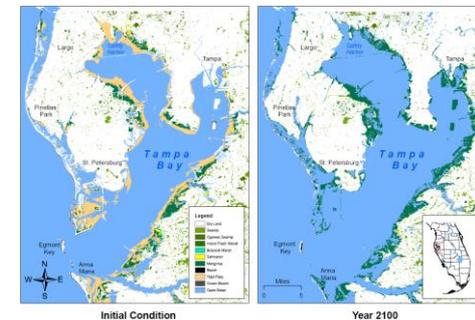
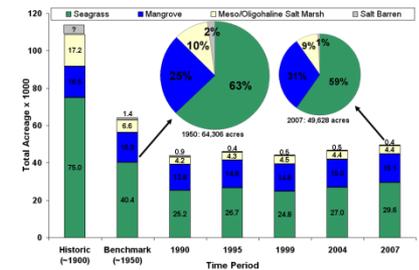
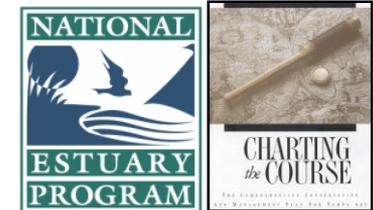


TAMPA BAY COASTAL  
HABITATS: CLIMATE CHANGE  
POTENTIAL IMPACTS &  
MANAGEMENT FOR THE  
FUTURE

Ed Sherwood  
Tampa Bay Estuary Program  
263 13<sup>th</sup> Ave. South  
St. Petersburg, FL 33701  
[esherwood@tbep.org](mailto:esherwood@tbep.org)  
<http://www.tbep.org>

# Overview

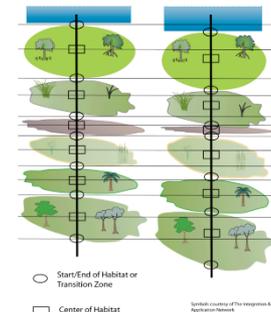
- Tampa Bay Estuary Program
  
- Current Habitat Restoration Targets & Strategies
  
- Anticipated Habitat Vulnerabilities from Climate Change & Sea Level Rise
  
- Future Work: Habitat, Blue Carbon, Ocean Acidification Assessments



Initial Condition Year 2100

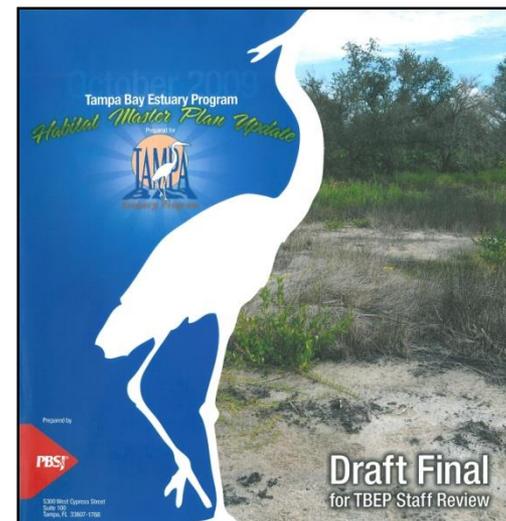
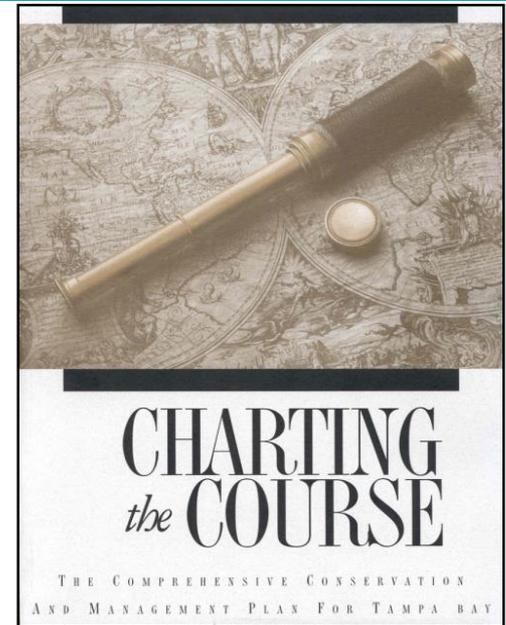
Tampa Bay Critical Coastal Habitat Assessment

Baseline Survey Baseline + x years



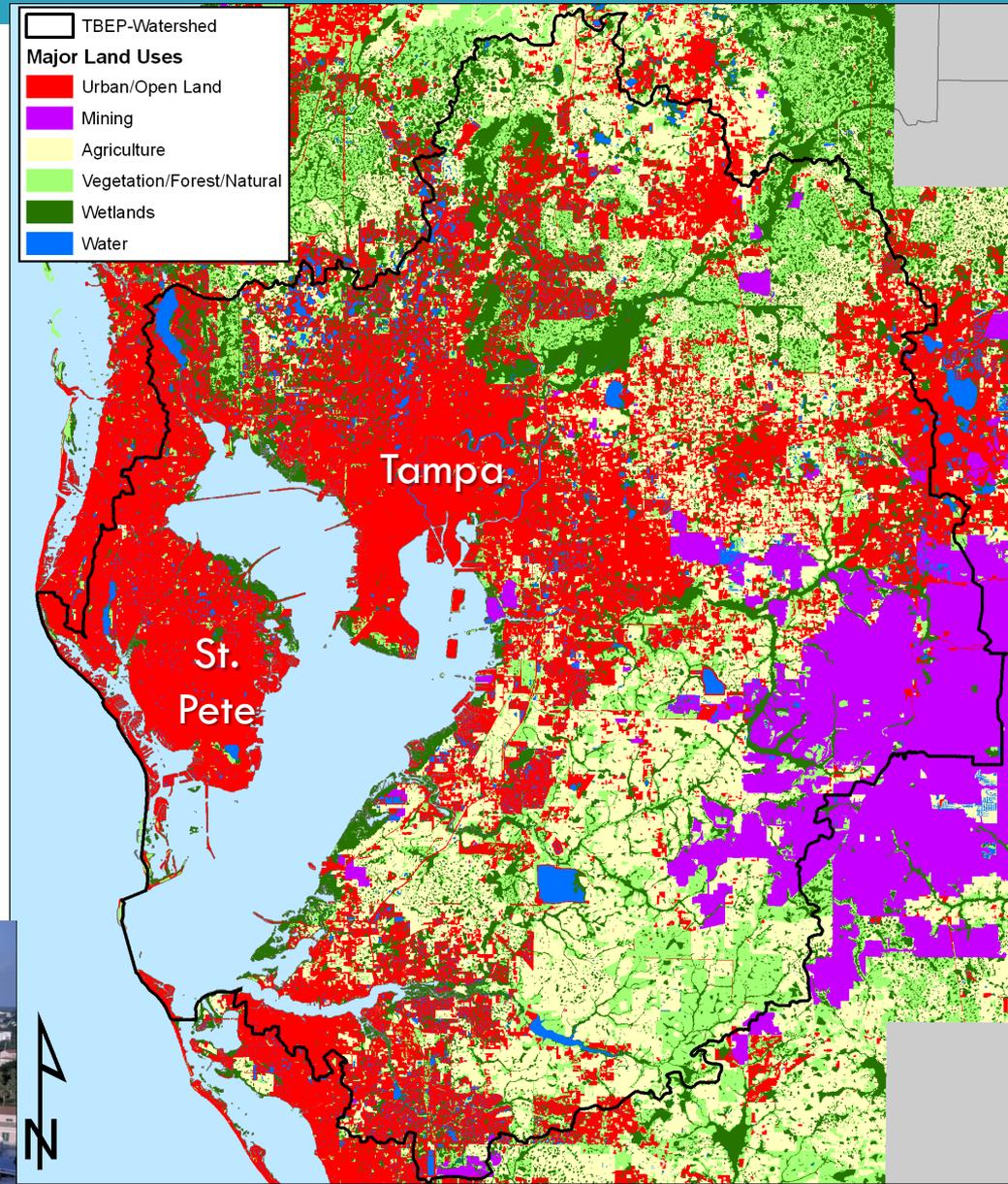
# Tampa Bay Estuary Program: Comprehensive Conservation & Management Plan (CCMP)

- 1996 – Tampa Bay Master Plan adopted by TBEP partners
  
- 2006 – 1<sup>st</sup> CCMP Update
  - ▣ 42 actions
  - ▣ 2010 Updated Habitat Master Plan Developed
  
- 2016 – Next Anticipated Update
  - ▣ Climate Change Effects Need to be Considered w/ regards to New Goals & Actions



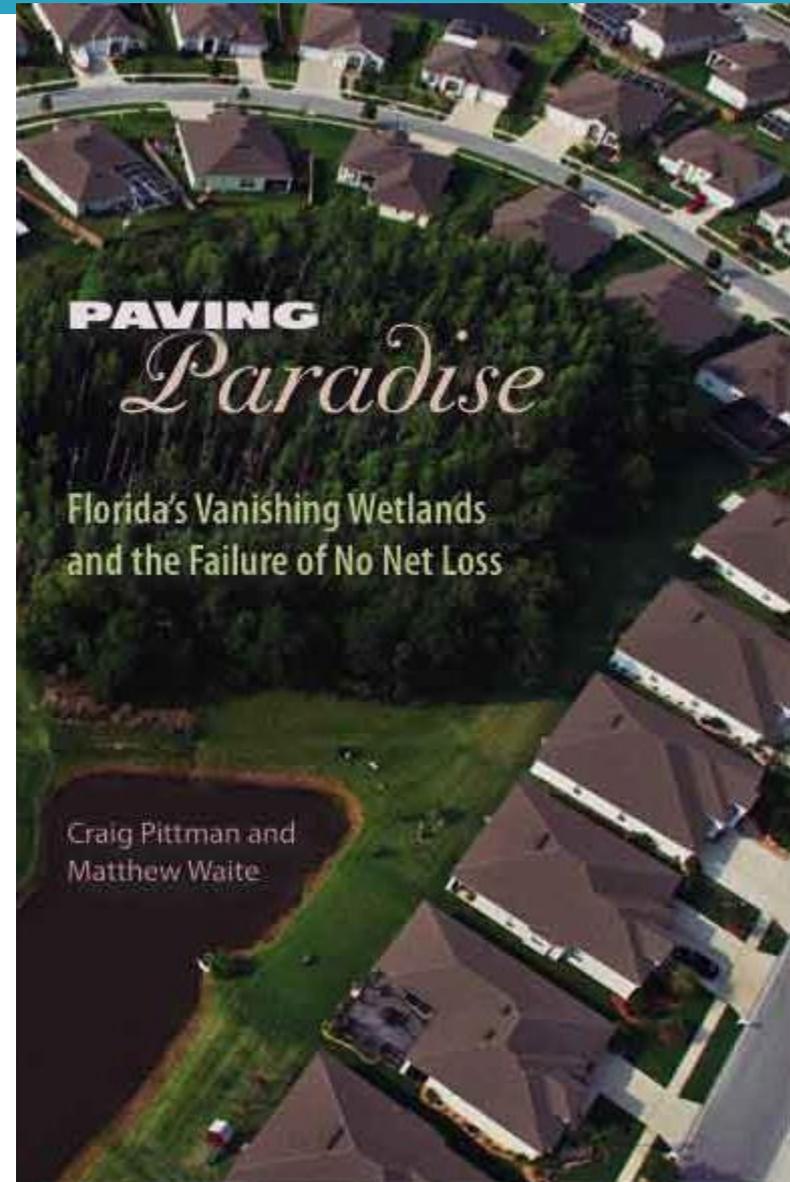
# Tampa Bay Watershed

- Urban Centers in Pinellas County & City of Tampa
  - ▣ (43% Urb / Suburb Lands)
- Agriculture / Mining Activities in Eastern Portion

