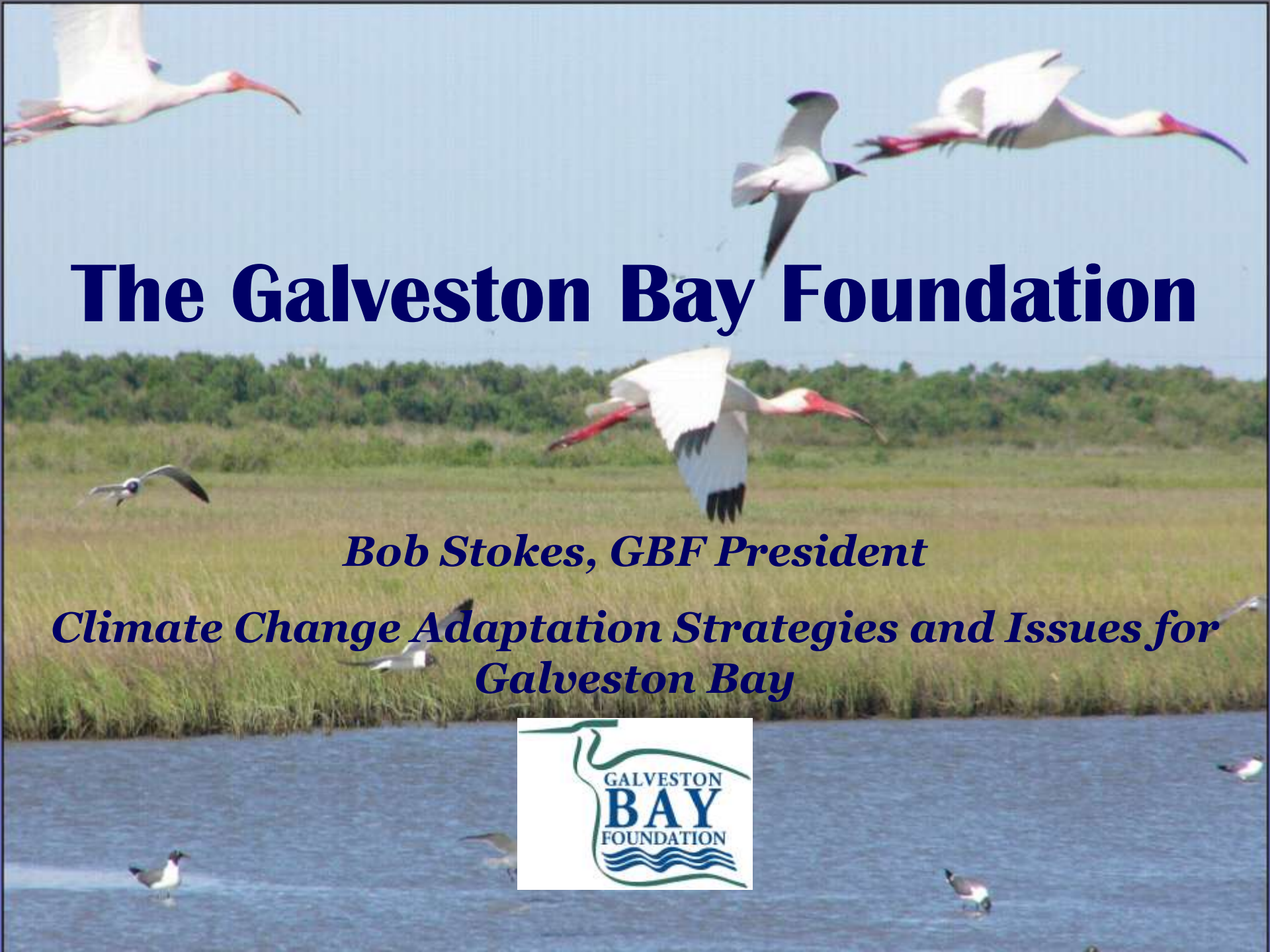


The Galveston Bay Foundation

Bob Stokes, GBF President

Climate Change Adaptation Strategies and Issues for Galveston Bay

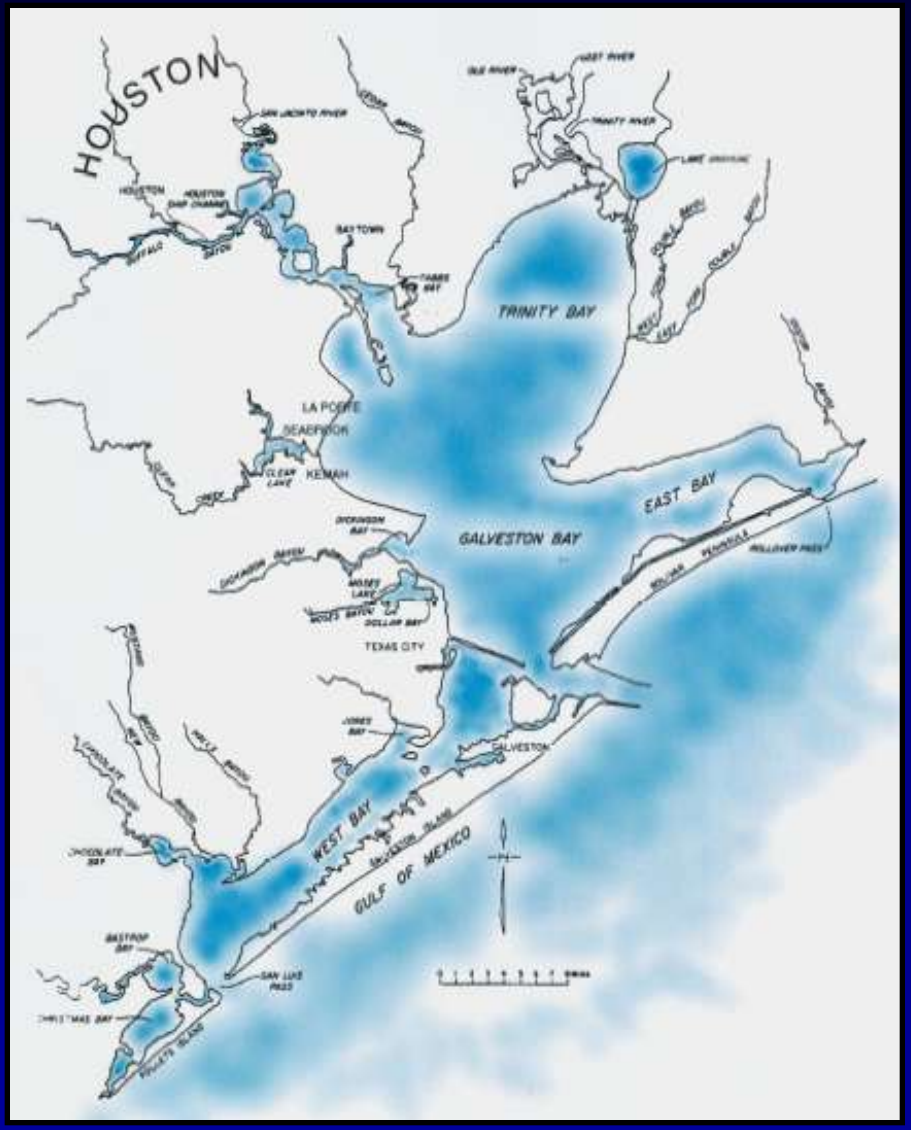
GALVESTON BAY FOUNDATION

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?

