION:**

Reduce nitrogen pollution associated with improper use of lawn and landscape fertilizer.

#### **STATUS:**

New action to support implementation of local ordinances regulating urban fertilizer use.

#### **BACKGROUND:**

Residential fertilizer is a significant source of nitrogen to the bay, accounting for about 20% of total loadings. Because of the increasing costs of treating stormwater from urban areas (estimated at \$3,500 per pound, per DEP's 319h stormwater project database), TBEP was asked by its Policy Board to develop a Model Ordinance restricting urban fertilizer use to reduce pollution of the bay and surrounding waterways with fertilizer runoff, especially during the summer rainy season. Specifically, the Model Ordinance:

- Prohibits use and retail sale of lawn and landscape fertilizers containing nitrogen and phosphorous from June-September.
- Requires use and retail sale of lawn and landscape fertilizers containing a minimum of 50% slow-release nitrogen from October-May.

This ordinance has been adopted fully or partially by Manatee and Pinellas counties (and all 24 Pinellas cities) and the city of Tampa. Additionally, Hillsborough County has adopted a local ordinance based on a statewide model developed by the Florida Department of Environmental Protection.

Pinellas County's own research shows that 75% of its water bodies are considered impaired under current water quality standards; 80% of Tampa's waterways are impaired for excess nutrients or low dissolved oxygen. The local fertilizer ordinances in these communities offer a practical and cost-effective way to substantially reduce nitrogen inputs in these areas at little cost to taxpayers. TBEP has conservatively estimated that moderate compliance (50%) with summer fertilizer application bans could reduce nitrogen loads to the bay by 84 tons per year.

TBEP is spearheading a regional education campaign supporting the local fertilizer ordinances called "Be Floridian" to educate homeowners, retail outlets and lawn care professionals about the ordinances. Utilizing social marketing techniques, Be Floridian seeks to foster a permanent behavior change in both fertilization practices and cultural attitudes about what constitutes an attractive landscape. The campaign mascot, a plastic pink yard flamingo, and its key message to "Protect Our Fun" reinforces the importance of water-based recreation to West Central Florida residents, while spreading the message to "skip the fertilizer in the summer."

The campaign uses a combination of conventional mass media strategies such as billboards, print ads and radio ads; web-based technologies such as digital ads, You Tube videos, smartphone games and online pledges; and targeted outreach at both community events and relevant commercial venues such as garden centers and big box stores that sell lawn care products.

Concurrent with the education campaign, local governments and extension specialists are training lawn care professionals in “Best Management Practices” to reduce runoff. BMP certification is now required by state law of all commercial fertilizer applicators. Additionally, training for general landscape maintenance personnel is required in Pinellas and Manatee counties. TBEP has purchased the certification decals used in Hillsborough, Manatee and Pinellas counties.

Local governments are serving as role models in the effort to reduce fertilizer use. Pinellas County no longer applies fertilizer on its parks or rights-of-way; Tampa has halted fertilizer applications at parks; and Manatee no longer fertilizes landscapes at county facilities, and has substantially reduced fertilizer use on its athletic fields.

The Florida Department of Transportation has released new guidelines that discourage use of fertilizer except where needed to maintain vegetation in erosion-prone soils. Minimal or no fertilization is mandated near stormwater treatment ponds and other water bodies, as well as swales.

Recognizing that research is needed to examine whether fertilizer ordinances are effective tools for reducing nutrient pollution, TBEP has joined with its local partners to conduct a 3-year study to measure and compare nitrogen concentrations in stormwater in residential communities with similar characteristics in each of our three counties. Water quality sampling for nitrogen will be conducted in stormwater ponds in select residential communities, and in the closest receiving waters during both wet and dry seasons, to detect changes in nitrogen levels. Social surveys of the homeowners in these areas also will be conducted at regular intervals, to establish a baseline of lawn care management, and then track changes in their lawn care regimen that can be attributed to education. This study should provide concrete data as to the relative effectiveness of the various ordinances currently in effect in Pinellas, Manatee and Hillsborough counties. The results of this study are expected in December 2013.

#### STEP 1      Support Local Ordinances Addressing Use of Lawn/Landscape Fertilizers

- Continue support for Be Floridian fertilizer education campaign
- Support other efforts of community partners to educate citizens about proper fertilizer use, Florida-Friendly Landscaping™ and other watershed protection principles.

***Responsible parties:*** TBEP; Manatee , Pinellas and Hillsborough counties;

cities of Tampa, St. Petersburg and Clearwater; local extension programs  
**Schedule:** Ongoing. Be Floridian campaign funded through 2014 by TBEP; Campaign expanded to Manatee County in 2011 and Sarasota County in 2012. Pinellas County launched its “Watershed: Where We LiveWorkPlay” campaign in November 2012. Extension programs continue to staff the Florida Yards & Neighborhoods program to promote FFL.

STEP 2 Evaluate Effectiveness of Ordinances and Education in Reducing Nitrogen Loads from Residential Landscapes

**Responsible parties:** TBEP, Manatee and Pinellas counties; Environmental Protection Commission of Hillsborough County; City of Tampa

**Schedule:** Study to be completed in December 2013.