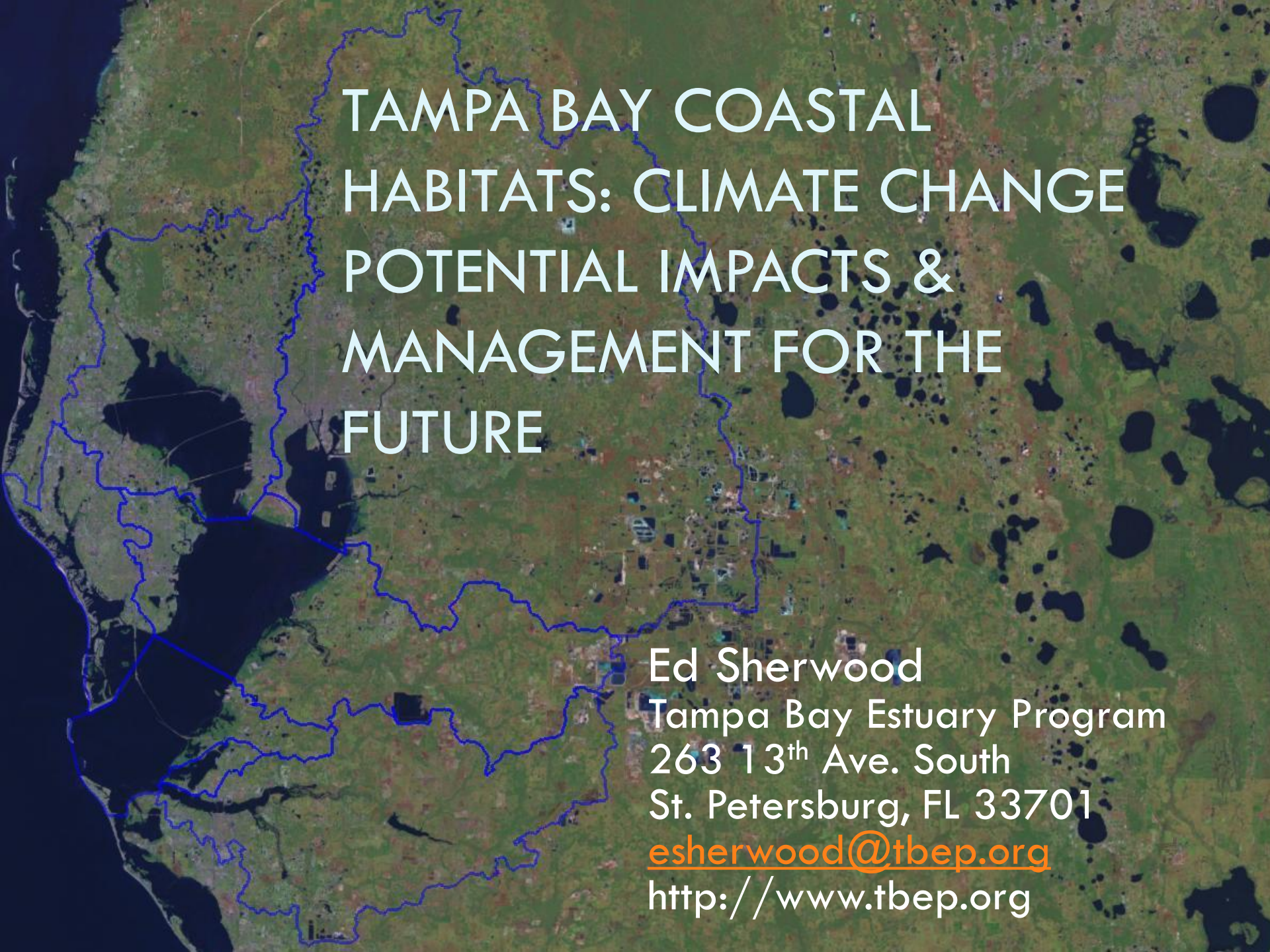

TAMPA BAY COASTAL HABITATS: CLIMATE CHANGE POTENTIAL IMPACTS & MANAGEMENT FOR THE FUTURE

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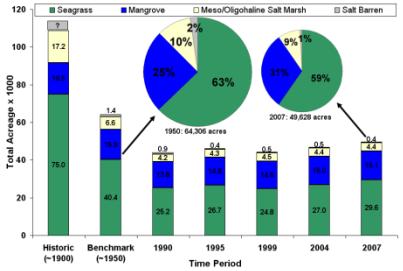
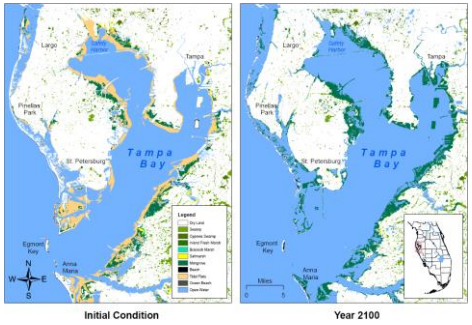
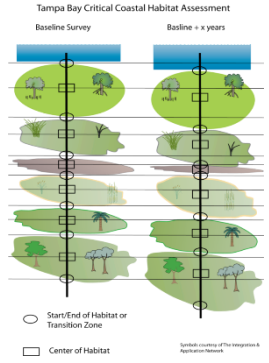
Overview

- 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

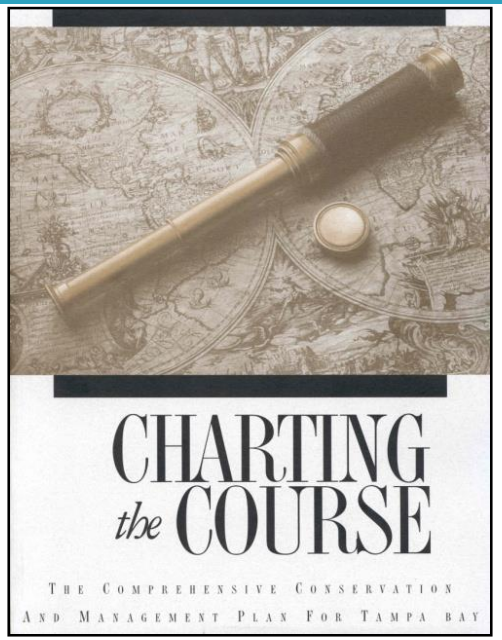


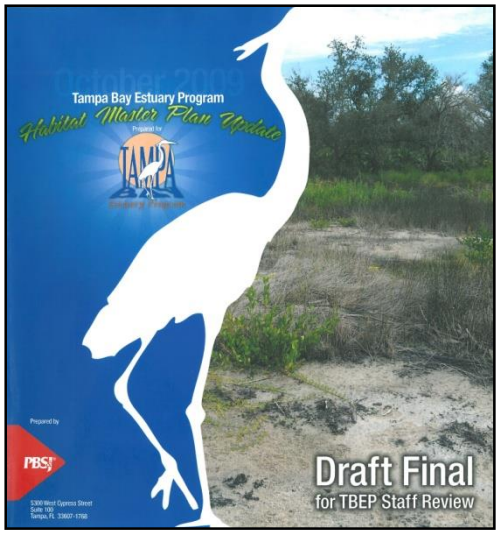




Tampa Bay Estuary Program: Comprehensive Conservation & Management Plan (CCMP)

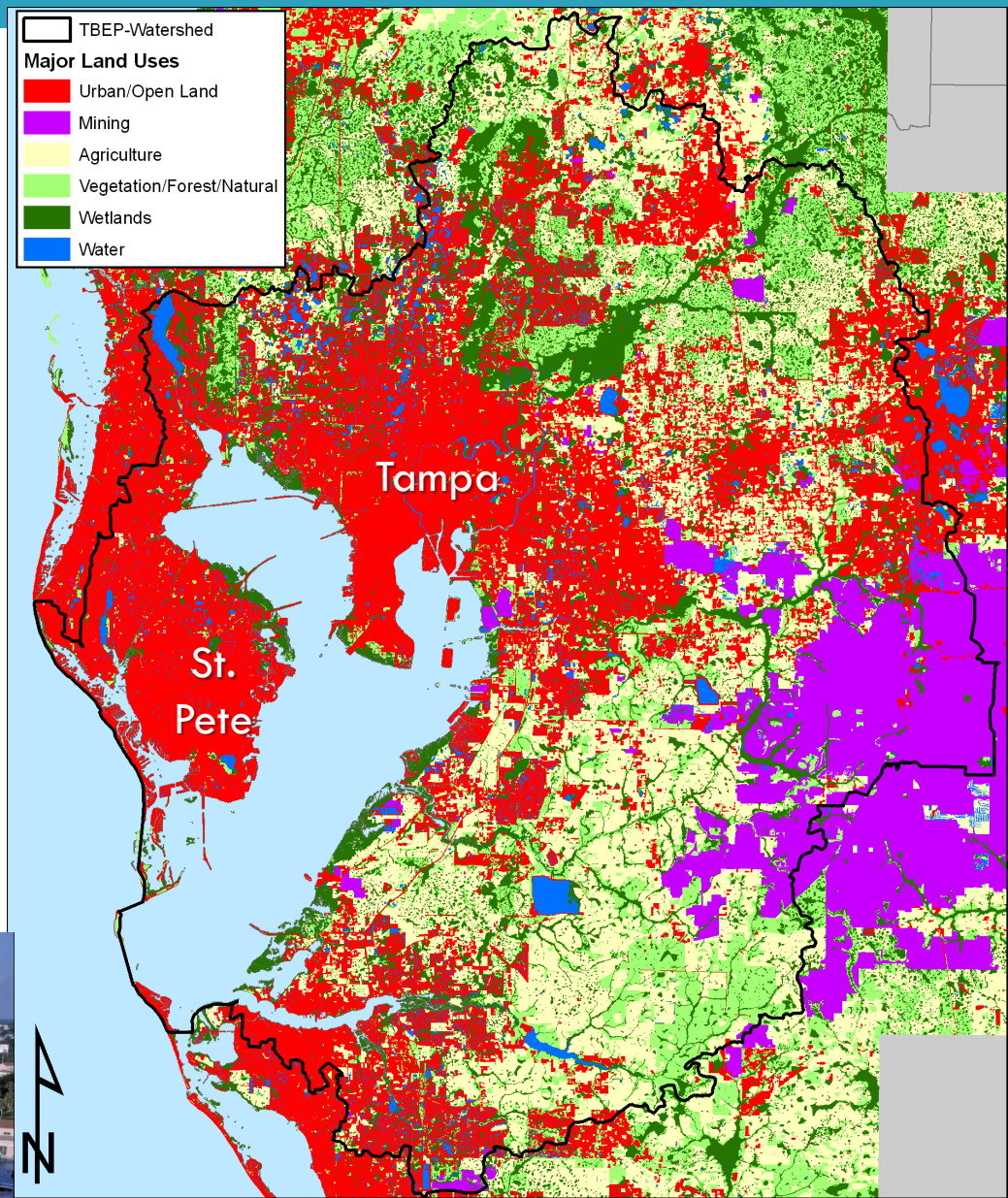
- 1996 – Tampa Bay Master Plan adopted by TBEP partners
- 2006 – 1st CCMP Update
  - 42 actions
  - 2010 Updated Habitat Master Plan Developed
- 2016 – Next Anticipated Update
  - Climate Change Effects Need to be Considered w/ regards to New Goals & Actions