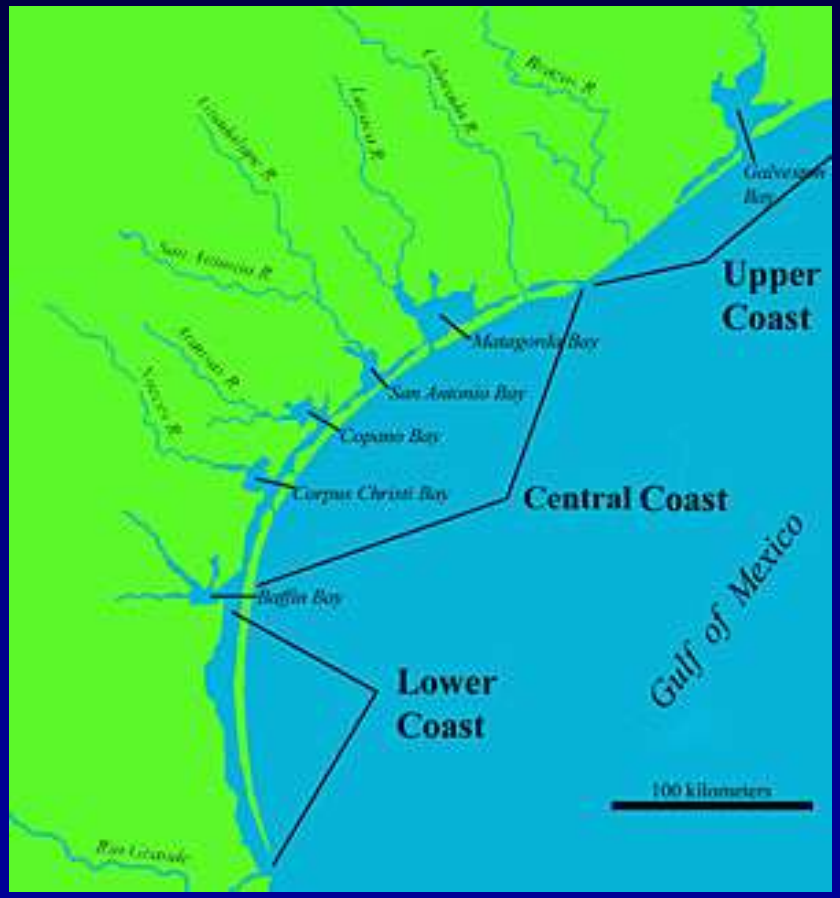
- Sea level rise
- Water temperature increases
- Air temperature increases
- Precipitation changes
- Seasonal change alterations