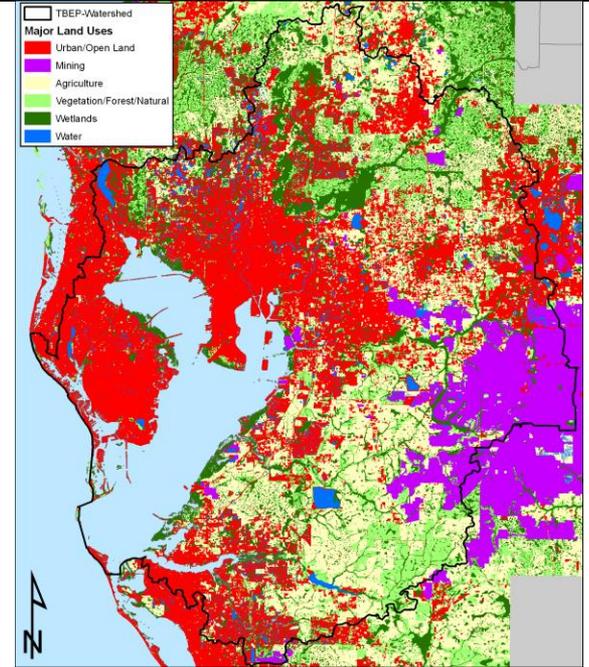


# Restoring Critical Bay Habitats a Priority

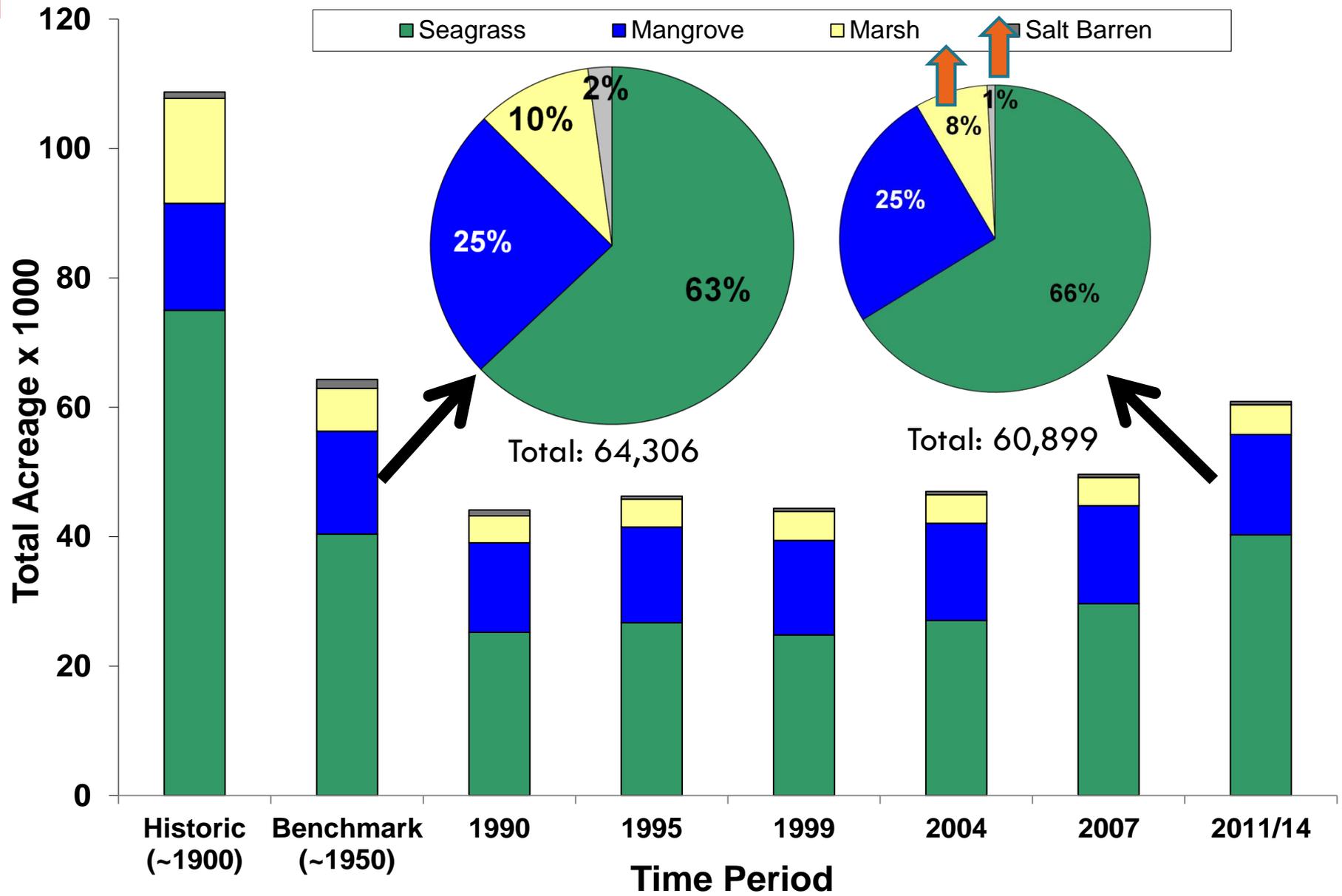
- ❑ Important Estuarine Emergent Habitats Have Been Historically Lost due to Expanding Coastal Population
- ❑ Many Coastal Habitat “Buffers” have Been Lost or Modified
- ❑ Critical Coastal Habitats:
  - ▣ Mangrove, salt marsh, salt barrens



Reality check: some areas are not restorable. But **“Restoring the Balance”** of habitat to 1950s levels may reduce “bottlenecks” for habitat-sensitive species.



# “Restoring the Balance” - Critical Coastal Habitats

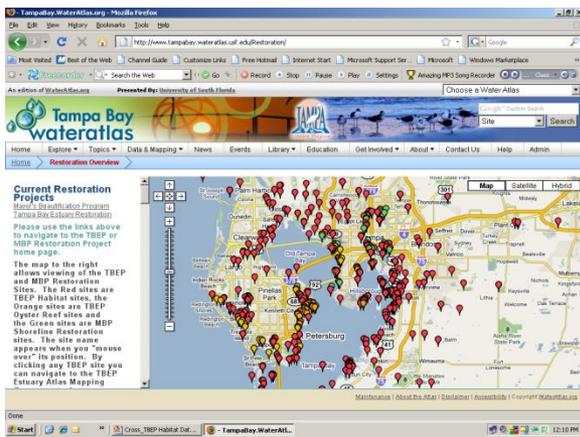
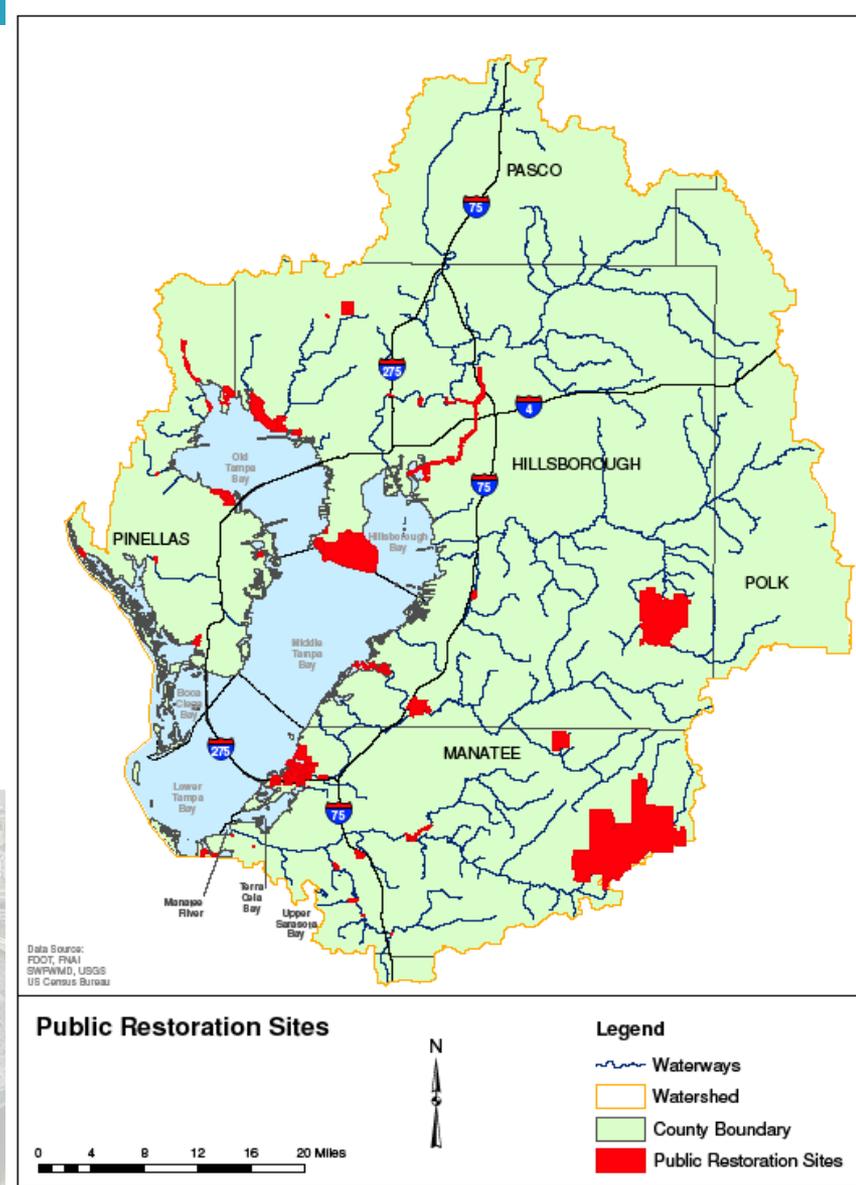


<b>Habitat Type</b>	<b>Actual Estimates</b>	<b>Restoring the Balance Calculated Acreage Goals</b>	
	<b>2011/14 Acres</b>	<b>Target Acreage</b>	<b>Habitat restoration goals</b>
Seagrass (2014)	40,295!!!	38,000	Maintain Acreages
Mangrove / Polyhaline Marsh	15,500	15,500	
Salt Marsh	4,603	6,313	<b>+1,710</b>
Salt Barren	501	1,287	<b>+786</b>