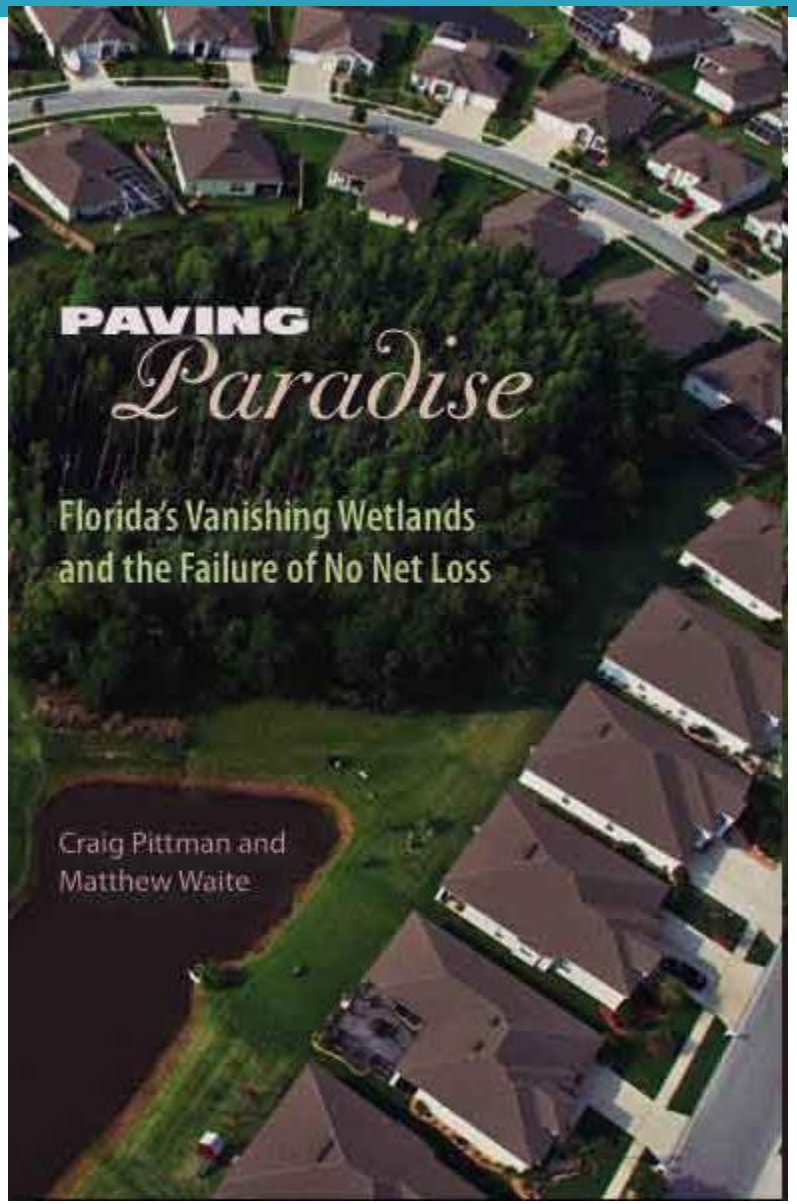
Tampa Bay Watershed

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

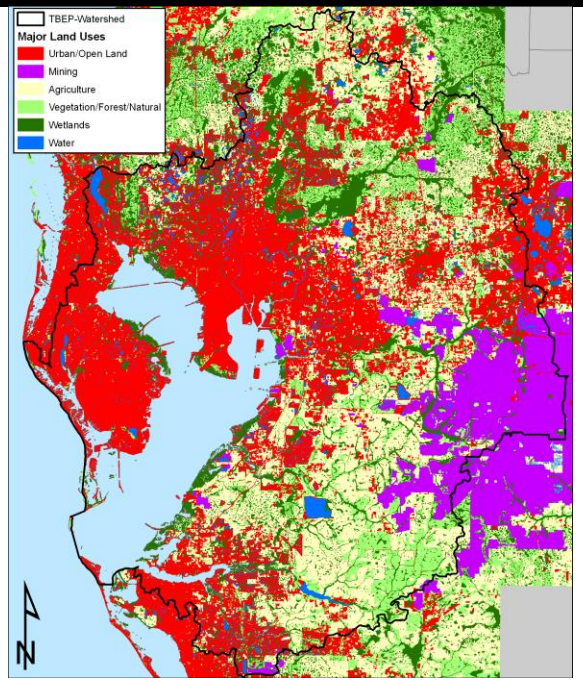


Restoring Critical Bay Habitats a Priority

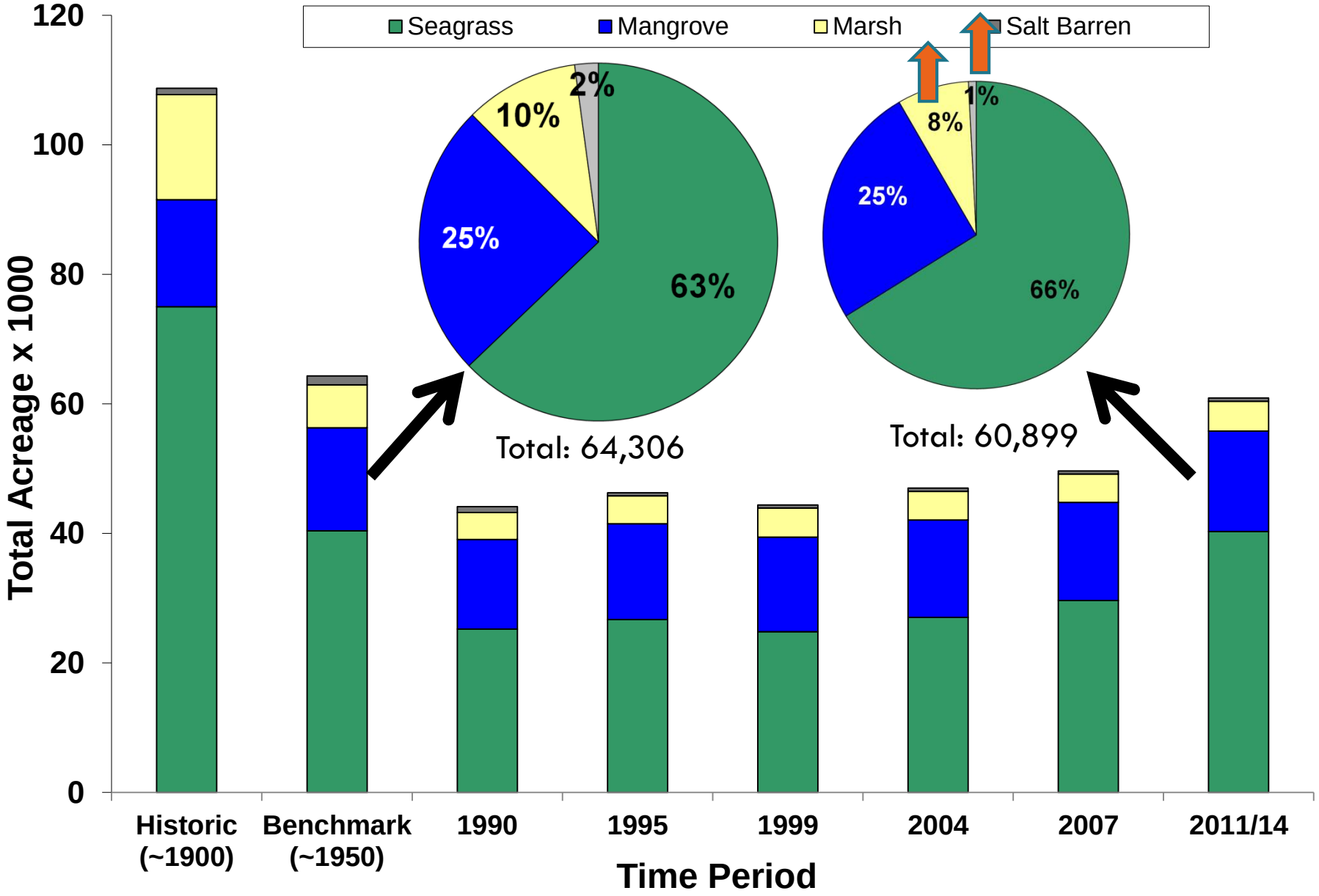
- Important Estuarine Emergent Habitats Have Been Historically Lost due to Expanding Coastal Population
- Many Coastal Habitat "Buffers" have Been Lost or Modified
- Critical Coastal Habitats:
  - Mangrove, salt marsh, salt barrens



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

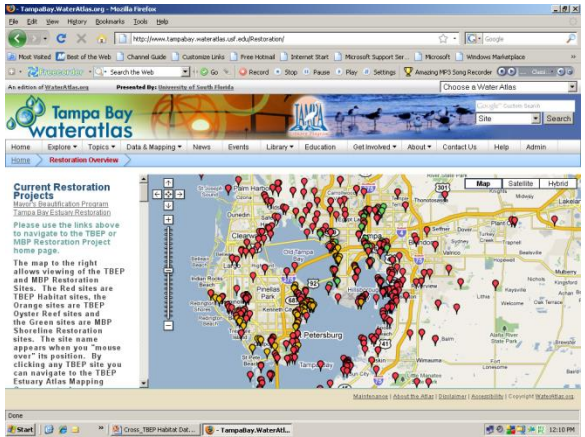


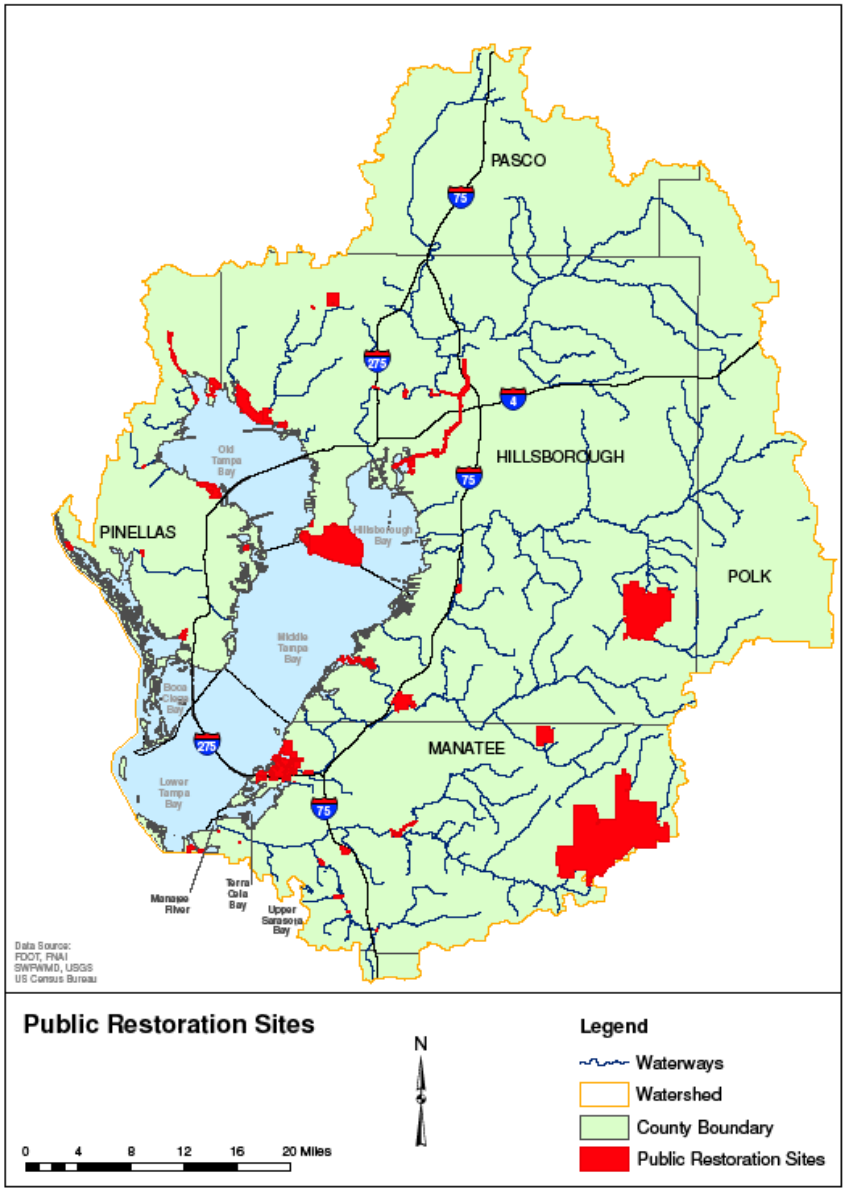
Habitat Type	Actual Estimates	Restoring the Balance Calculated Acreage Goals	
	2011/14 Acres	Target Acreage	Habitat restoration goals
Seagrass (2014)	40,295!!!	38,000	Maintain Acreages
Mangrove / Polyhaline Marsh	15,500	15,500	
Salt Marsh	4,603	6,313	+1,710
Salt Barren	501	1,287	+786