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

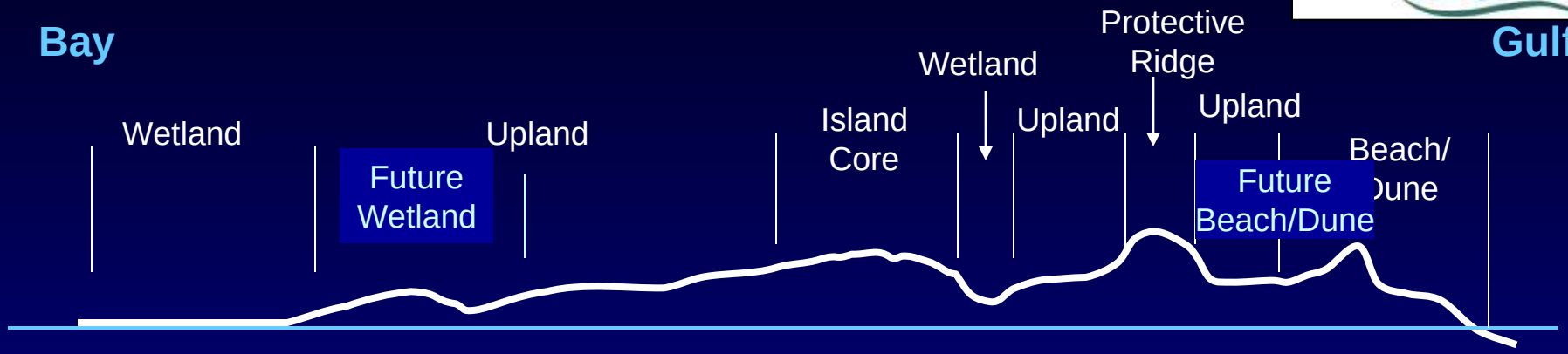
The Texas Coast

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