**Restoration Strategy: Increase salt marsh and salt barren acreage when ecologically appropriate. Use a habitat mosaic approach in designing restoration plans.**

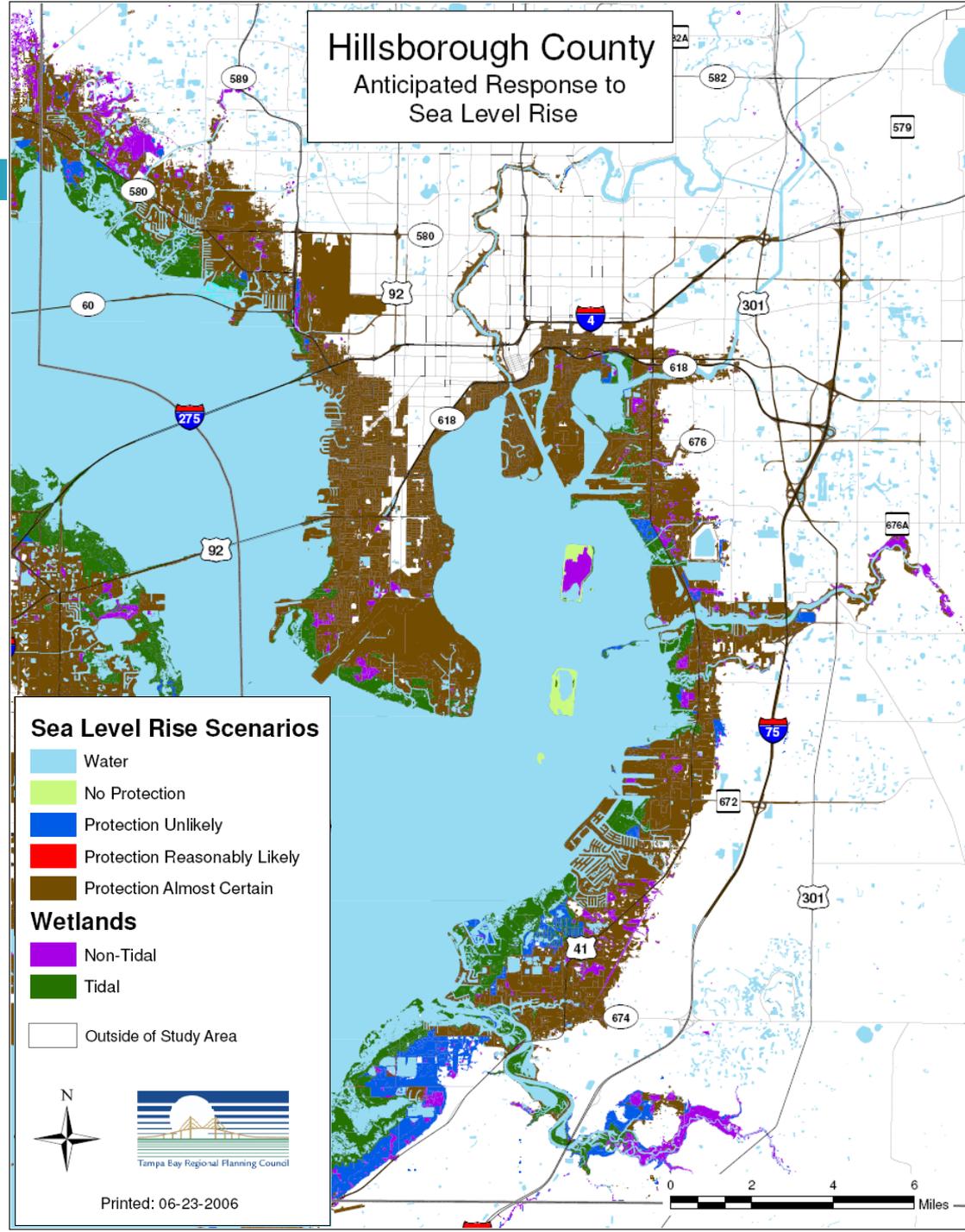
# Restoration Challenges

- ❑ Continuing Development: Focusing “Mitigation” & Restoration Opportunities Towards Targeted Areas / Habitats in the Watershed
- ❑ Limited Land Purchasing Opportunities
- ❑ Sea Level Rise & Climate Change



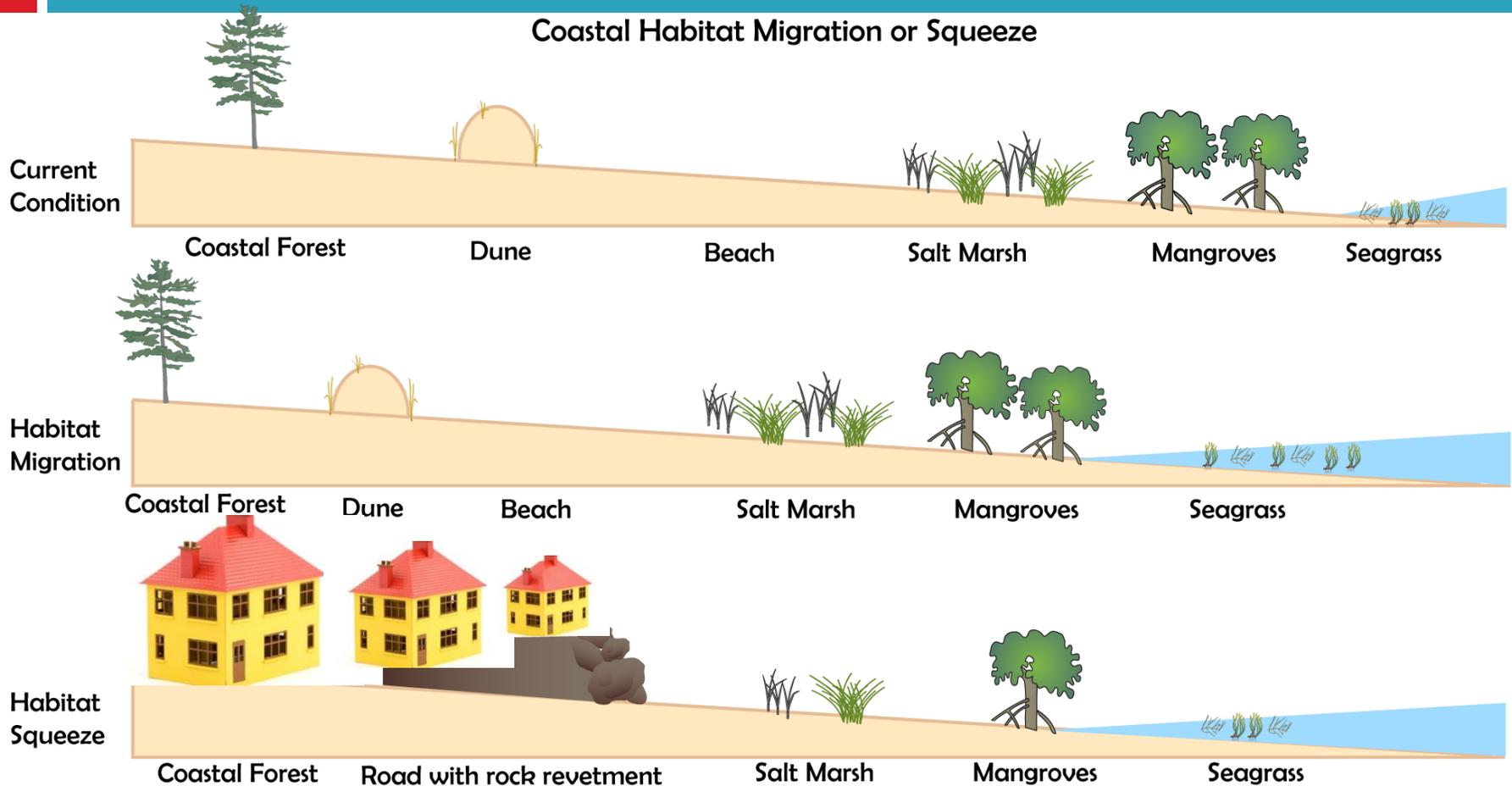
# Protecting Developed Lands Likely

- “Sea Level Rise in the Tampa Bay Region” (TBRPC 2006)
- 18% of Coastal Lands Could be Impacted
- Adaptation Strategies Include:
  - ▣ Retreat
  - ▣ Accommodate
  - ▣ **Protect (Most Likely for Tampa Bay Region)**



# Habitats May Be Squeezed from Both Directions

Coastal Habitat Migration or Squeeze



- Habitat migration or squeeze
- Changes in habitat extent expected

# Preparing for Climate Change

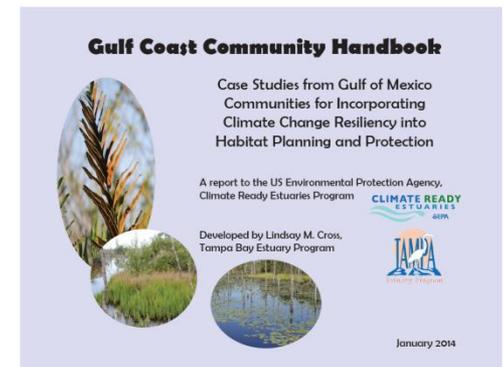
## □ 2009 – Received funding from EPA's Climate Ready Estuaries Program

- Tampa Bay Estuary Program
- Charlotte Harbor National Estuary Program
- Sarasota Bay Estuary Program
- Coastal Bend Bays & Estuaries Program
- Galveston Bay Estuary Program
- Barataria-Terrebonne National Estuary Program
- Mobile Bay National Estuary Program
- 3 NEERs



## □ Develop a Gulf Coast Handbook

- Identify adaptation strategies that incorporate resiliency to climate change as a component of habitat restoration and protection plans
- <http://www.tbep.tech.org/DATA/cre/gulfcoasthandbook.pdf>