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

Restoration Challenges

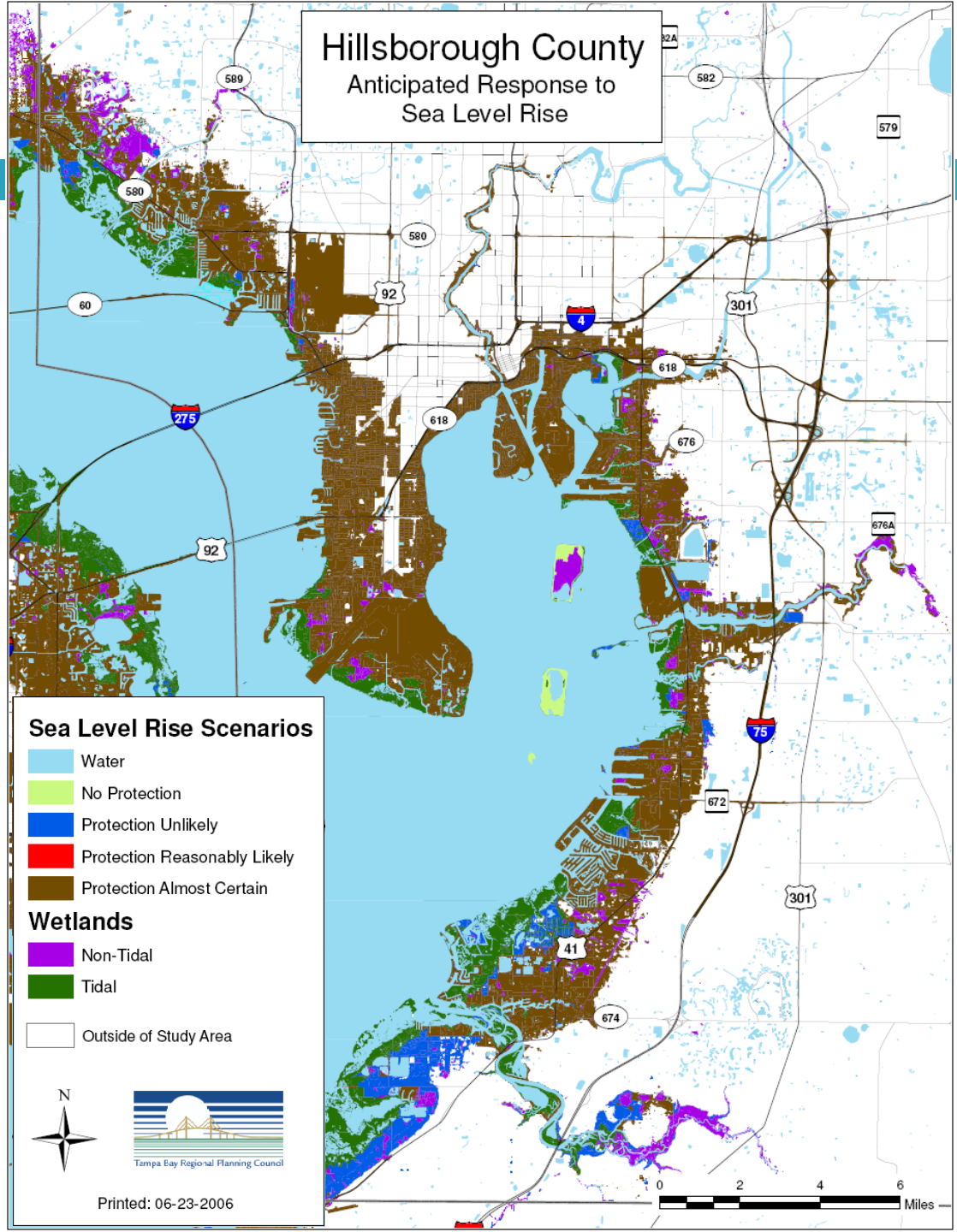
- Continuing Development: Focusing "Mitigation" & Restoration Opportunities Towards Targeted Areas / Habitats in the Watershed
- Limited Land Purchasing Opportunities
- **Sea Level Rise & Climate Change**



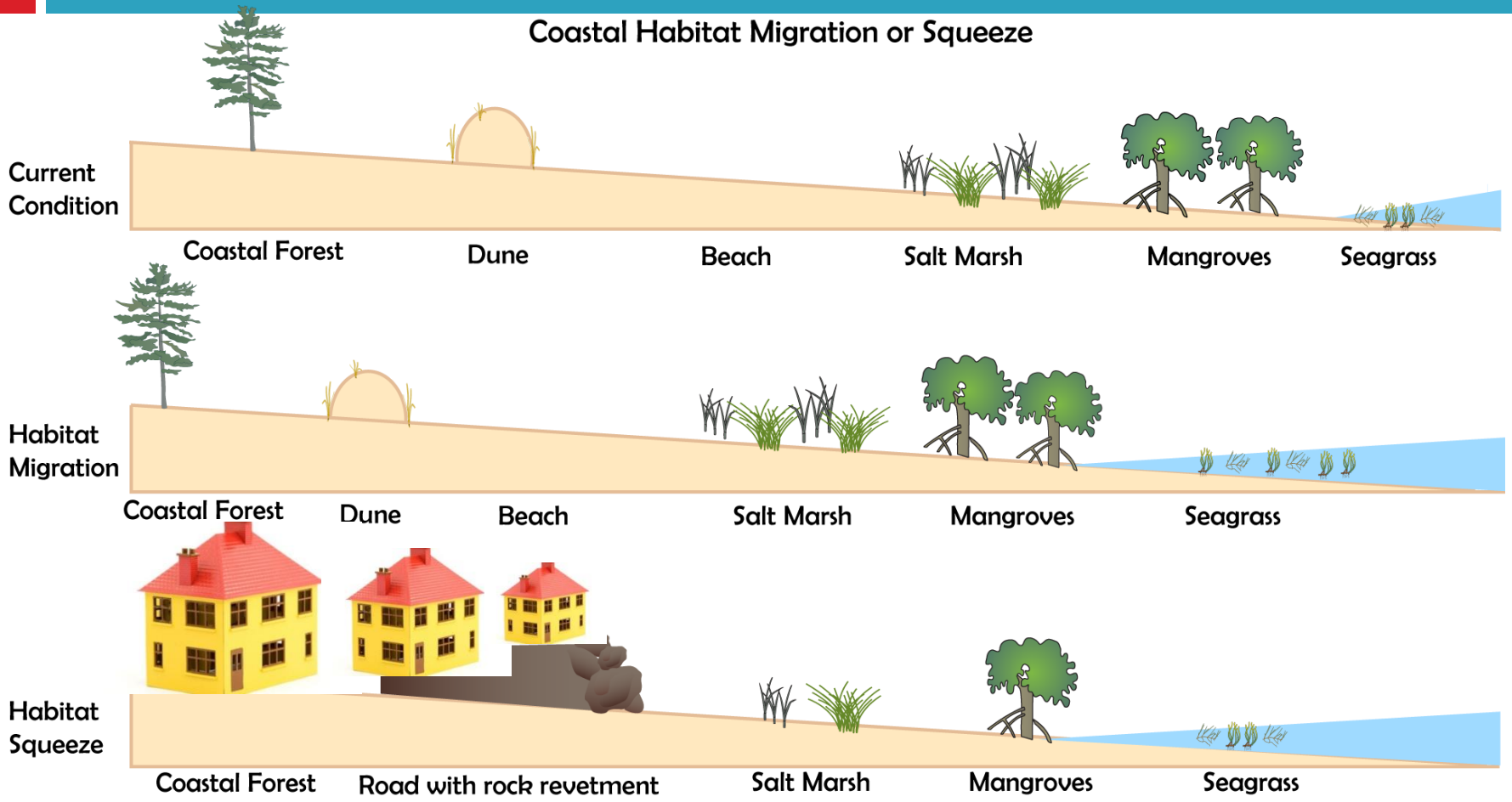


Protecting Developed Lands Likely

- "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

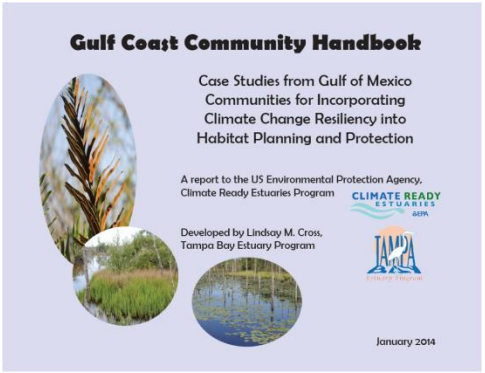


- Habitat migration or squeeze
- Changes in habitat extent expected

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.tbeptech.org/DATA/cre/gulfcoasthandbook.pdf



