The Galveston Bay Foundation

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Climate Change Adaptation Strategies and Issues for Galveston Bay
Galveston Bay Foundation

Mission:
To preserve, protect, and enhance the natural resources of the Galveston Bay estuarine system for present users and for posterity.
Do you know Galveston Bay?

- Averages 7-8 feet deep
- 660 square miles of water
- 4 counties: Brazoria, Chambers, Galveston, and Harris
- Freshwater inflows from the San Jacinto and Trinity Rivers
- 24,000 square mile watershed
How Do We Use Galveston Bay?

- Jobs
- Homes
- Food
- Recreation
- Transportation of goods
- Wildlife habitat
Climate Change in Estuaries

- Estuaries are very vulnerable to climate change.

- Vulnerability is a function of:
  - Degree/rate of stressor
  - Sensitivity of the system
  - Adaptive capacity of the system
What are the Stressors?

- Sea level rise
- Water temperature increases
- Air temperature increases
- Precipitation changes
- Seasonal change alterations
What are the Potential Impacts?

- Erosion of shorelines
- Landward migration of shorelines
- Break up of barrier islands
- Increased algal blooms
- Altered freshwater supply and quality
- Increased water depths and less sunlight available to SAV
- Altered species distribution
- Increased invasive species
- Increased coastal storm intensity
The Texas Coast

- Over 624 miles of tidal coastline
- Important for manufacturing, commerce, and tourism
- Home to more than 25% of the state population
Barrier Island Profile

Today

Bay

Wetland

Upland

Future Wetland

Island Core

Upland

Wetland

Protective Ridge

Upland

Future Beach/Dune

Beach/Dune

Gulf

After 60 Years of Sea-Level Rise and Erosion

Wetland

Upland

Island Core

Upland

Wetland

Protective Ridge

Beach/Dune
Climate Change in Texas

Loss of coastal marsh

➢ Reduces critical habitat for shorebirds, wading birds, shellfish; reduces stopover sites for migratory waterfowl; reduces nursery grounds for young shrimp, crab, and fish

➢ Allows for saltwater intrusion into freshwater marshes
Climate Change in Texas

Increased intensity, duration, and extent of harmful algal blooms

In 1996, 2/3 of the Texas coast was closed to shellfish harvesting due to large “red tide” event
Sea Level Rise in Galveston

- Sea level rising by 25 inches per century
- Likely to rise ~38 inches by 2100
- Reactive management methods including beach renourishment
Relative Sea-Level Change

Pier 21 - Galveston

Average water level (cm)

Year

y = 0.652x - 1145.6

R² = 0.9436

4.36 + 2.16 = 6.52 mm/yr

Local land subsidence

Global ocean-level rise
Adaptation Strategies

- **Proactive measures**
  - Reduce long-term vulnerability of coastal communities

- **Reactive measures**
  - Consistent with resilience
  - Developed immediately, but initiated once impacts are observed
  - Ad hoc reactive responses after impacts are observed
Ecosystem-based Adaptation

- Preserve and restore natural ecosystems that naturally and cost-effectively protect against climate change impacts.
- Make ecosystems more resistant and resilient so they continue to provide full suite of natural defenses.
Ecosystem-based Adaptation Options

Maintain/restore wetlands

- Allow coastal wetlands to migrate inland (land purchases, rolling easements, etc.)
- Promote wetland accretion by providing source of sediment
- Avoid hard shoreline protection (bulkheads)
Ecosystem-based Adaptation Options

Preserve coastal lands

- Land acquisition/conservation program
- Land exchange programs
- Limit locations for landfills, hazardous waste facilities, wastewater treatment plants, etc.
- Consider climate change impacts when planning new infrastructure
Ecosystem-based Adaptation Options

“Soft” Shoreline Management

- Living Shorelines
- Remove hard shorelines to allow for shoreline migration
- Use “natural” breakwaters (oyster reefs)
- Plant marsh grass and SAV
- Protect marshes in high wave energy environments
- Create dunes and plant dune vegetation
Ecosystem-based Adaptation Options

Invasive Species Management

- Remove invasive species
- Restore native species
GBF’s Conservation Program

- Conservation through enhancement
- Conservation through land holdings
- Habitat restoration
Conservation Through Enhancement

- Removal of invasive species, such as Brazilian peppertree and Chinese tallow, that outcompete native species and reduce biodiversity
Conservation Through Land Holdings

- 8 conservation properties totaling over 3,265 acres around Galveston Bay
- 4 conservation easements totaling over 103 acres
- Currently working on several more easements for 2011
GBF Habitat Restoration

- Actively restoring habitat since 1991
- Diverse habitat types: marsh, seagrass, & oyster reef
- Working directly with local citizens for “community based” habitat restoration
Marsh Restoration: Marsh Mania

- Community-based effort to restore the loss of 35,000 acres of estuarine marsh from Galveston Bay since the 1950s
- Began in 1999
- Involved over 5,875 volunteers
- Restored over 170 acres of habitat
- 61 different sites around Galveston Bay
Before and After
Before and After
Living Shorelines Program

- Provide erosion control benefits & enhance natural shoreline habitat

- Allow for natural coastal processes to remain
  - Absorbs wave energy from wind, boats, storm events
  - Hydrology unchanged
  - Movement of organics
  - Flood protection - absorption & release of excess water
  - Pollutant filtration from runoff

- Create critical habitat
  - Provides habitat for fin and shellfish
  - Provides rookery, foraging and nesting habitat for birds

- Can provide additional protection to existing bulkheads
Living Shorelines

Before

During construction

6 months after planting
Seagrass Restoration

- At least 80% of seagrasses in Galveston Bay were lost since the 1950s
- Recent successes in seagrass restoration in West Bay
Oyster Reef Restoration

- As a result of Hurricane Ike, approximately 50% of Galveston Bay’s consolidated oyster reefs were destroyed.
- “Oyster Gardening” for the purpose of habitat restoration
Dickinson Bay Oyster Reef Enhancement
GBF served as local host for Restore America’s Estuaries national conference in Galveston in November 2010

Focus on Climate Change: Science, Practice, and Policy
Needs

- Dedicated federal funding
- Federal-state coordination
- Implementation of ecosystem-based adaptation methods
References


THANKS FOR YOUR SUPPORT!

www.galvbay.org