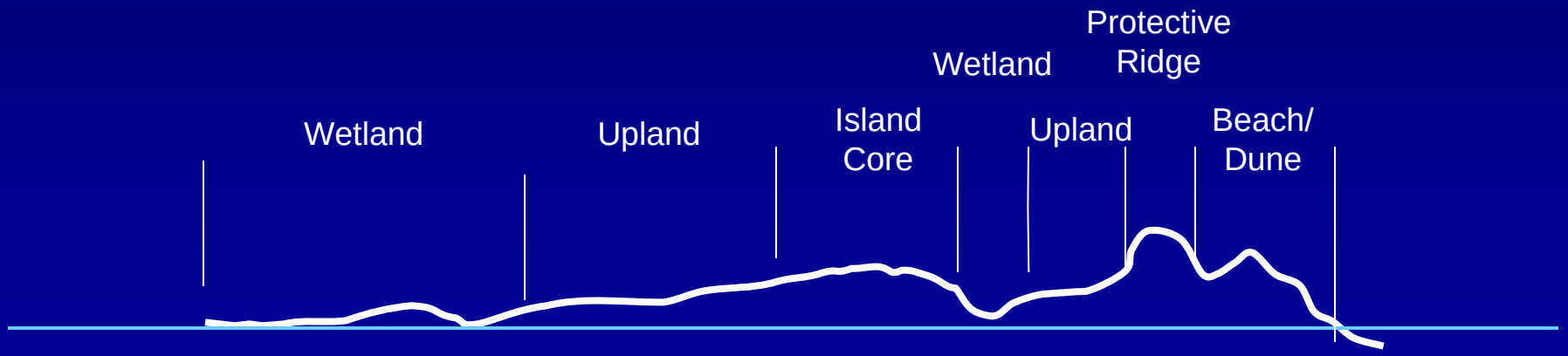


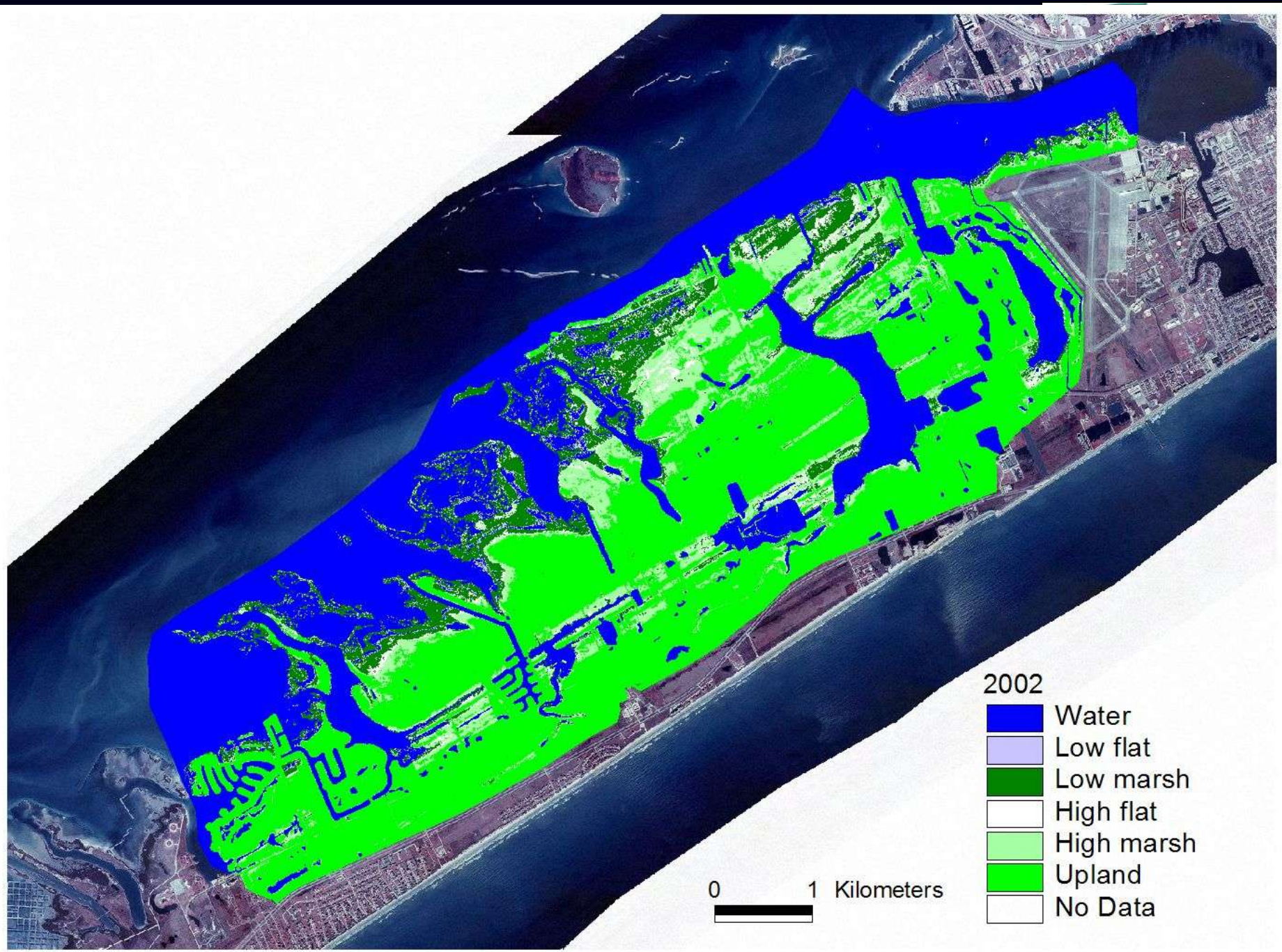
Barrier Island Profile

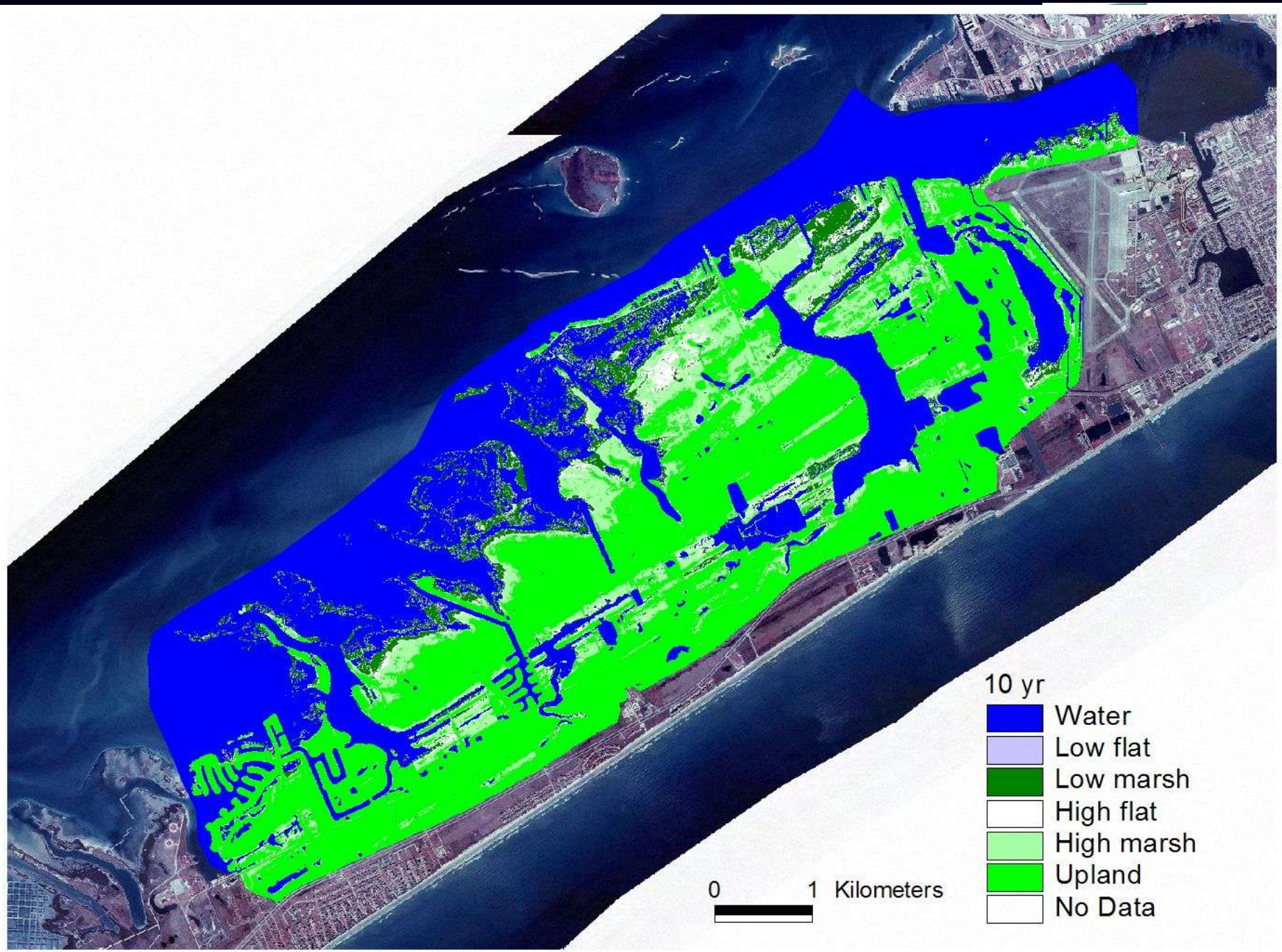