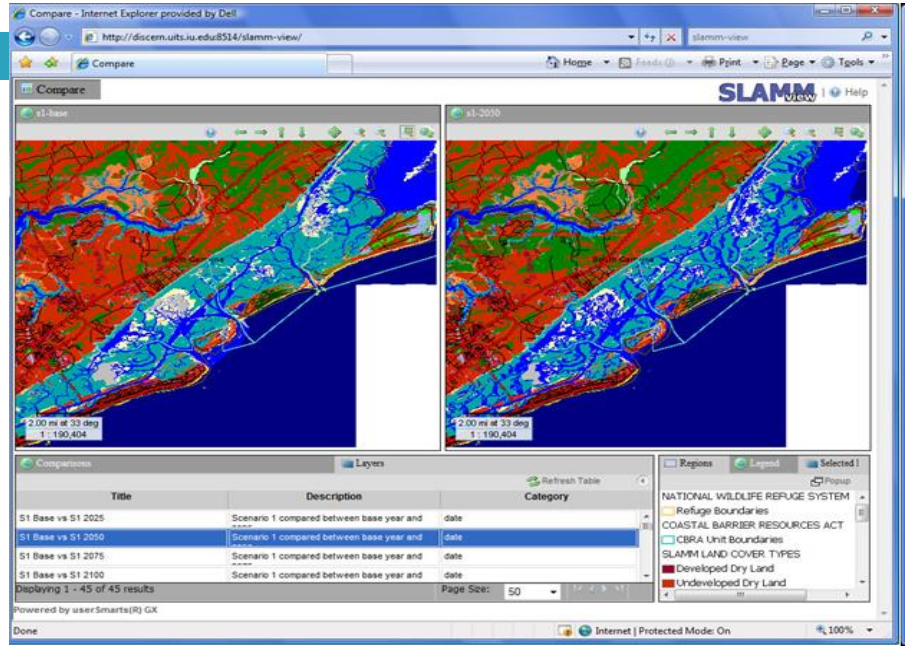
Step-by-Step Recommendations

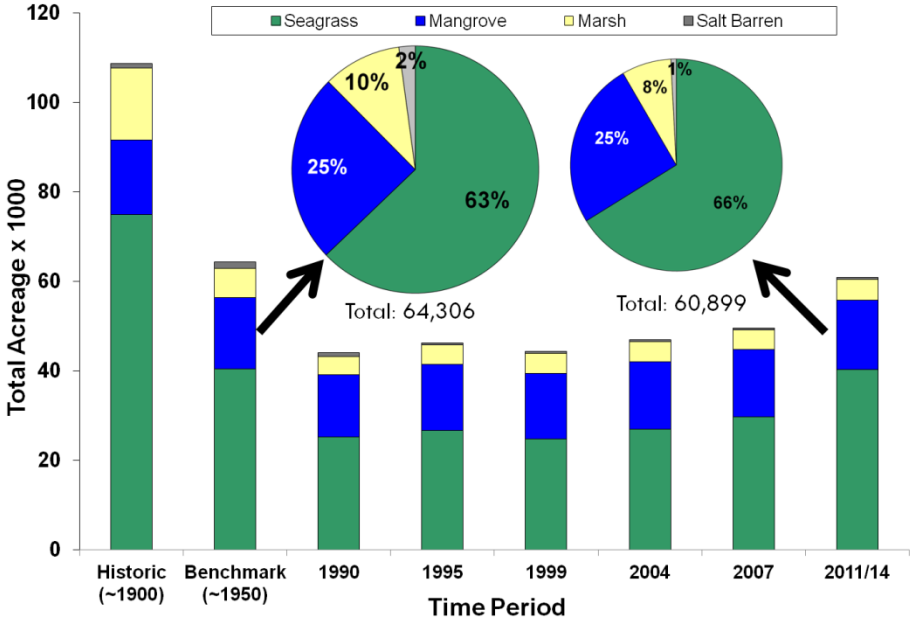
1. Assess current vulnerabilities
2. Map areas that may become inundated
3. Identify habitats for protection and preservation
4. Prioritize strategies that incorporate environmental benefits
5. Develop post-disaster recovery plans
6. Engage business community

Source: Tracy Skrabal, rosiemade.com

Development of SLR Vulnerability & Future Habitat Management Tools

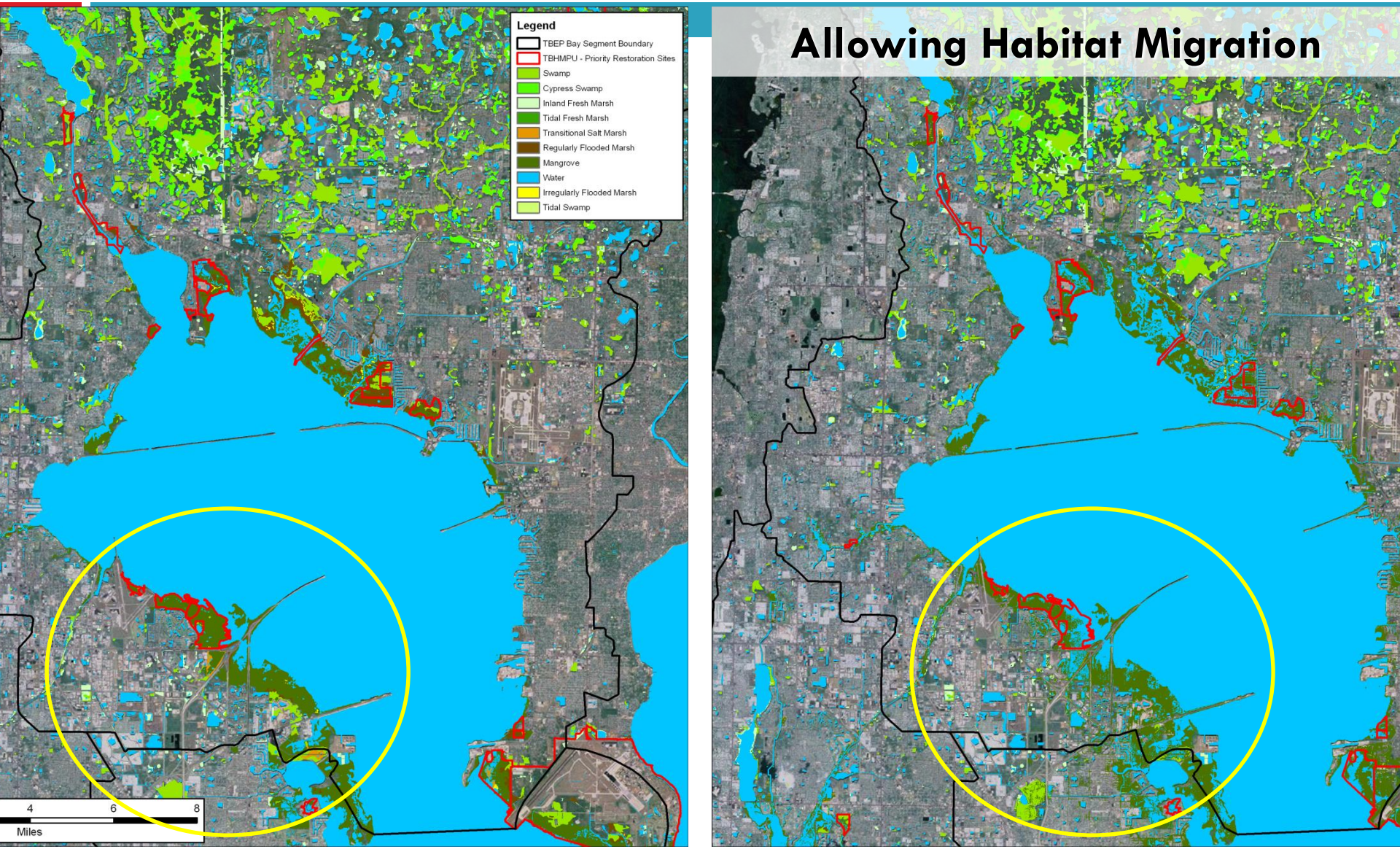
- Refine Tampa Bay's Vulnerability Assessment
  - New Impact Maps (SLAMM v6)
  - Develop GIS-based Coastal Manager Toolbox
- Refine Acreage Estimates of Impacted Habitats
- Develop New "Restoring the Balance" Targets and Acquisition Strategies that Continue to Build Resiliency into Restoration Planning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