# Step-by-Step Recommendations

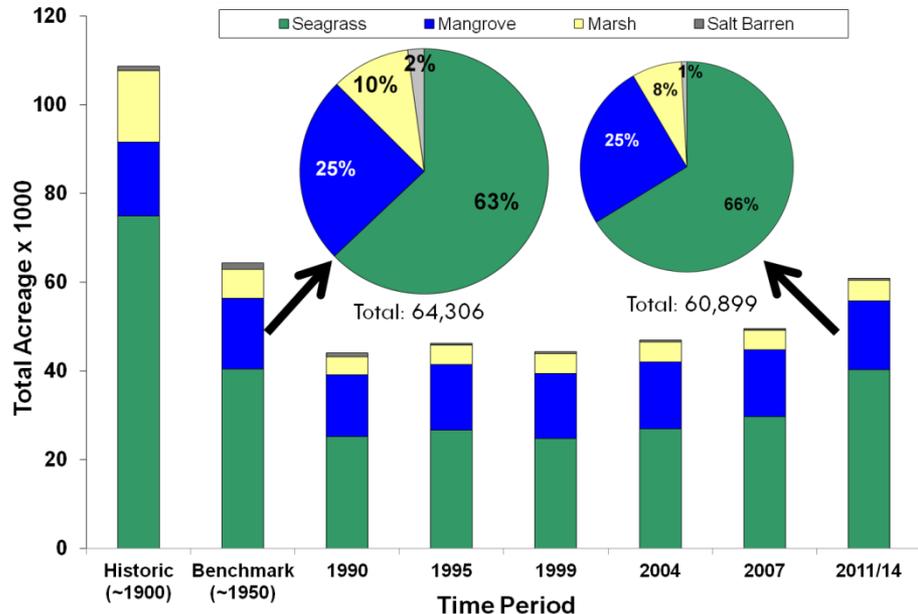
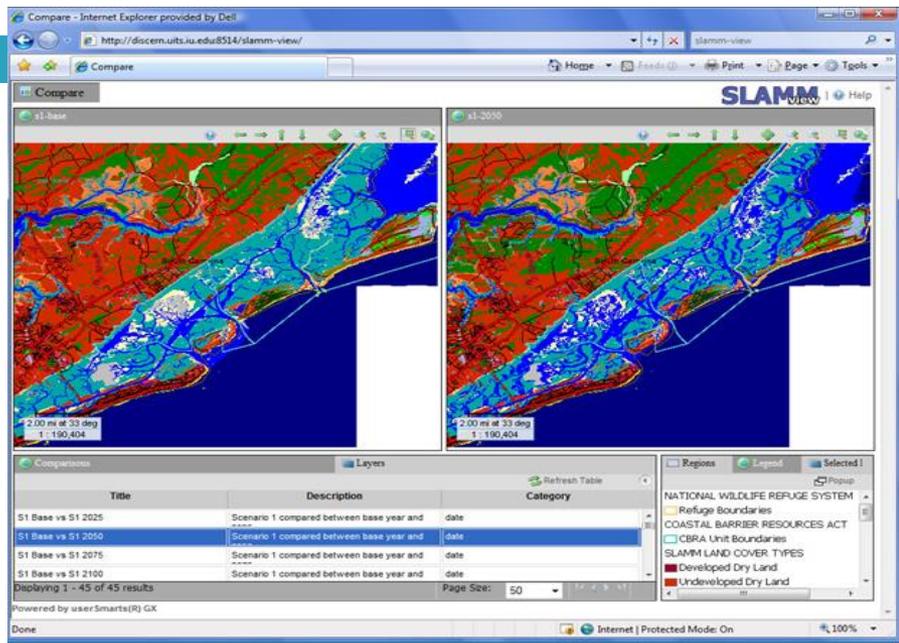
1. Assess current vulnerabilities
2. Map areas that may become inundated
3. Identify habitats for protection and preservation
4. Prioritize strategies that incorporate environmental benefits
5. Develop post-disaster recovery plans
6. Engage business community



Source: Tracy Skrabal, [rosiemade.com](http://rosiemade.com)

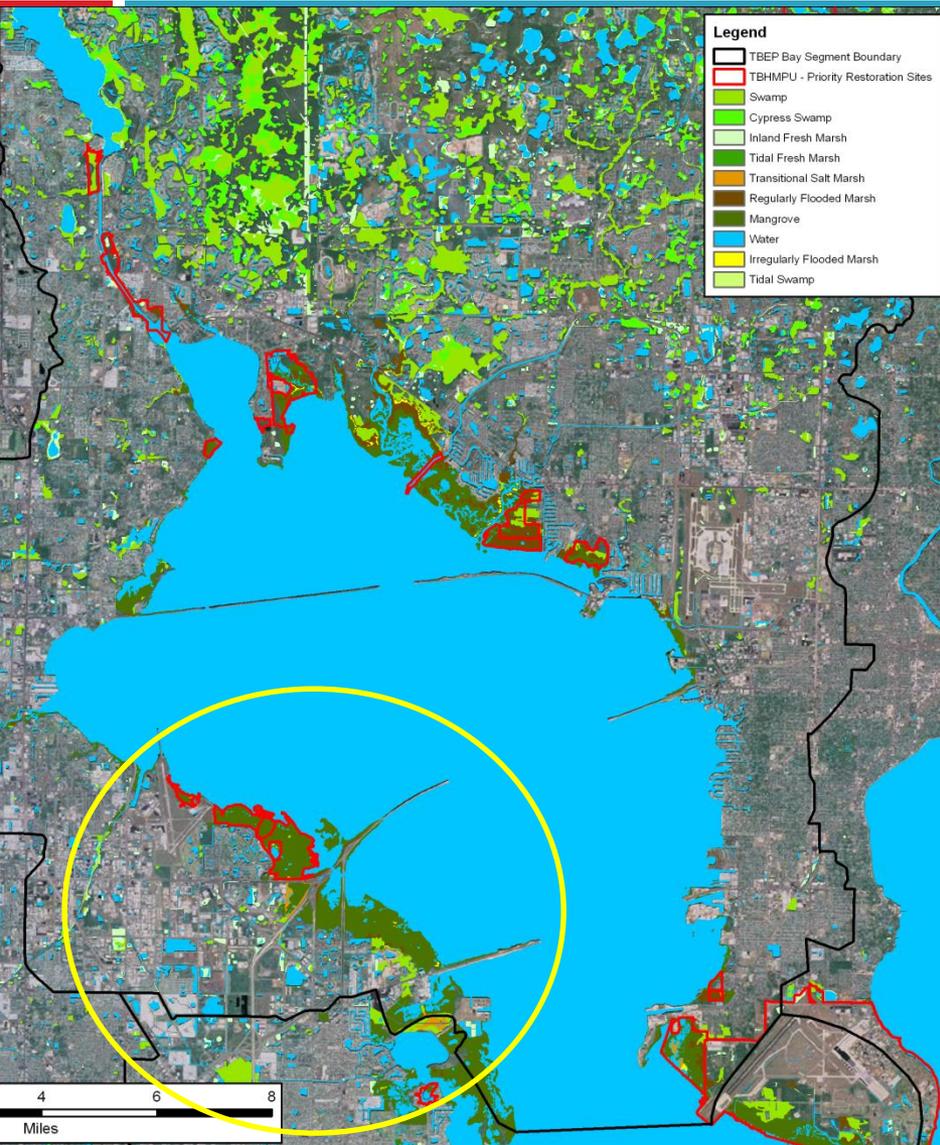
# Development of SLR Vulnerability & Future Habitat Management Tools

- Refine Tampa Bay’s Vulnerability Assessment
  - ▣ New Impact Maps (SLAMM v6)
  - ▣ Develop GIS-based Coastal Manager Toolbox
  
- Refine Acreage Estimates of Impacted Habitats
  
- Develop New “Restoring the Balance” Targets and Acquisition Strategies that Continue to Build Resiliency into Restoration Planning
  
- Disseminate to & Educate Local/Regional Planners



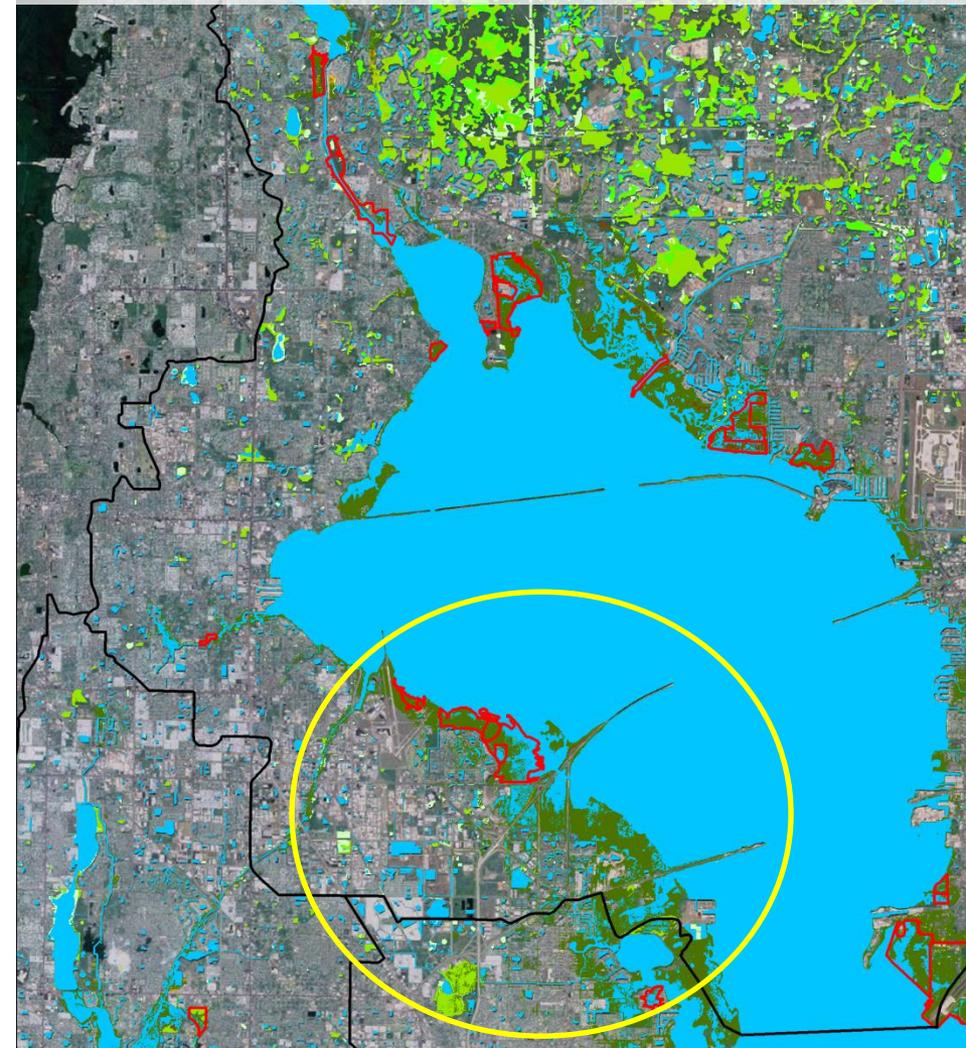
# Example of New Vulnerability Assessments

[http://www.tampabay.wateratlas.usf.edu/TB\\_SLRViewer/](http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/)