Today

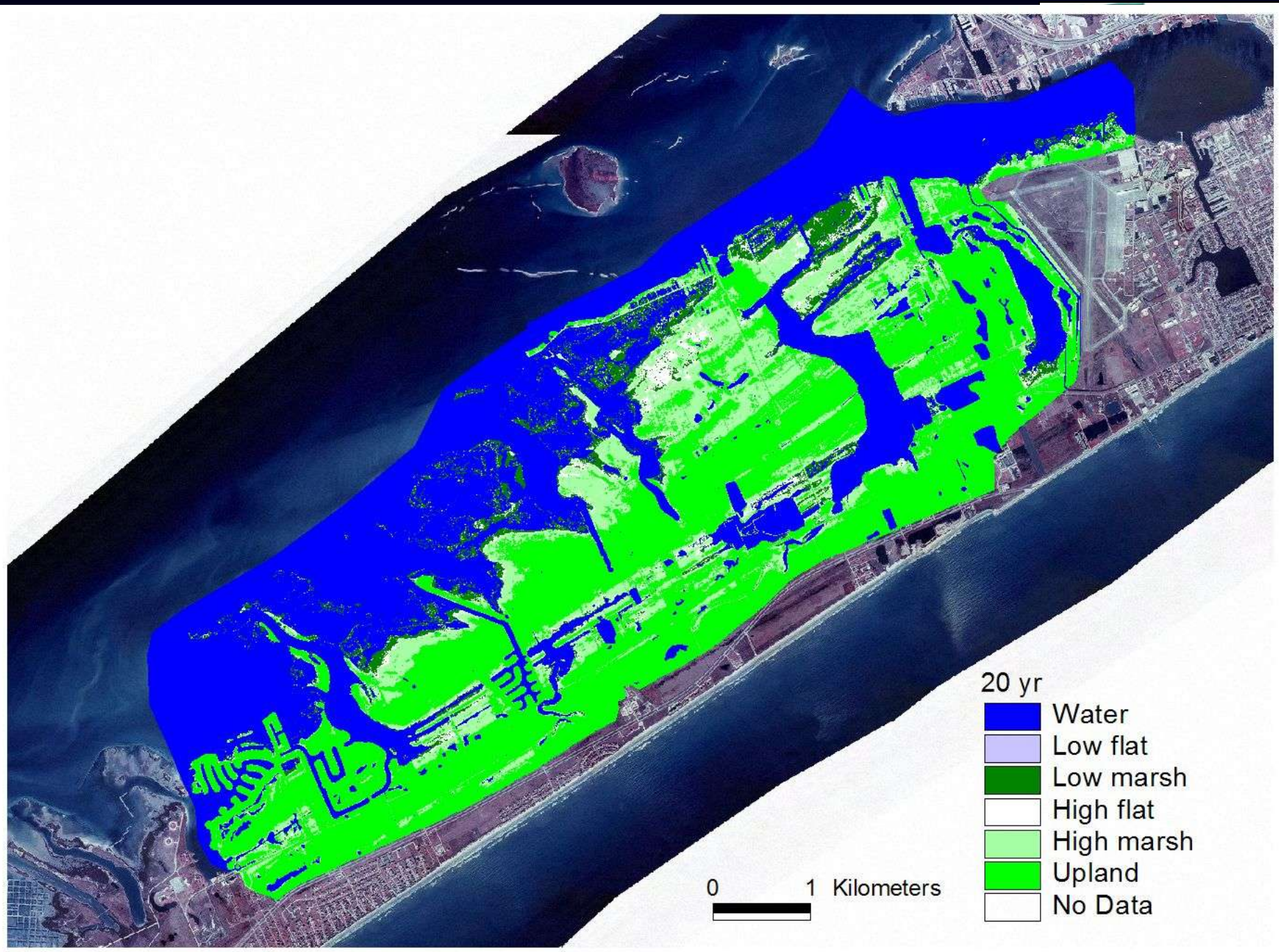


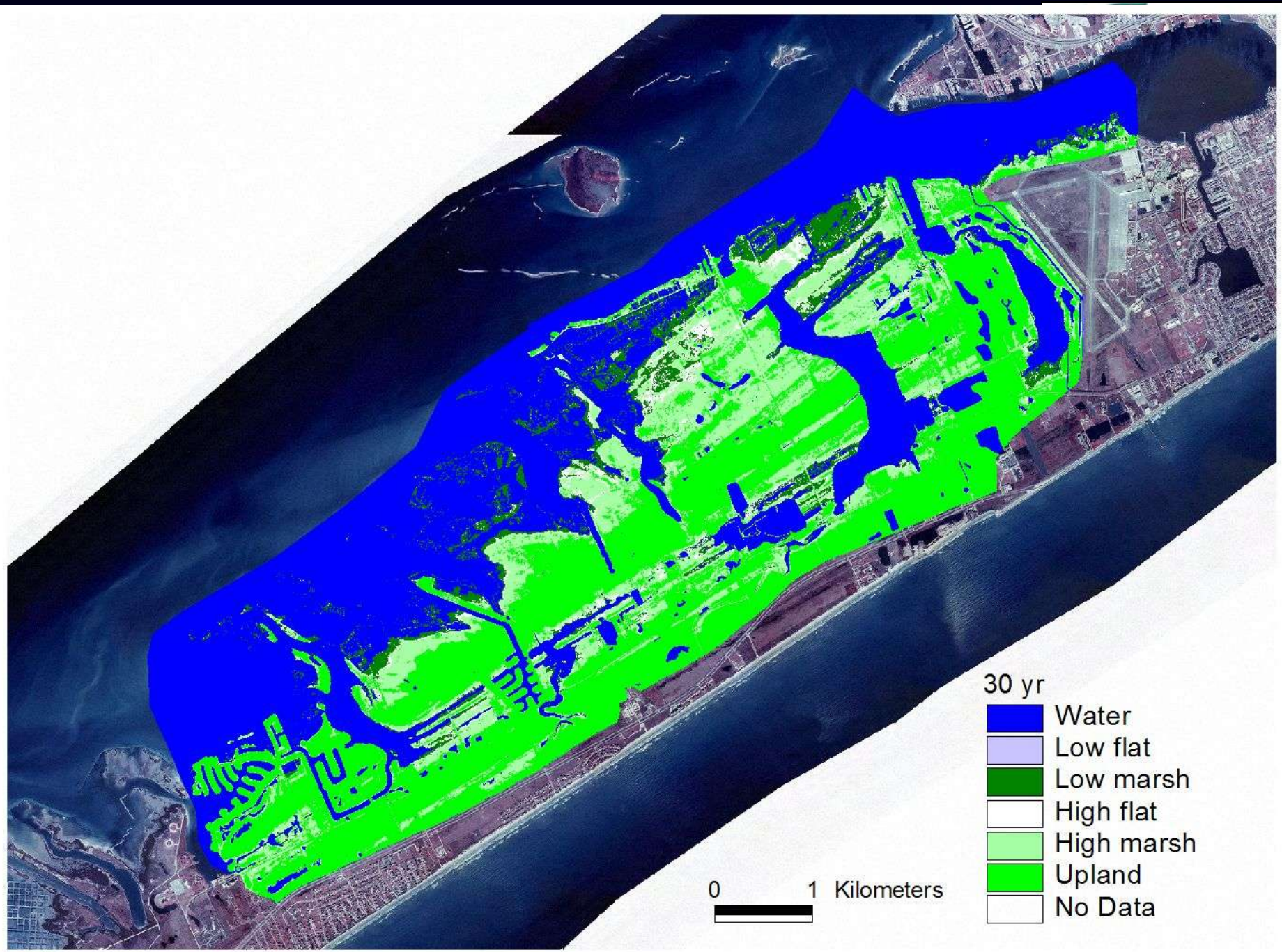
After 60 Years of Sea-Level Rise and Erosion