Example of New Vulnerability Assessments

http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/



2007

2100 ~ 3 ft SLR

Example of New Vulnerability Assessments

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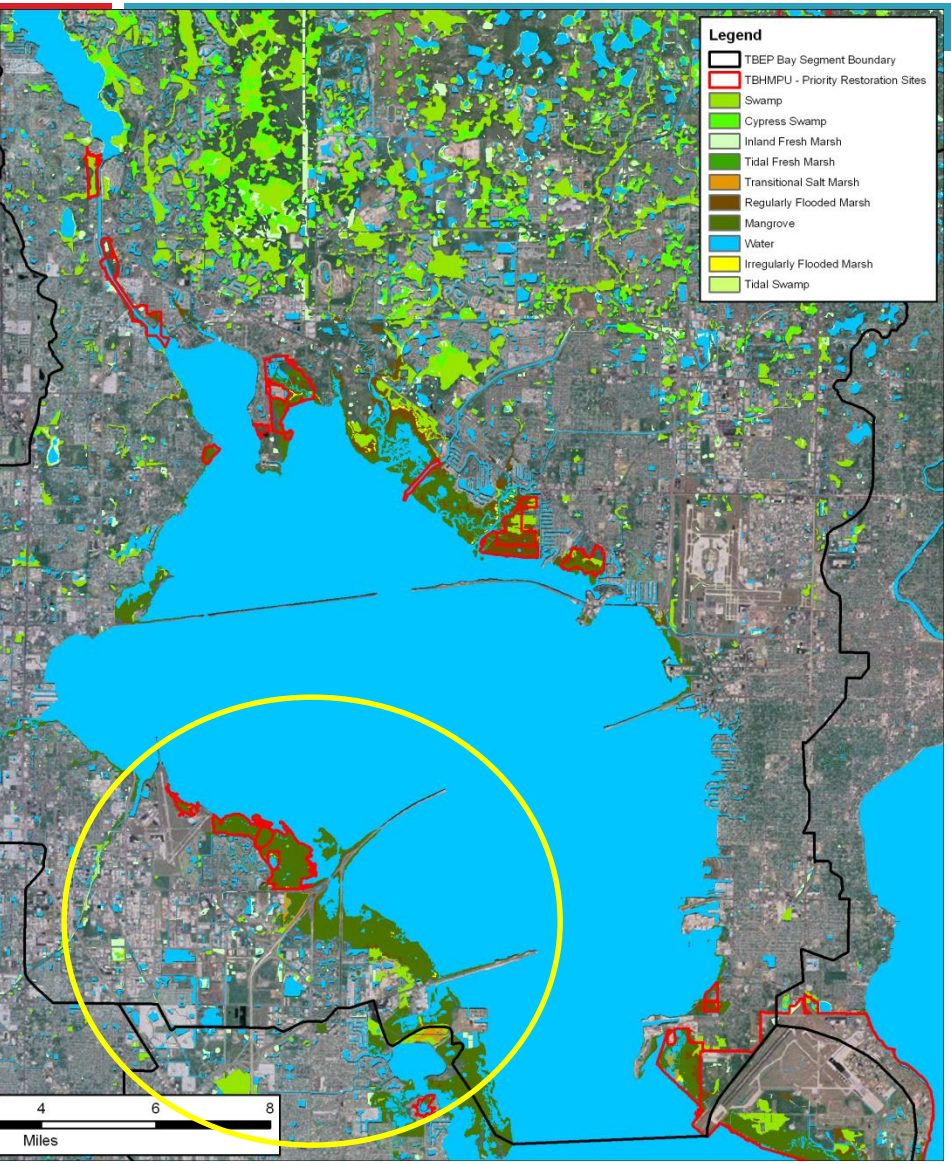
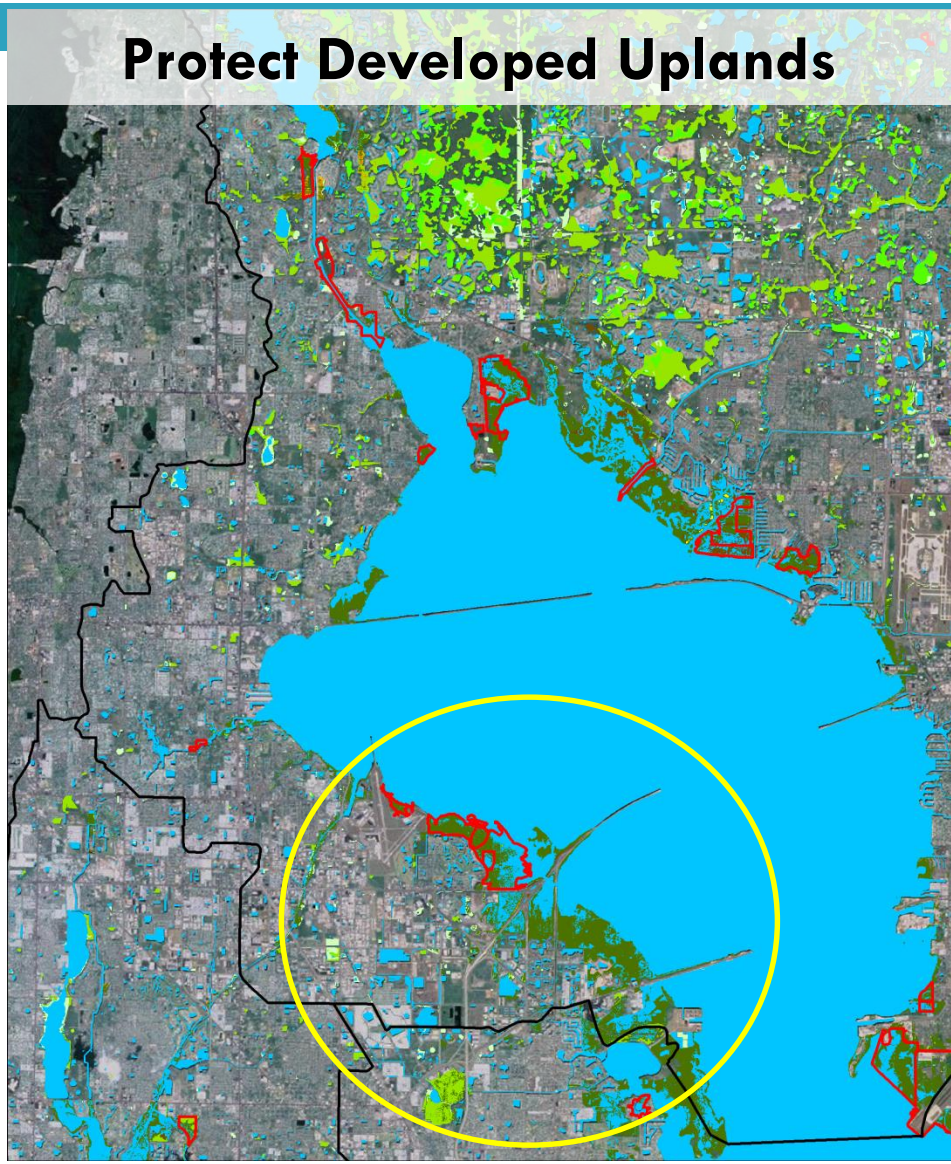
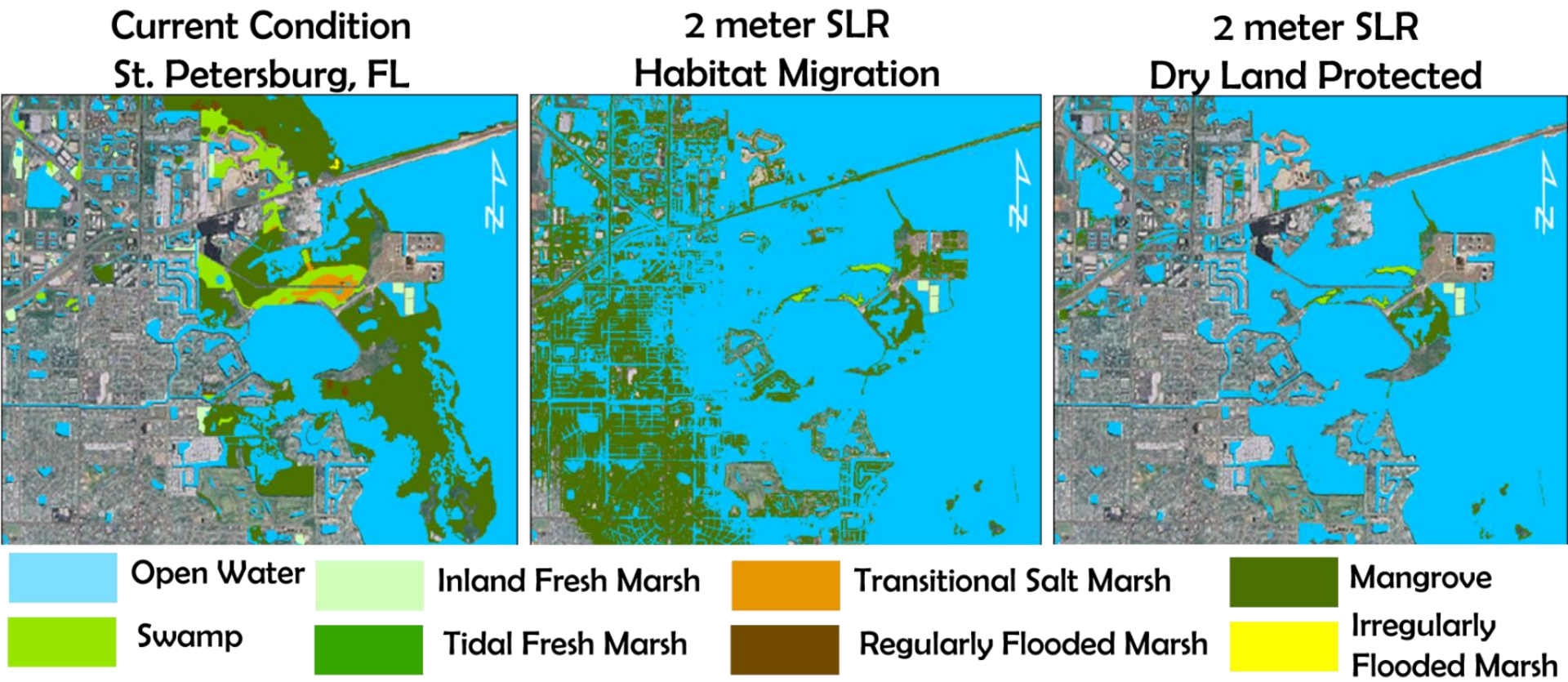


2007



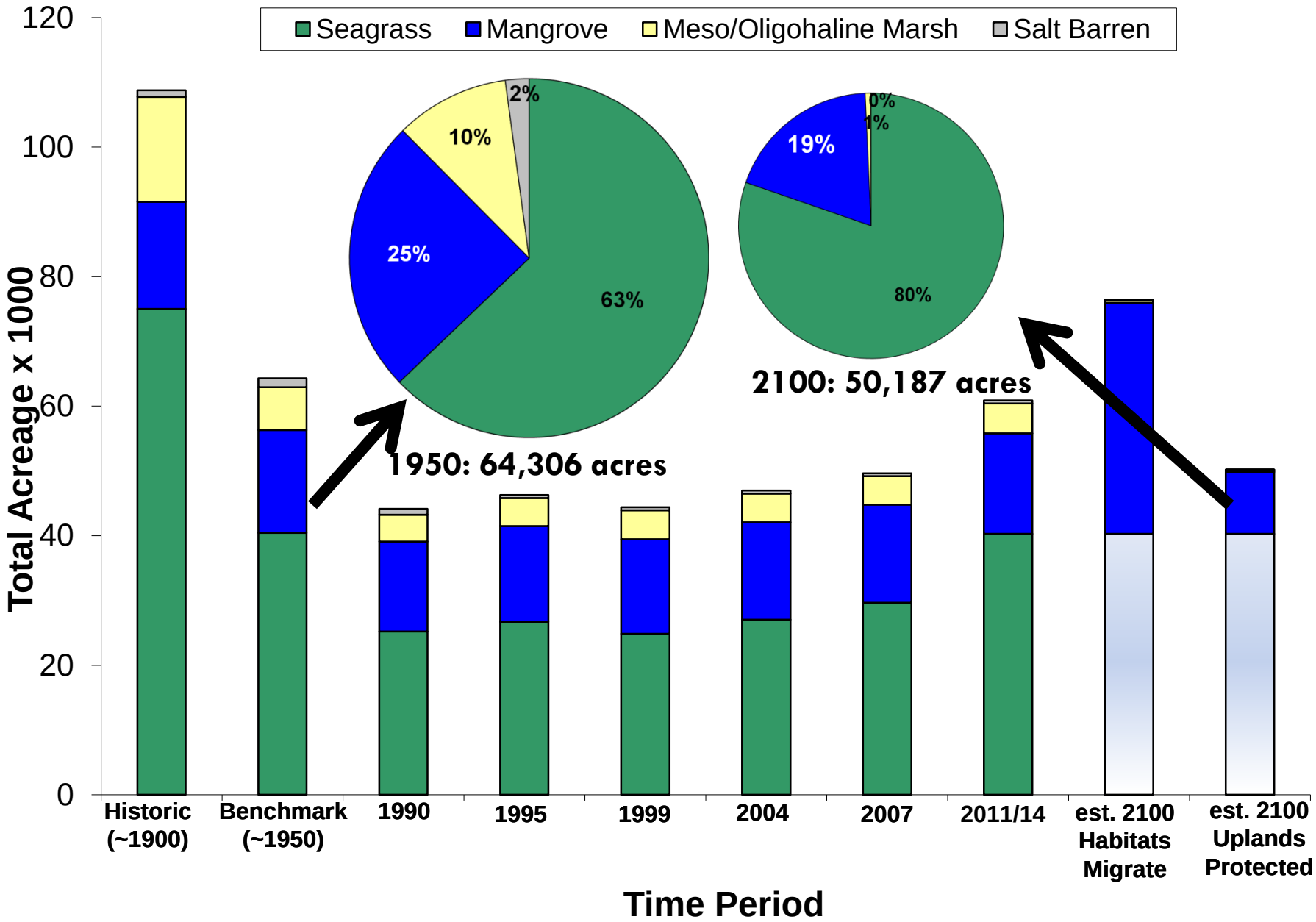
2100 ~ 3 ft SLR

Marsh & Salt Barren are Highly Vulnerable



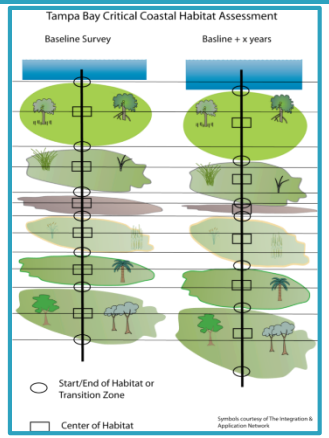
http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/

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

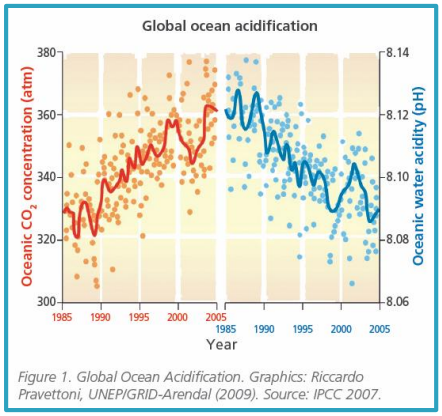
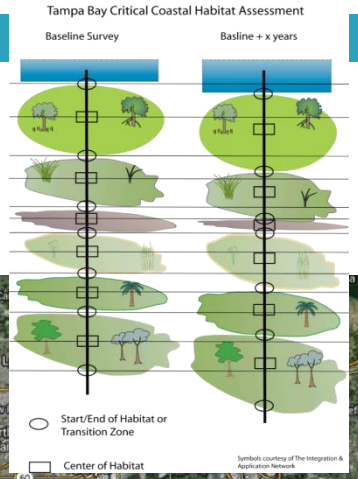
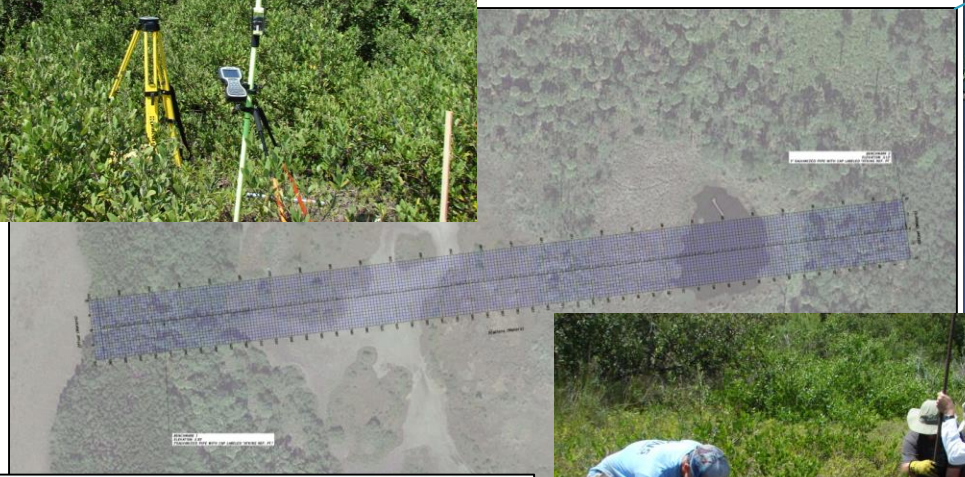


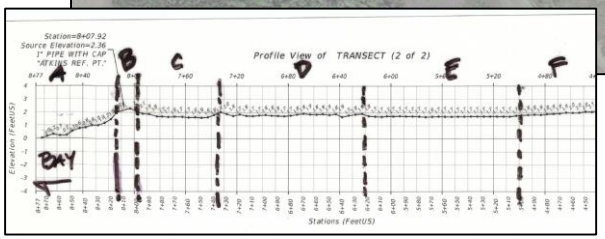
Figure 1. Global Ocean Acidification. Graphics: Riccardo Pravettoni, UNEP/GRID-Arendal (2009). Source: IPCC 2007.