**2007**

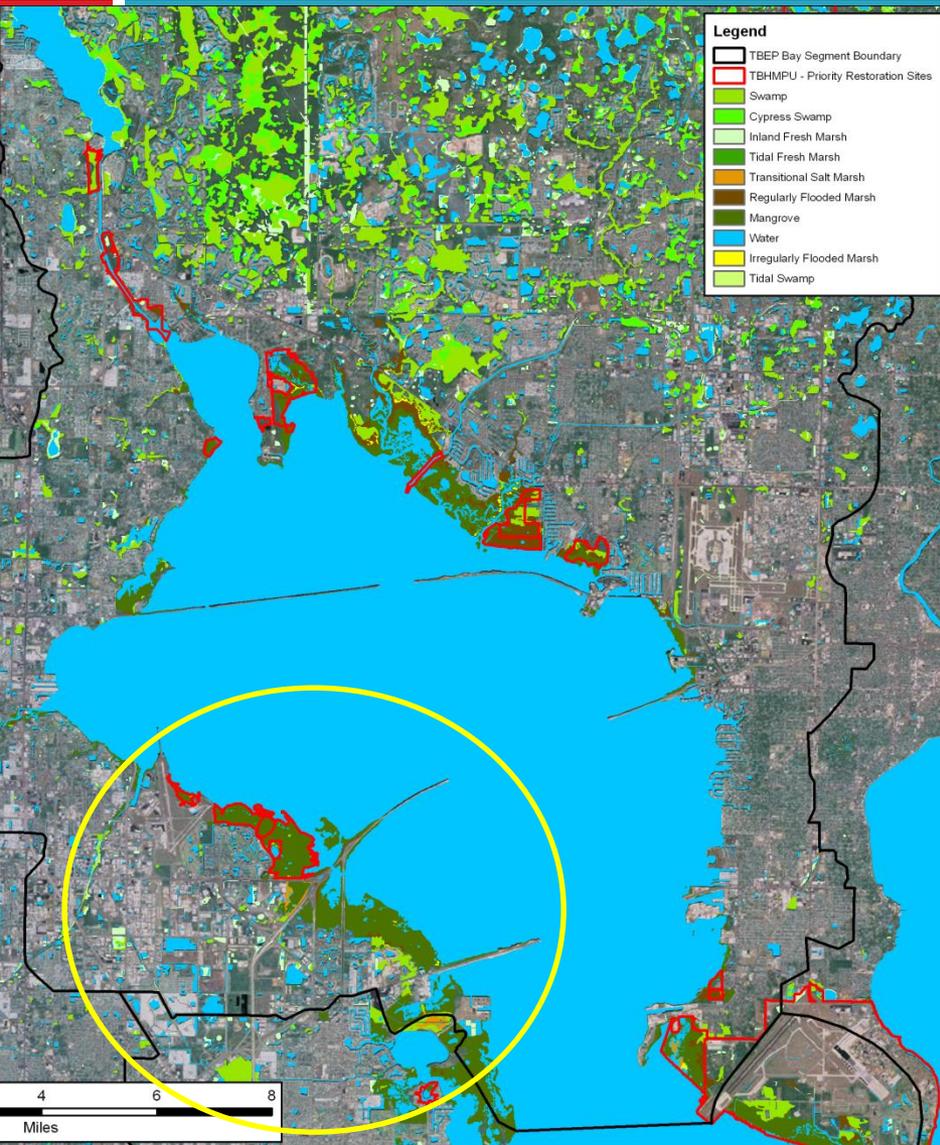
## Allowing Habitat Migration



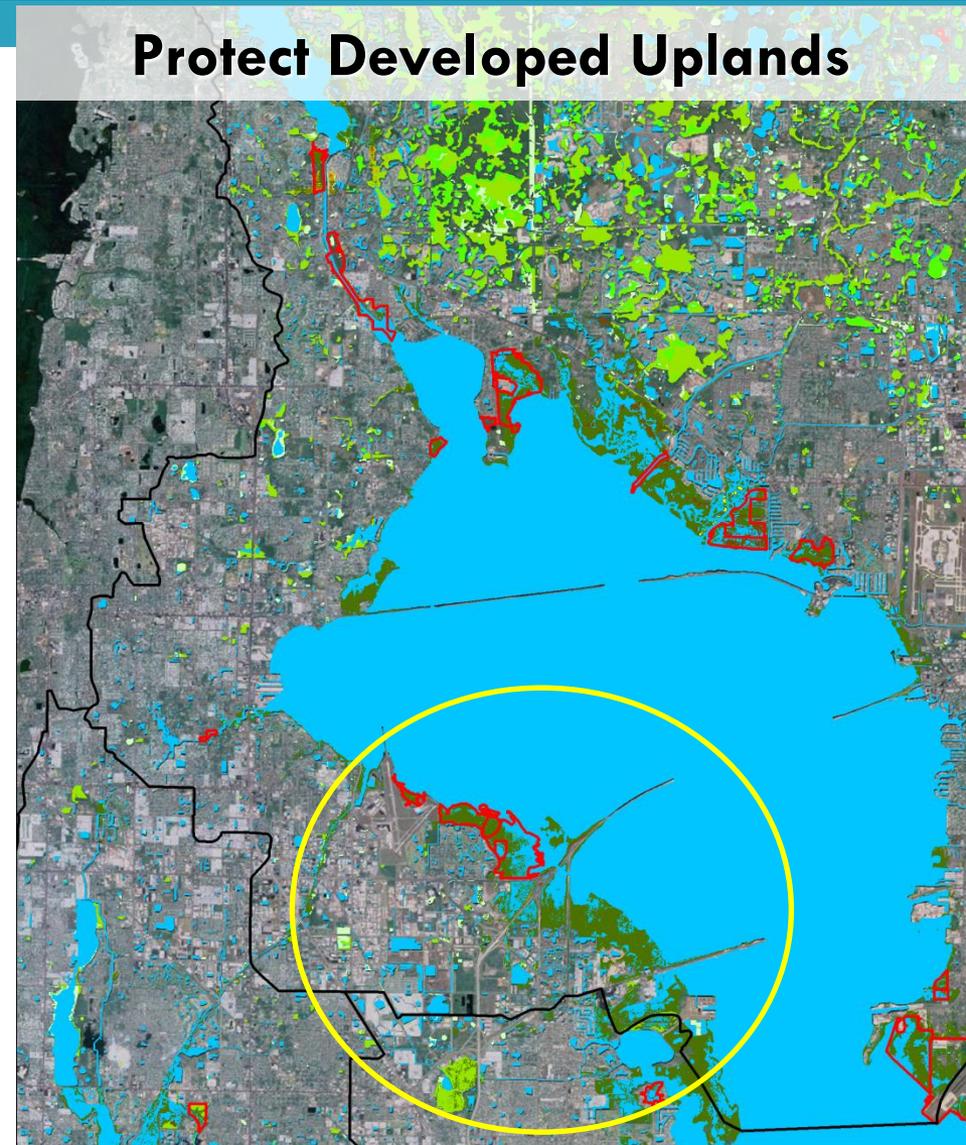
**2100 ~ 3 ft SLR**

# Example of New Vulnerability Assessments

[http://www.tampabay.wateratlas.usf.edu/TB\\_SLRViewer/](http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/)