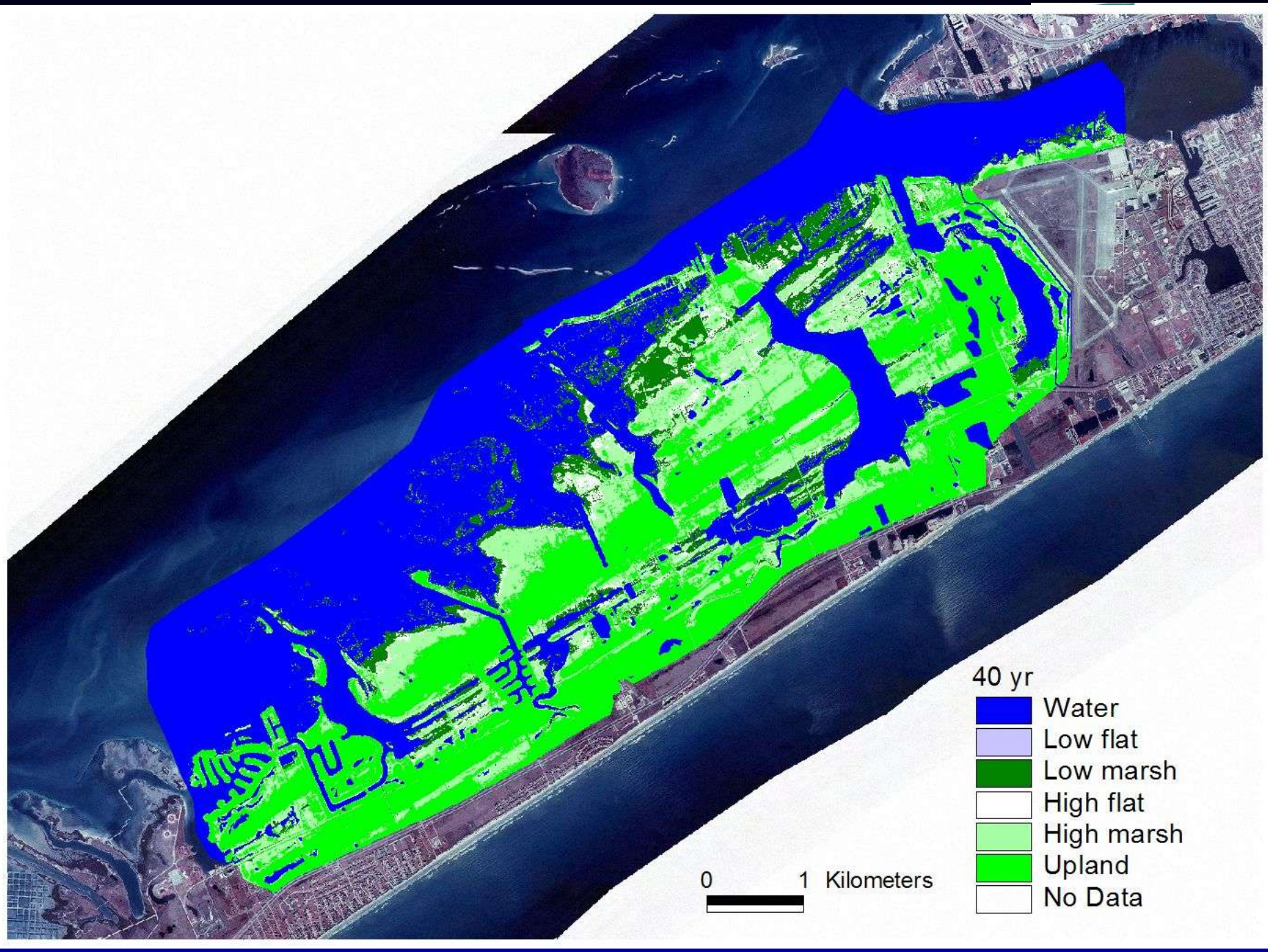


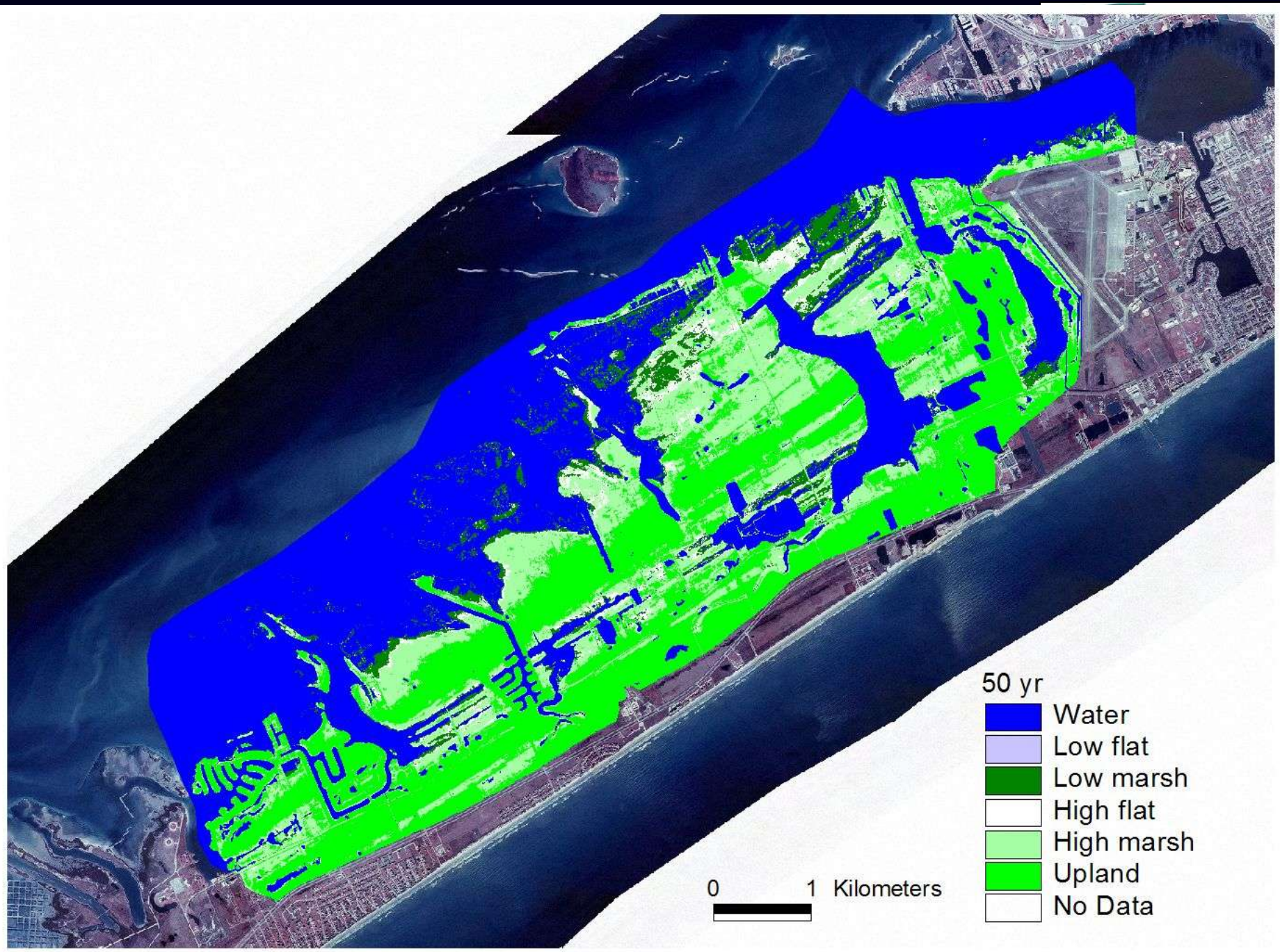

2002
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers

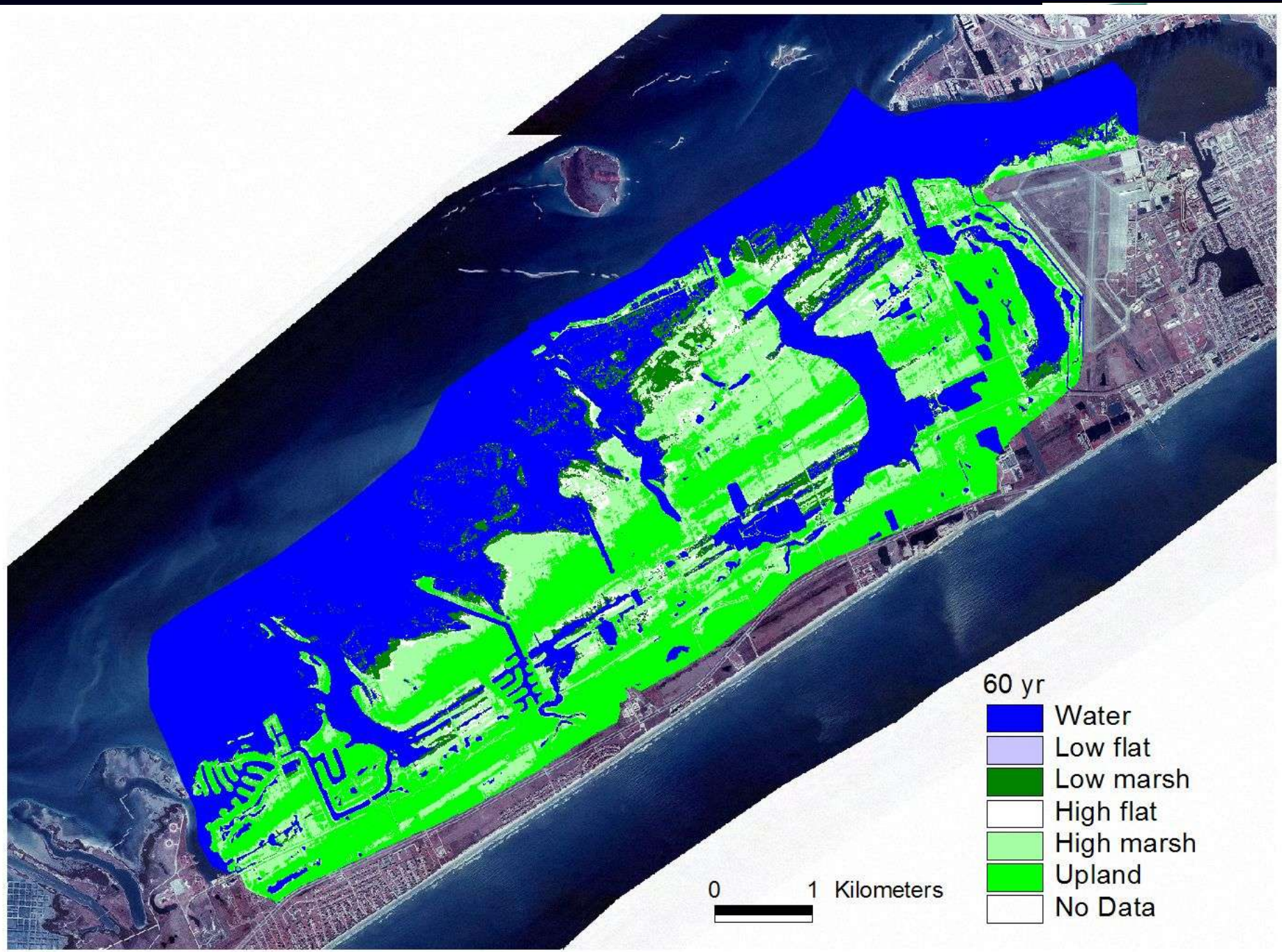

10 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers

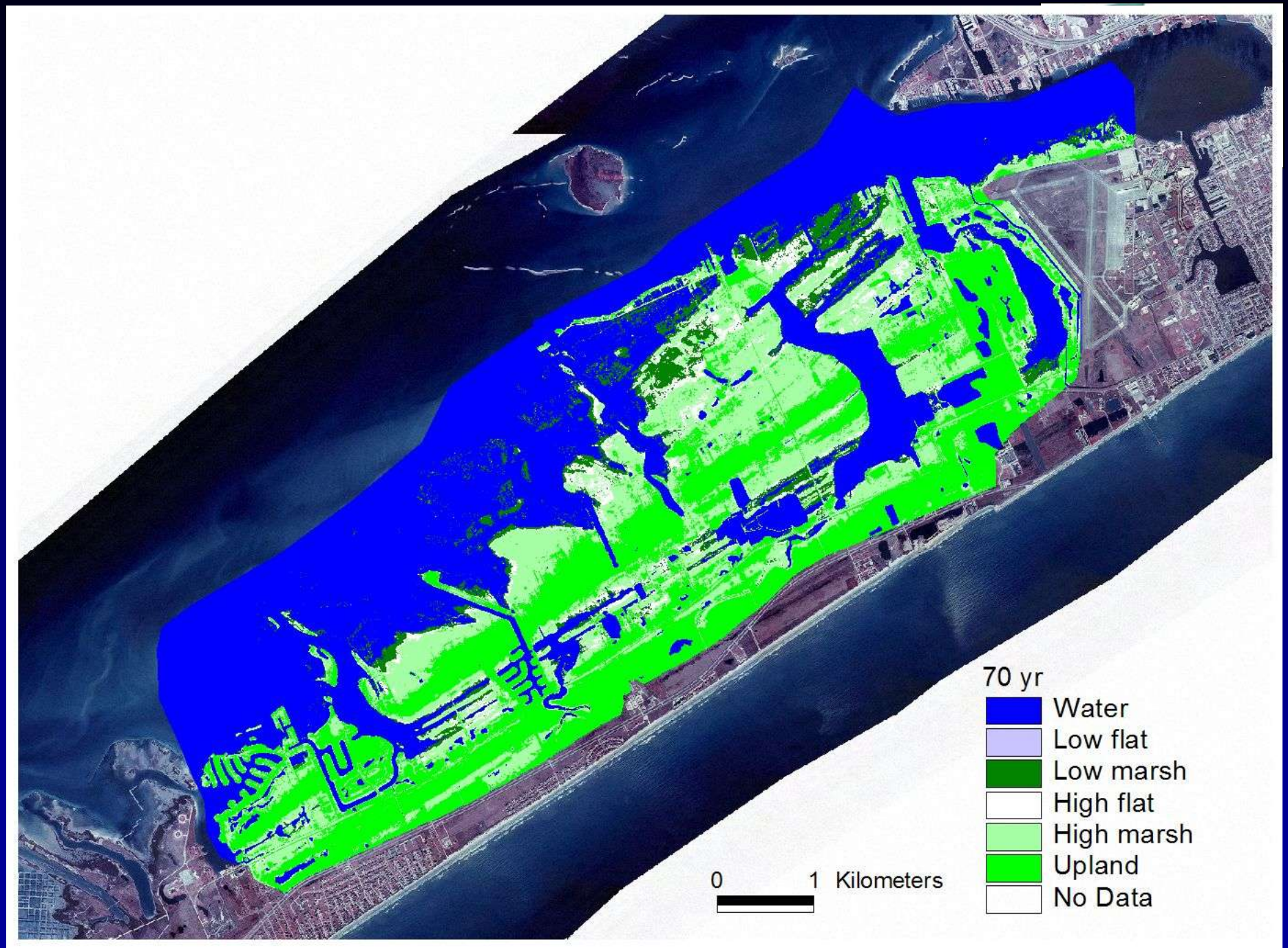