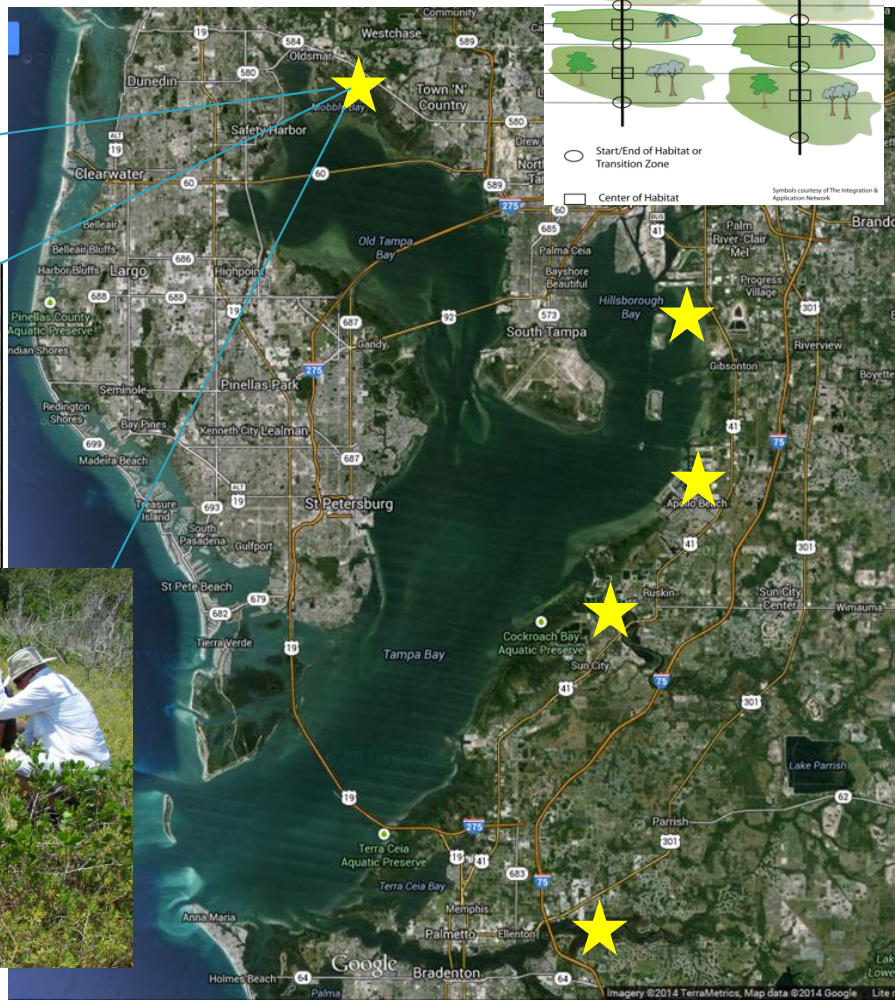
Critical Coastal Habitat Assessment (CCHA)

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



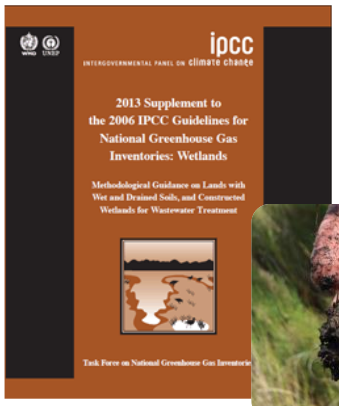


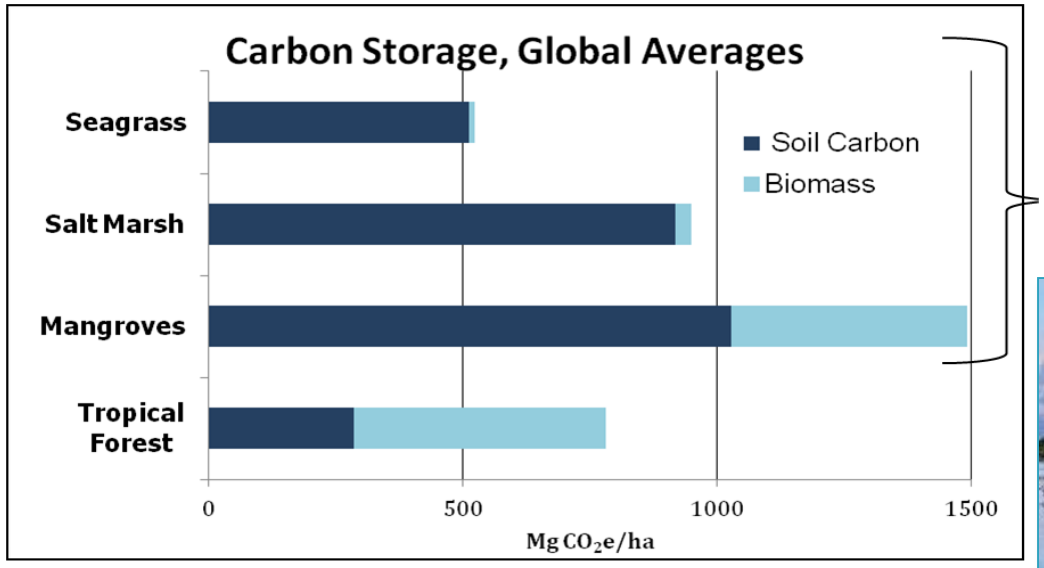




Blue Carbon: Benefits of Habitat Restoration

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

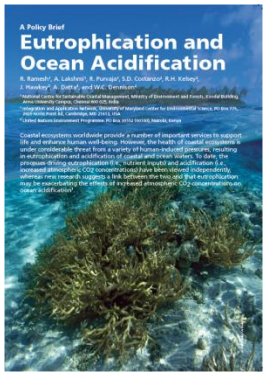


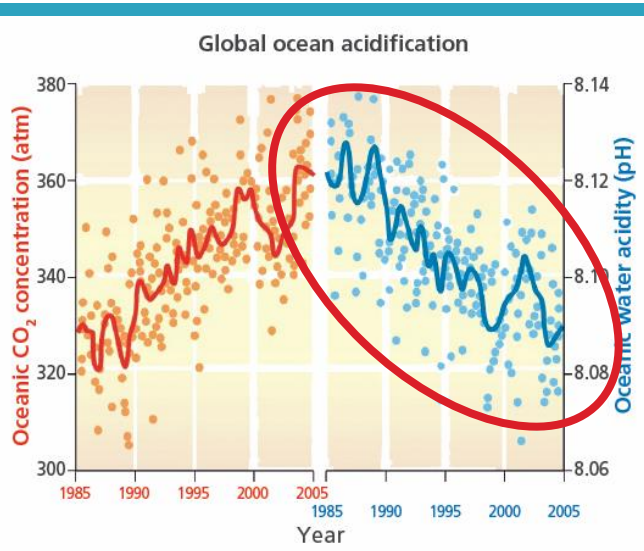


Source: Pendleton et al. (2012) and Pan el al, (2011)

OA Monitoring: Benefits of a Recovering Estuary

- Seagrass may buffer ocean acidification (OA) effects
- Provide OA 'refugia' for sensitive species
- Long-term monitoring framework





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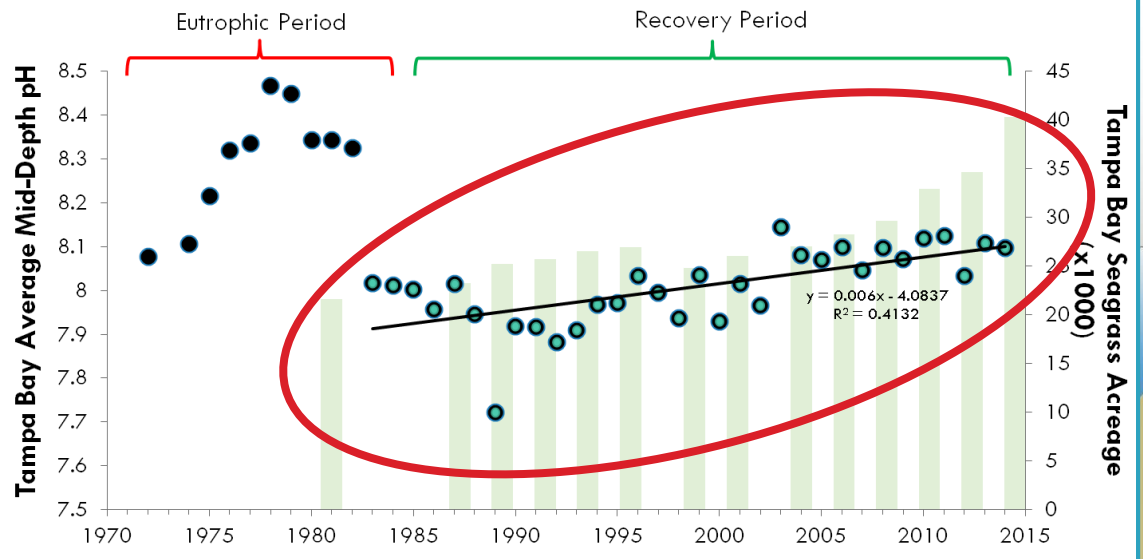

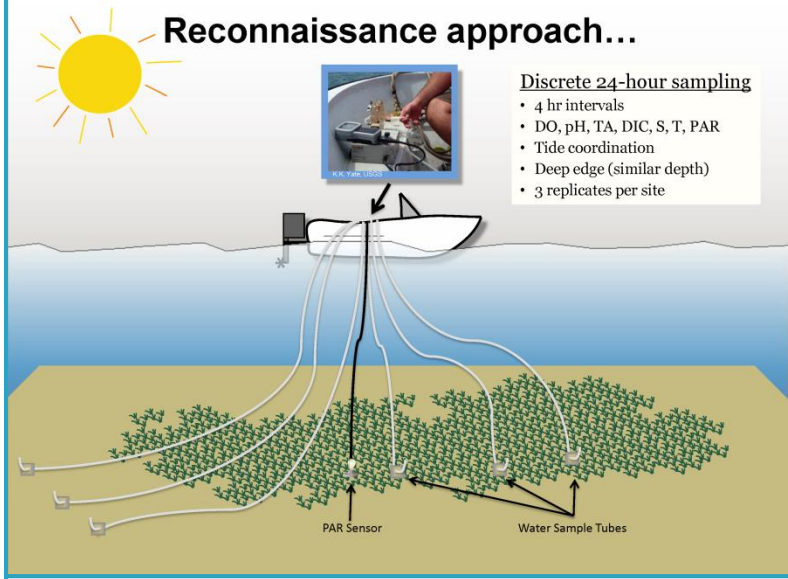

Questions?