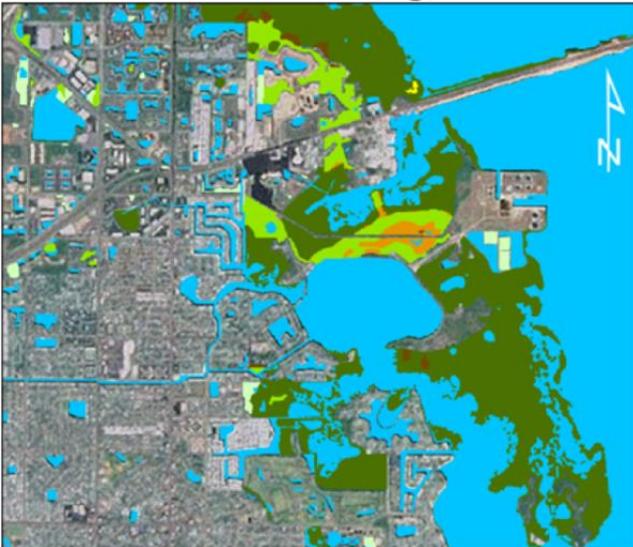
**2007**



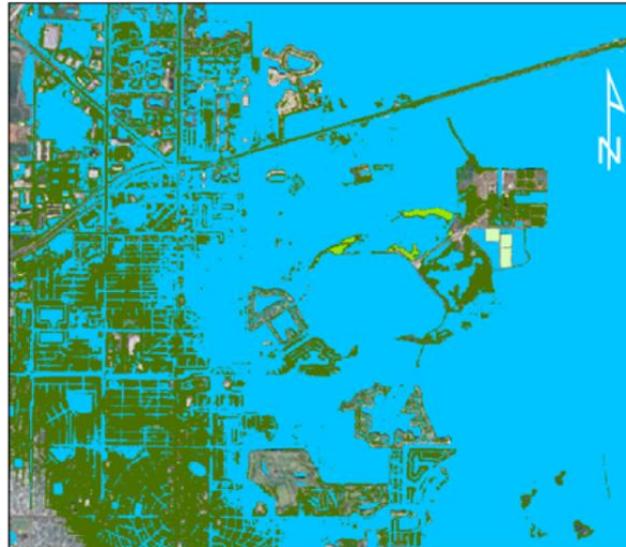
**2100 ~ 3 ft SLR**

# Marsh & Salt Barren are Highly Vulnerable

Current Condition  
St. Petersburg, FL



2 meter SLR  
Habitat Migration

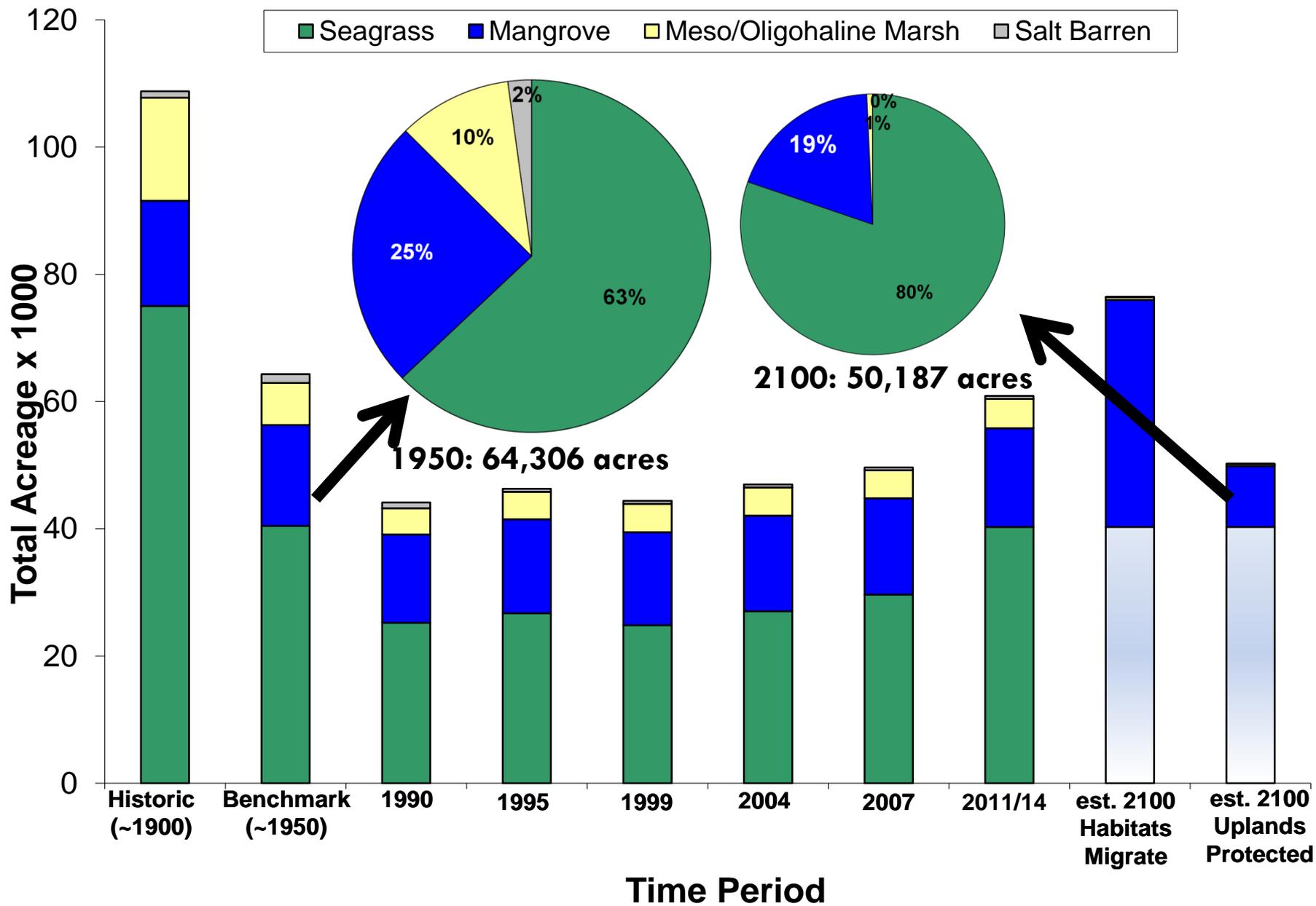


2 meter SLR  
Dry Land Protected



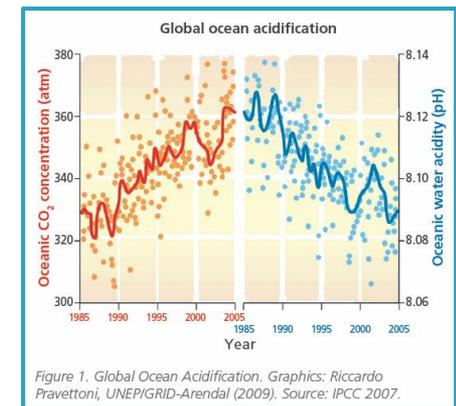
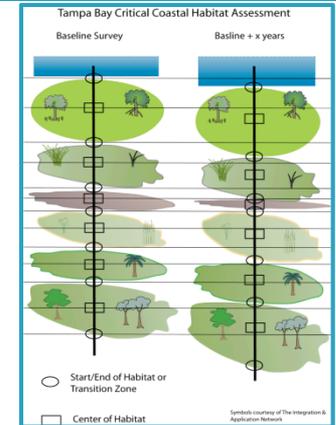
[http://www.tampabay.wateratlas.usf.edu/TB\\_SLRViewer/](http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/)

# SLAMM Estimates ~ 6 ft (2m) SLR



# Managing Coastal Habitats for the Future

- ❑ Critical Coastal Habitat Assessment:
  - ▣ Monitor the Effects of Climate Change
  
- ❑ Blue Carbon Assessment:
  - ▣ Provide Incentives to Continue Restoration Activities
  
- ❑ Ocean Acidification Monitoring:
  - ▣ Identify Benefits of Investing in the Estuary's Recovery

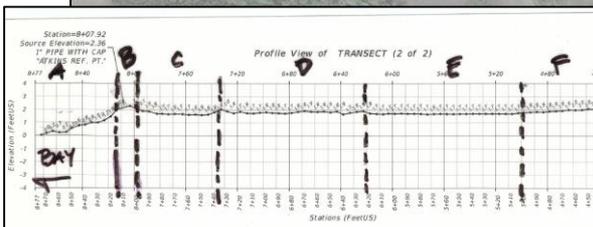
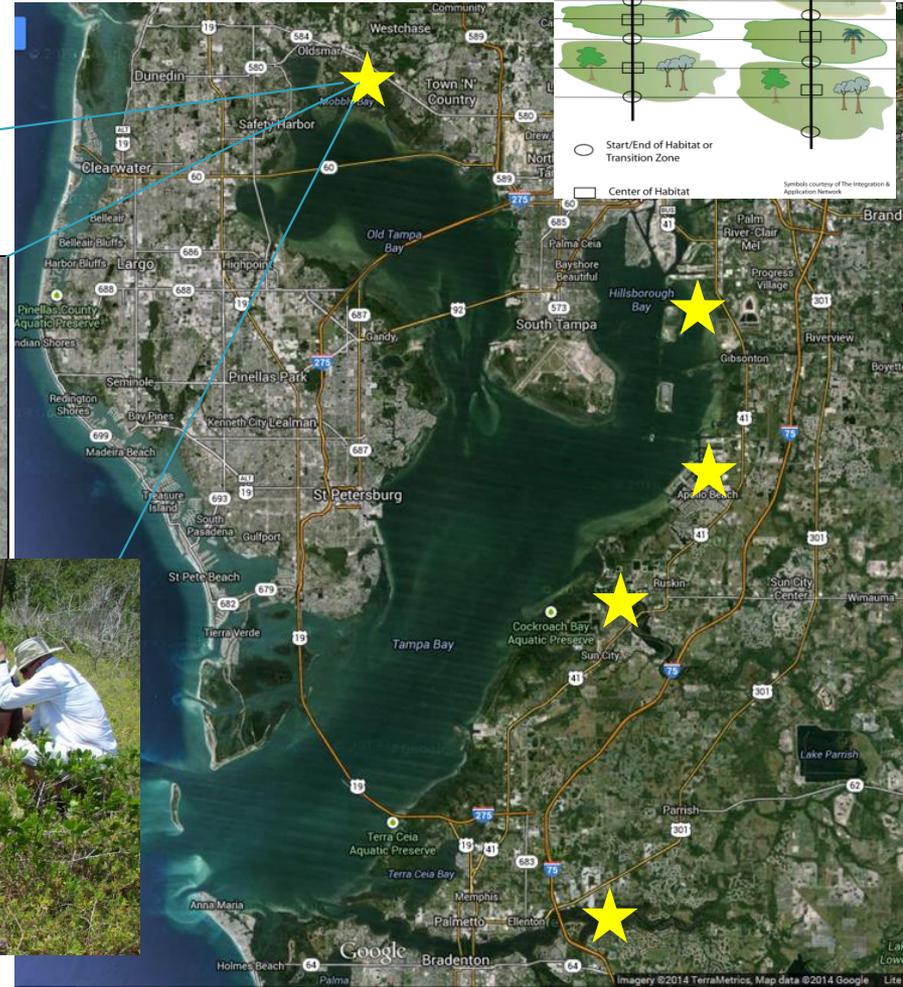
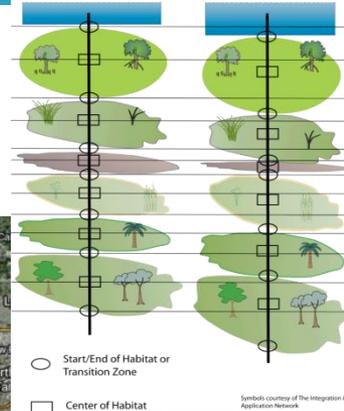


# Critical Coastal Habitat Assessment (CCHA)

- Establish permanent transects to monitor possible effects of CC / SLR into the future (100+ years)

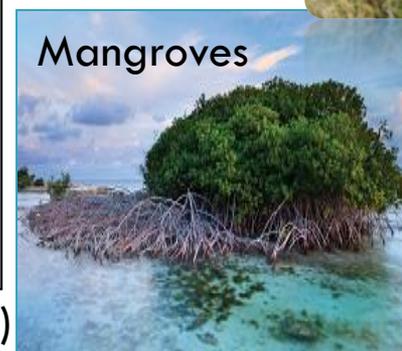
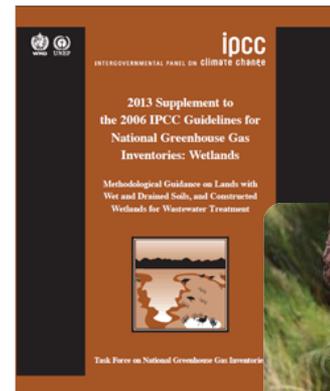
Tampa Bay Critical Coastal Habitat Assessment

Baseline Survey Baseline + x years

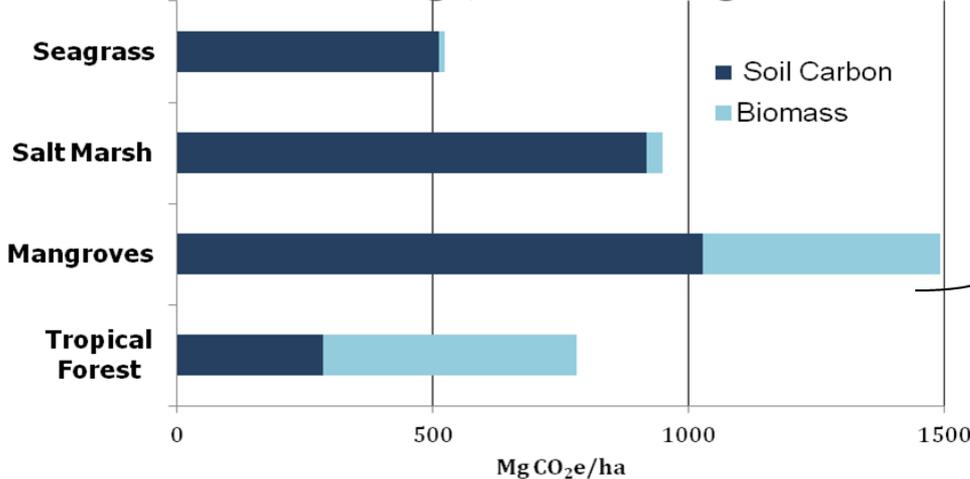


# Blue Carbon: Benefits of Habitat Restoration

- Carbon Sequestration
  - ▣ Carbon Credit Markets
  
- Provide \$\$\$ Incentive to Invest in Habitat Restoration
  
- Identify Interim Land Management Alternatives for Vulnerable Areas



Carbon Storage, Global Averages



Source: Pendleton et al. (2012) and Pan et al, (2011)



# Questions?

Ed Sherwood

Tampa Bay Estuary Program

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<http://www.tbep.org>



[Visit TBEP on Facebook](#)

**SEA LEVEL RISE VISUALIZATION TOOL**

This 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.