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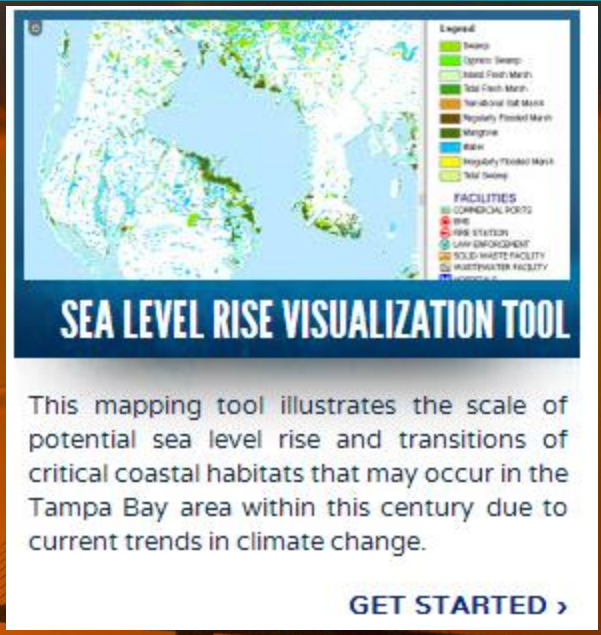
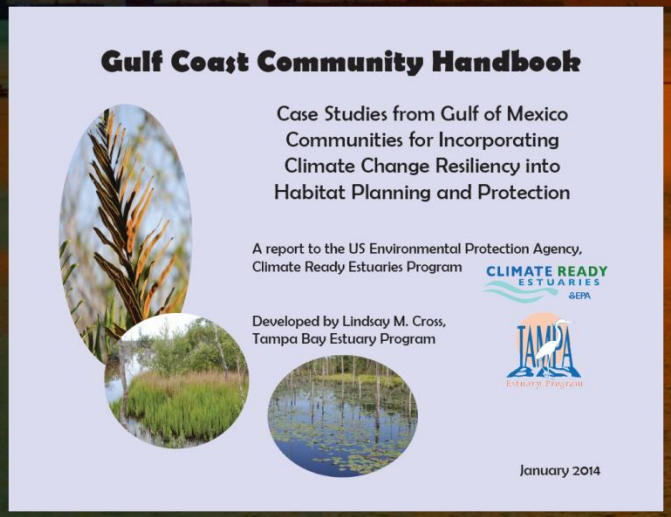
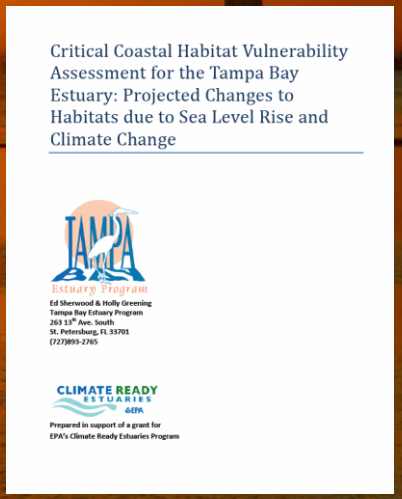




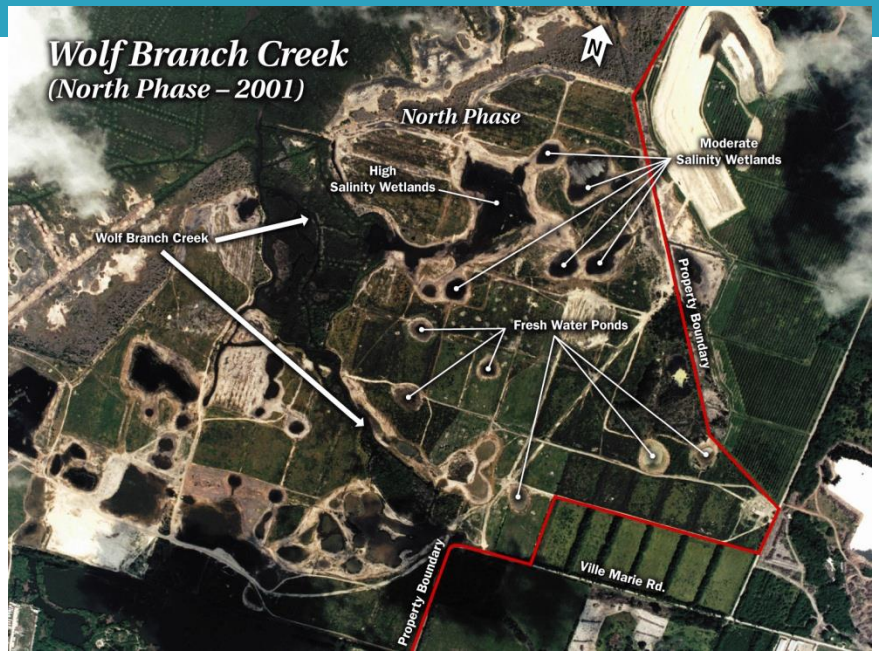
http://www.tbeptech.org/DATA/cre/gulfcoasthandbook.pdf

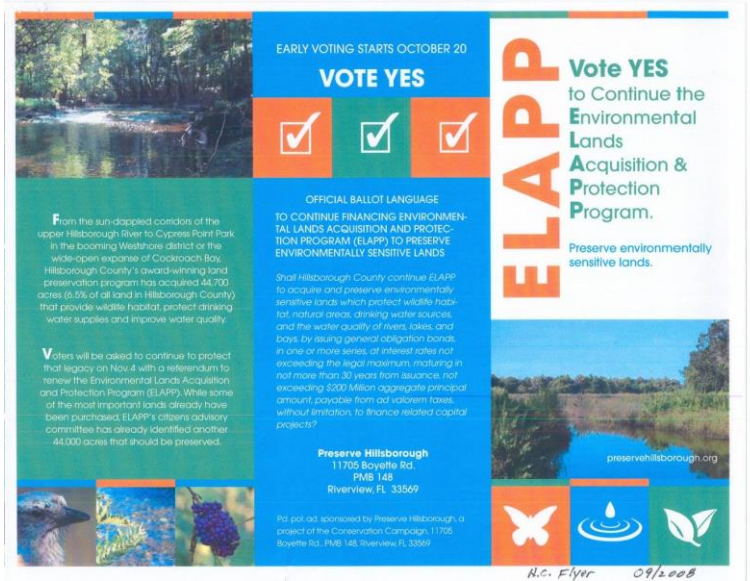


http://www.tbeptech.org/TBEP_TECH_PUBS/2012/TBEP_03_12_Updated_Vulnerability_Assessment_082012.pdf

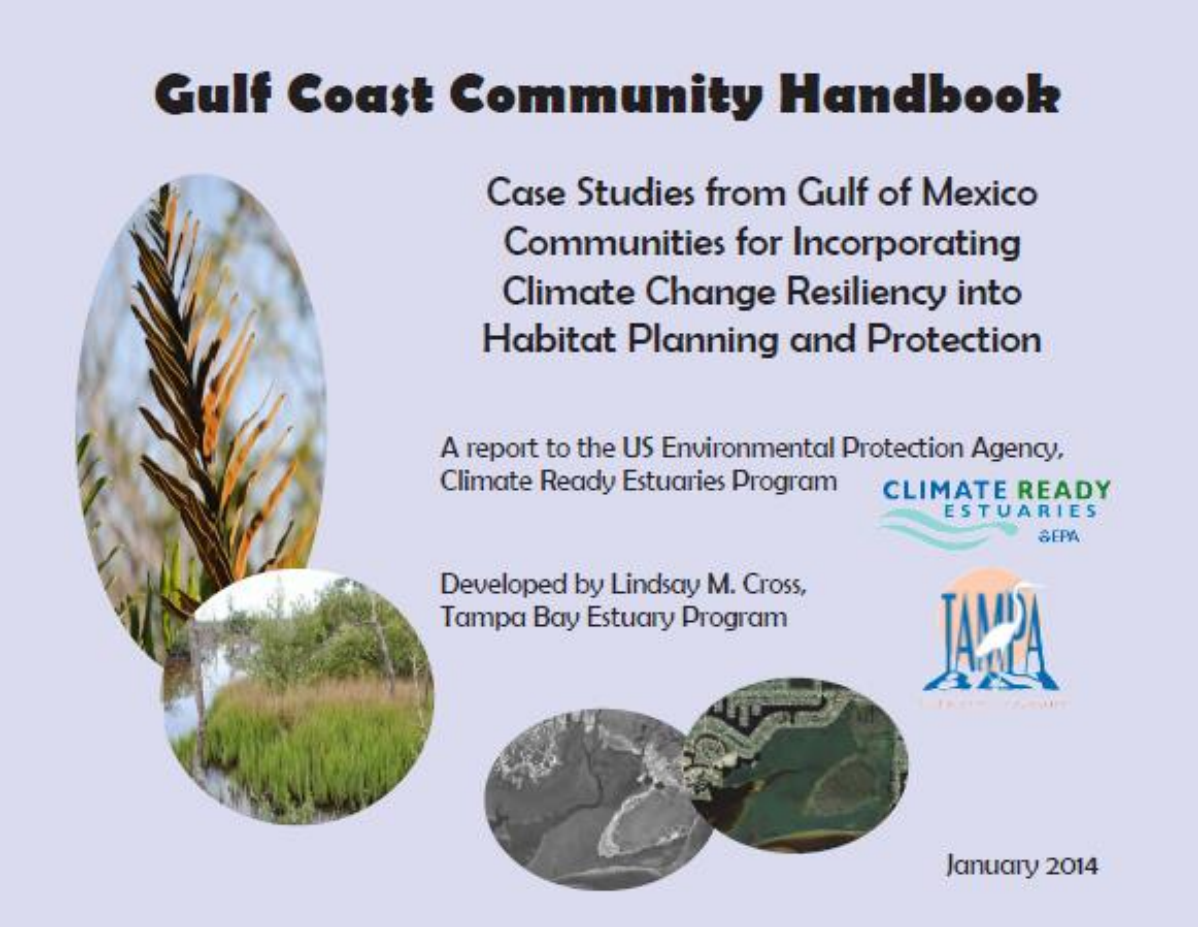
Coastal Habitat Resiliency Strategies

- 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





Gulf of Mexico Examples

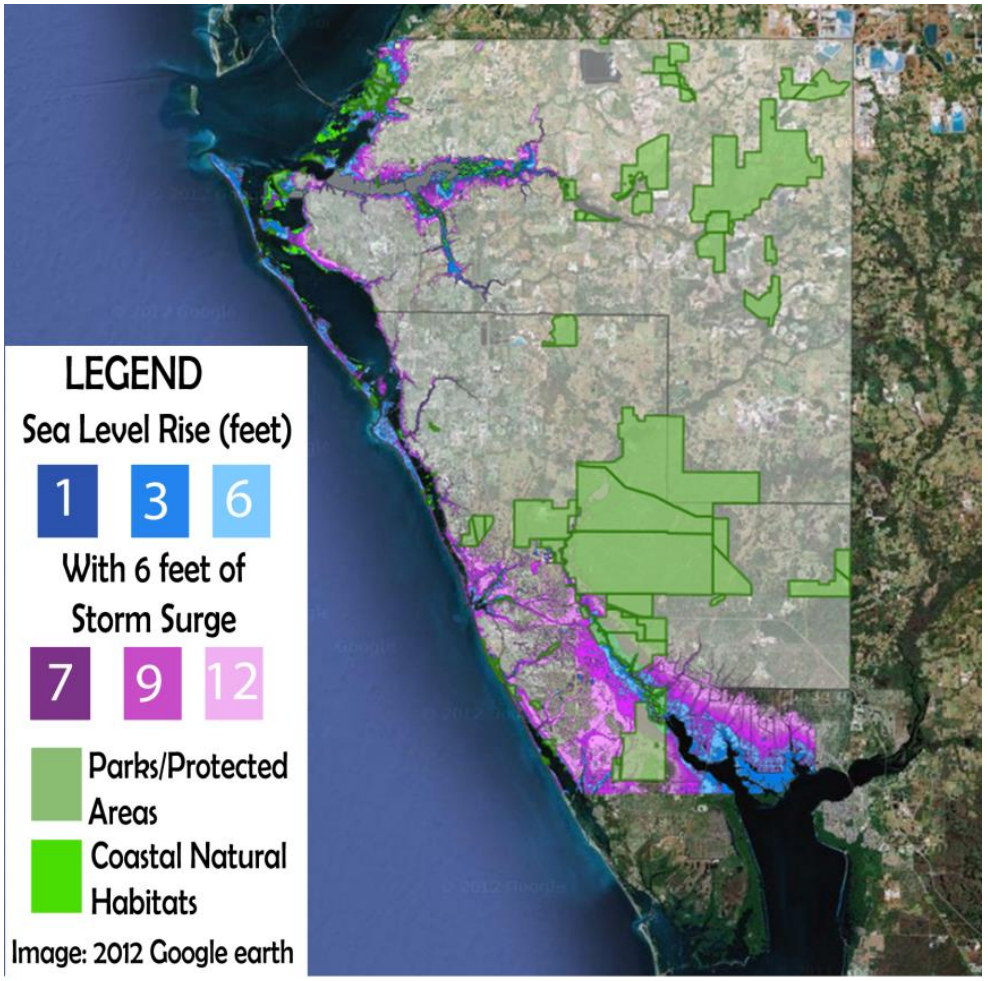


TBEP worked with local partners & the Gulf management community to develop regional approaches for incorporating resiliency into habitat restoration strategies throughout the Gulf of Mexico

http://www.tbeptech.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

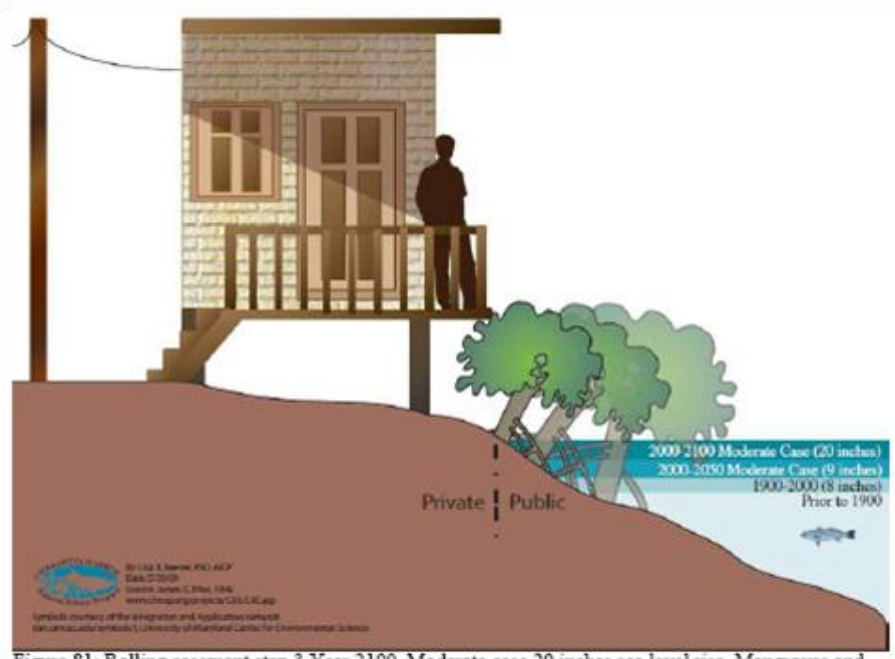


Figure 81: Rolling easement step 3 Year 2100. Moderate case 20 inches sea level rise. Mangroves and marsh move inland. Former mangroves become inundated.

Source: Lisa Beever

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

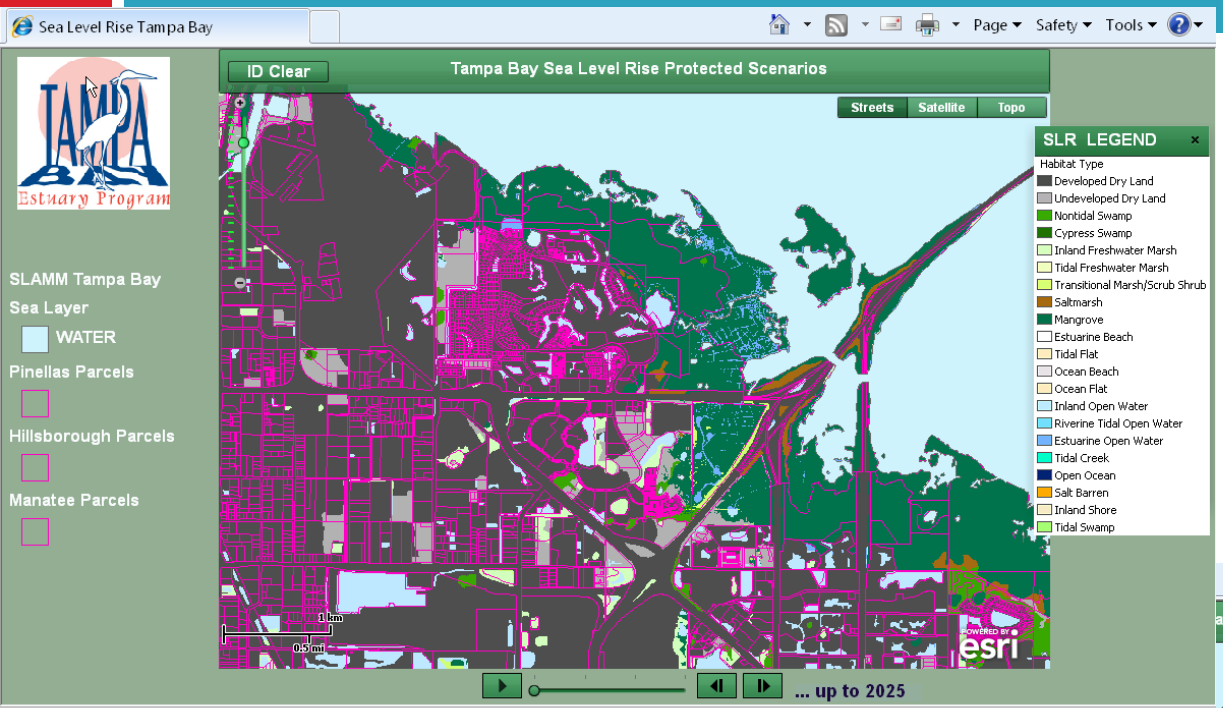
Coastal habitat mosaics, Schultz Preserve, FL: Tampa Bay Estuary Program

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

Source: Hillsborough County, Aerial Innovations

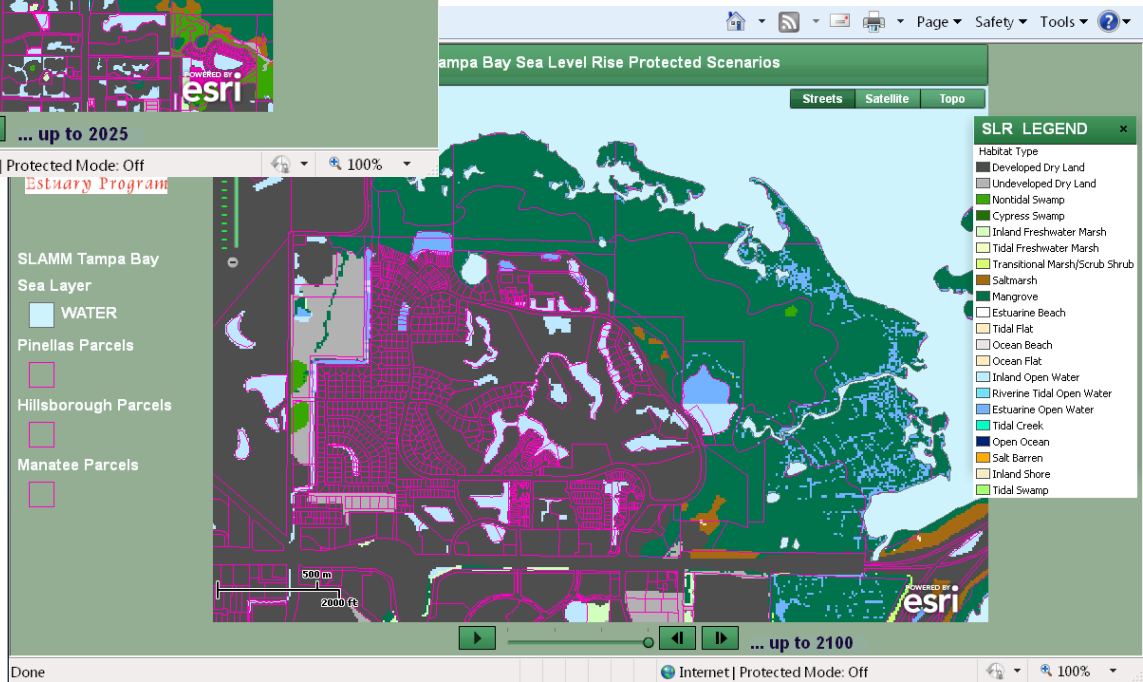
Website Management Tool Developed

http://www.tampabay.wateratlas.usf.edu/TB_SLRViewer/



- Land Use Planners & Managers
- Restoration & Site Acquisition

- Parcel-level calculations
- Anticipated changes in habitats



Potential Strategies

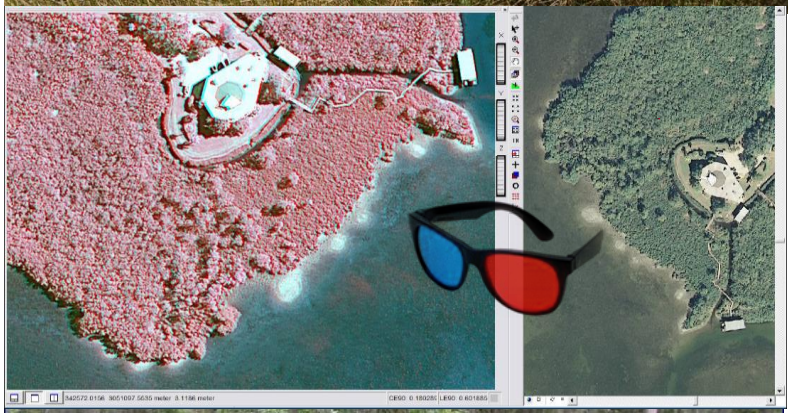
- Continue to incorporate RESILIENCY into restoration designs and construction (habitat mosaics)

- 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

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/