**GET STARTED >**

### Gulf Coast Community Handbook

Case Studies from Gulf of Mexico Communities for Incorporating Climate Change Resiliency into Habitat Planning and Protection

A report to the US Environmental Protection Agency, Climate Ready Estuaries Program

Developed by Lindsay M. Cross, Tampa Bay Estuary Program

January 2014

### Critical Coastal Habitat Vulnerability Assessment for the Tampa Bay Estuary: Projected Changes to Habitats due to Sea Level Rise and Climate Change

Ed Sherwood & Holly Greening  
Tampa Bay Estuary Program  
265 1st Ave. South  
St. Petersburg, FL 33701  
(727)899-2765

Climate Ready Estuaries Program  
EPA

Prepared in support of a grant for EPA's Climate Ready Estuaries Program

### ENVIRONMENTAL MANAGEMENT

Volume 33 • Number 2 February 2014

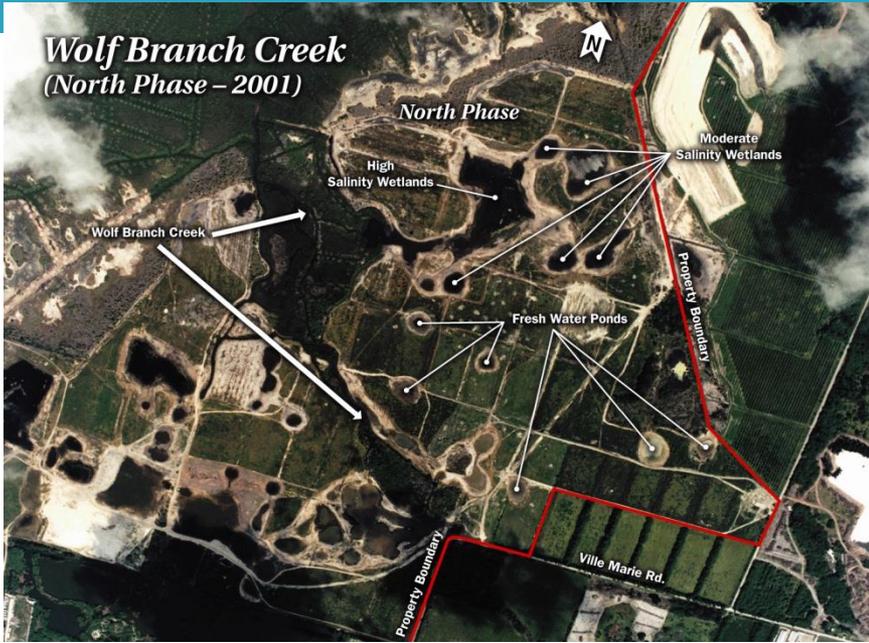
Springer

[http://www.tbep.tech.org/TBEP\\_TECH\\_PUBS/2012/TBEP\\_03\\_12\\_Updated\\_Vulnerability\\_Assessment\\_082012.pdf](http://www.tbep.tech.org/TBEP_TECH_PUBS/2012/TBEP_03_12_Updated_Vulnerability_Assessment_082012.pdf)



# Coastal Habitat Resiliency Strategies

- ❑ Purchase & Preserve!!!
- ❑ Creating Funding Mechanisms (Penny for Pinellas, Pasco, etc.)
- ❑ Watershed-Based Restoration (Public-Private Partnerships!!)
- ❑ Create Habitat Mosaics with Restoration
- ❑ Ensure Functionality in Restoration
- ❑ Learning from & Adapting Restoration Design Concepts



**From the sun-dappled corridors of the upper Hillsborough River to Cypress Point Park in the booming Westshore district to the wide-open expanse of Cockroach Bay, Hillsborough County's award-winning land preservation program has acquired 44,700 acres (6.5% of all land in Hillsborough County) that provide wildlife habitat, protect drinking water supplies and improve water quality.**

**Voters will be asked to continue to protect that legacy on Nov. 4 with a referendum to renew the Environmental Lands Acquisition and Protection Program (ELAPP). While some of the most important lands already have been purchased, ELAPP's citizens advisory committee has already identified another 44,000 acres that should be preserved.**

EARLY VOTING STARTS OCTOBER 20

VOTE YES

☑

☑

☑

OFFICIAL BALLOT LANGUAGE

TO CONTINUE FINANCING ENVIRONMENTAL LANDS ACQUISITION AND PROTECTION PROGRAM (ELAPP) TO PRESERVE ENVIRONMENTALLY SENSITIVE LANDS

Shall Hillsborough County continue ELAPP to acquire and preserve environmentally sensitive lands which protect wildlife habitat, natural areas, drinking water sources, and the water quality of rivers, lakes and bays by issuing general obligation bonds in one or more series, at interest rates not exceeding the legal maximum, maturing in not more than 30 years from issuance, not exceeding \$200 million aggregate principal amount, payable from ad valorem taxes, without limitation, to finance related capital projects?

**Preserve Hillsborough**  
11705 Boyette Rd.  
PMB 148  
Riverview, FL 33569

ELAPP

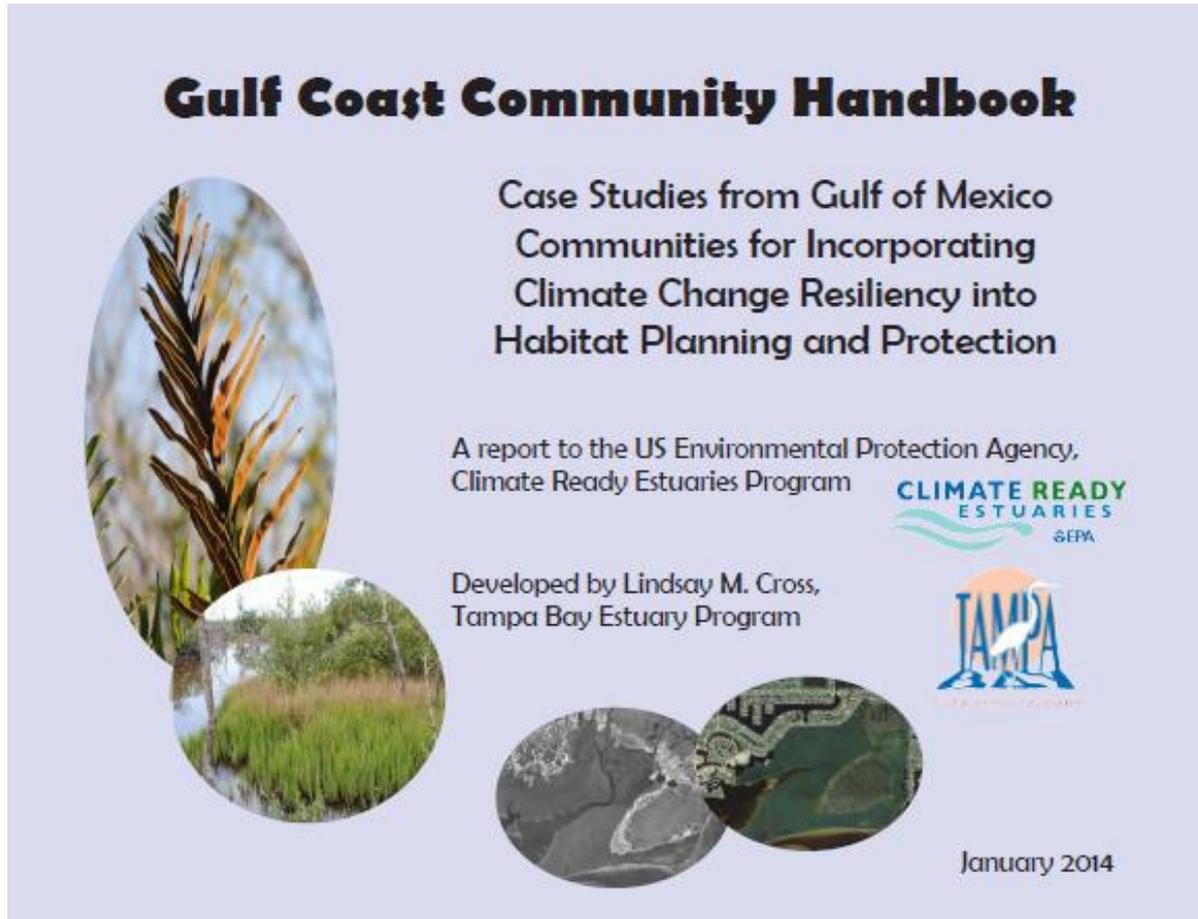
Vote YES  
to Continue the  
Environmental  
Lands  
Acquisition &  
Protection  
Program.

Preserve environmentally sensitive lands.

preservehillsborough.org

H.C. Flyer 09/2008

# Gulf of Mexico Examples



TBEP worked with local partners & the Gulf management community to develop regional approaches for incorporating resiliency into habitat restoration strategies throughout the Gulf of Mexico

<http://www.tbep.tech.org/DATA/cre/gulfcoasthandbook.pdf>

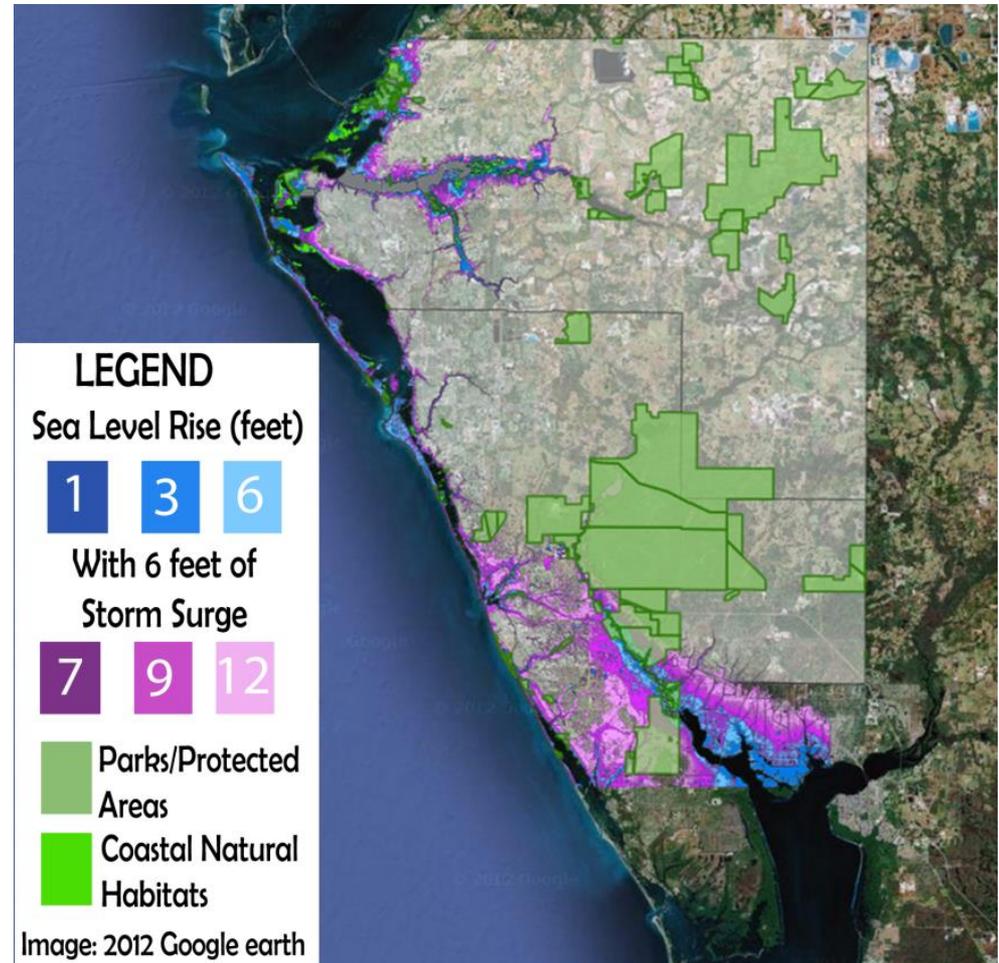
# Visualizing Sea level rise in Sarasota Bay: Sarasota Bay Estuary Program



- Web-based sea level rise visualization tool



- 3 sea level rise and 3 (additive) storm height scenarios
- Overlays for conservation areas and drainages



Source: SBEP

# Habitat creation at North Lido Park, FL: Sarasota Bay Estuary Program



- ❑ Mosaic of wetland habitats, including a new tidal channel with connection to Sarasota Bay
- ❑ Fill material used to create rolling dunes
- ❑ Restoration tested during tropical storm Debby

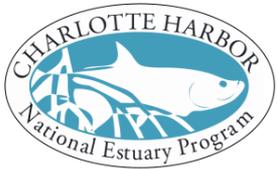


Source: Jay Leverone, Sara Kane

# Adaptation plan for Punta Gorda, FL: Charlotte Harbor NEP



- Extensive community-based effort
- Vulnerability, Adaptation and Acceptability Games
- Suite of strategies for adaptation, protection, planned relocation and accommodation through 2200



Source: Lisa Beever

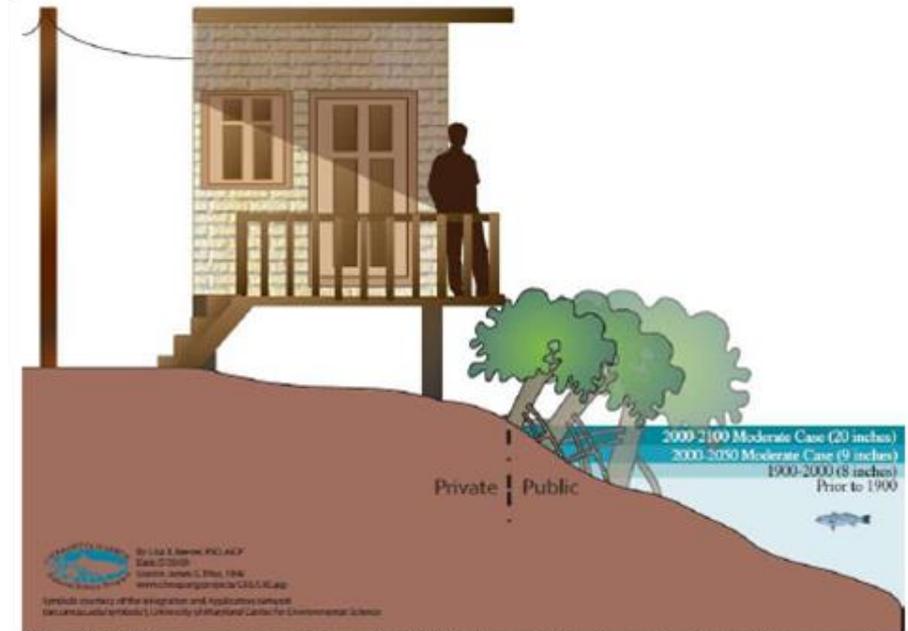
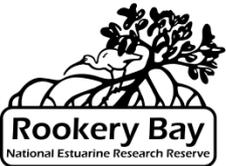


Figure 81: Rolling easement step 3 Year 2100. Moderate case 20 inches sea level rise. Mangroves and marsh move inland. Former mangroves become inundated.

# Effects of Everglades restoration on sharks in Rookery Bay, FL: Rookery Bay NERR



- Restoration in Everglades will improve distribution of freshwater
- Sharks indicate healthy salinity regimes



Source: RBNERR, US Army  
Corps of Engineers

# Coastal habitat mosaics, Schultz Preserve, FL:

## Tampa Bay Estuary Program

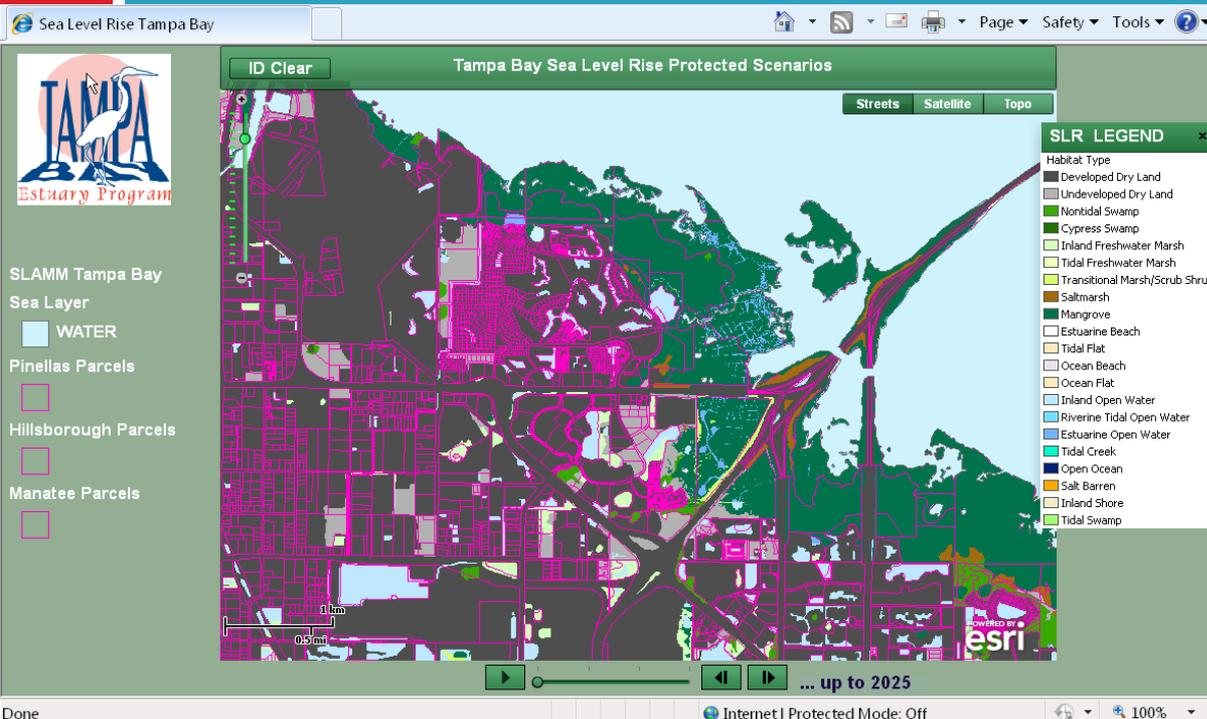


- ❑ Upland, spoil-created peninsula restored to braided tidal creek system
- ❑ 120 acres of subtidal, marsh and coastal uplands
- ❑ Tidal emergent wetlands can migrate upslope



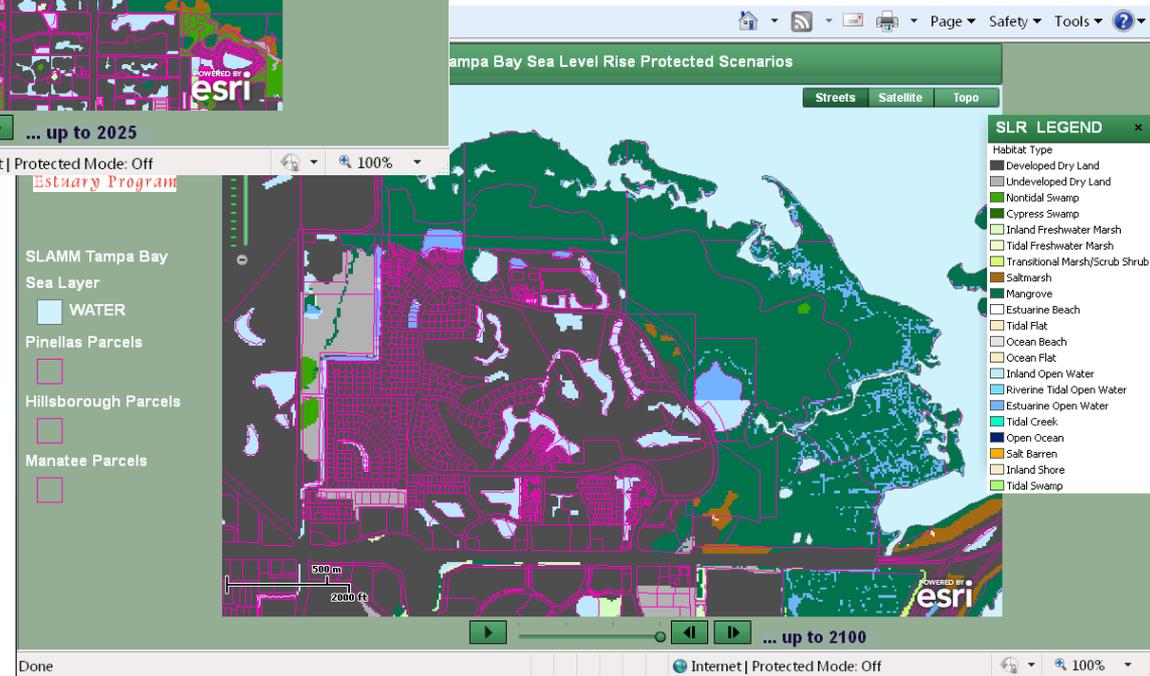
# Website Management Tool Developed

[http://www.tampabay.wateratlas.usf.edu/TB\\_SLRViewer/](http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/)



- Land Use Planners & Managers
- Restoration & Site Acquisition

- Parcel-level calculations
- Anticipated changes in habitats



# Potential Strategies

- Continue to incorporate **RESILIENCY** into restoration designs and construction (**habitat mosaics**)
- **Establish Refugia** areas for some habitat types particularly susceptible to sea level rise (e.g., salt barrens)
- Policy Level – Local Land Use Zoning
  - Rolling Easements
  - Development visioning
  - Still a work in progress



Pt. Redwing



# Needed Future

## Assessment Actions

- Better understand distribution and extent of key transitional habitats (**low-salinity marshes**)
- Evaluate functional effectiveness of restored areas
- Develop automated remote sensing techniques for rapid assessments
- Establish **long-term monitoring programs** to determine ecological and functional changes in critical coastal habitats (**Started 2014-15**)



# Some Ideas For You ...

- ❑ King Tide Travelling Photo Exhibit (Dates still available for 2015)
- ❑ Increase public awareness regarding TB's coastal flooding risks and potential impacts on the Bay
- ❑ <http://www.flickr.com/photos/62725999@N04/>