20 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers

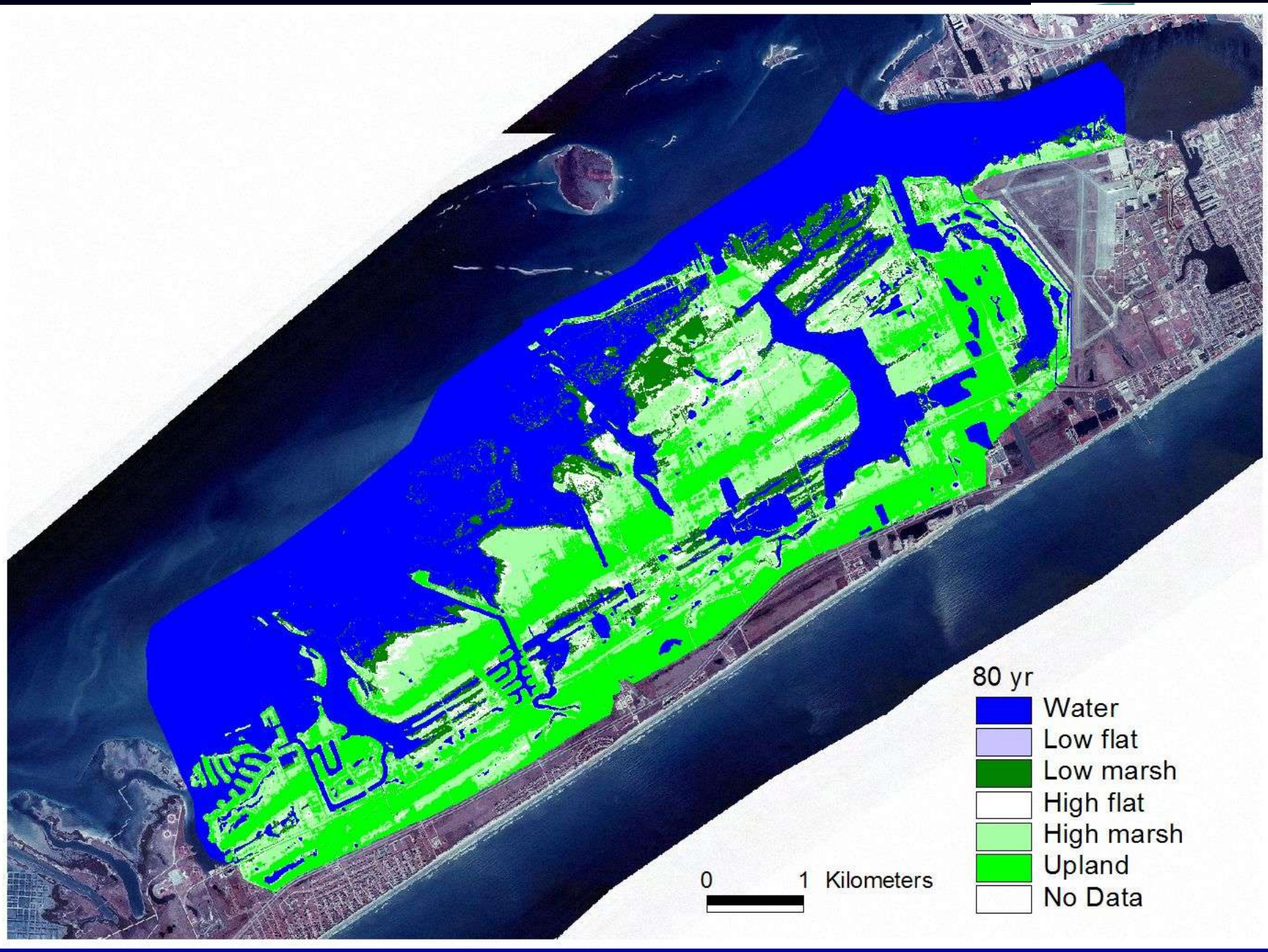

30 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers

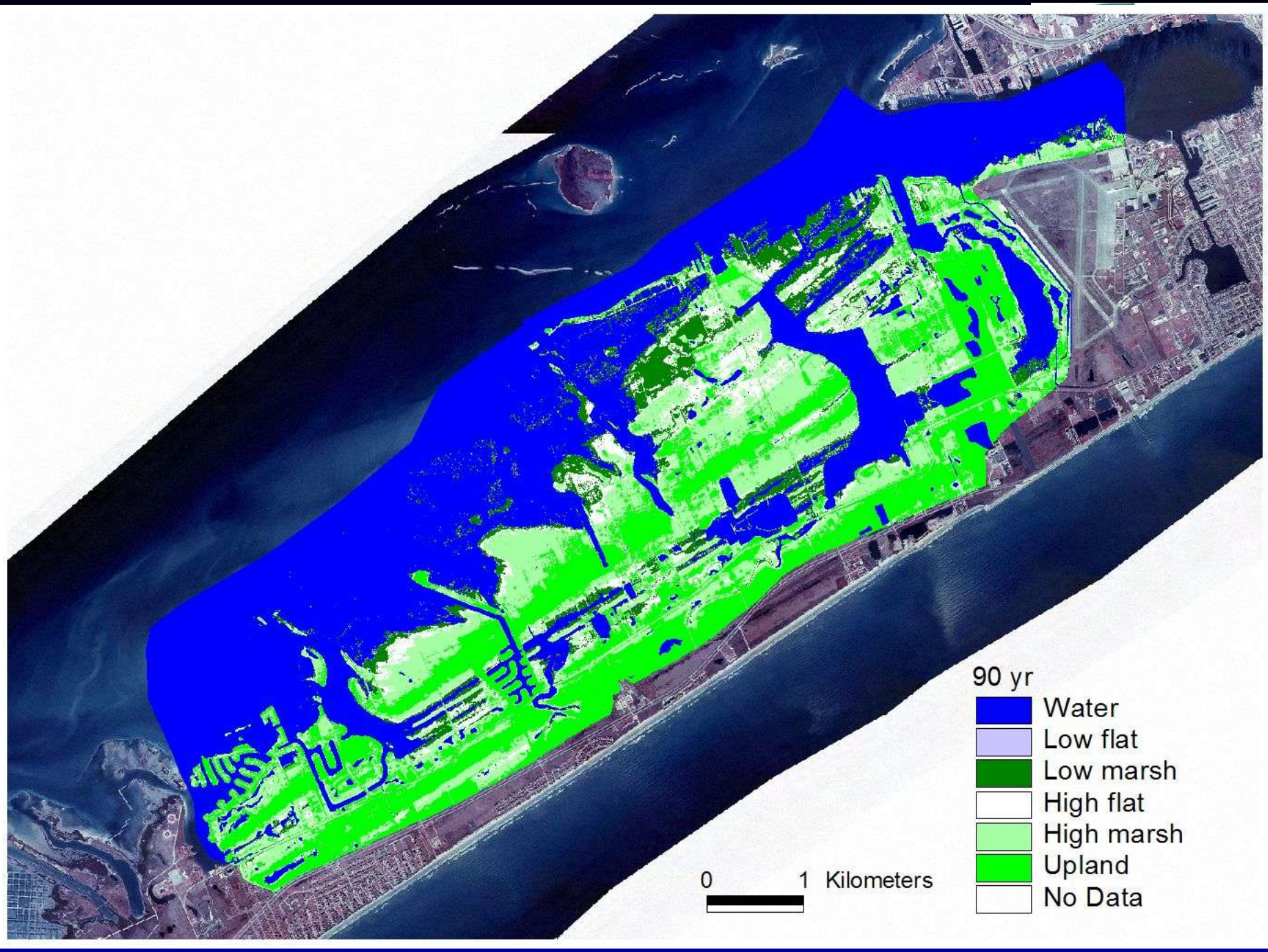

40 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers


50 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers


60 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers


70 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers


80 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers


90 yr
Water
Low flat
Low marsh
High flat
High marsh
Upland
No Data
0
1 Kilometers

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

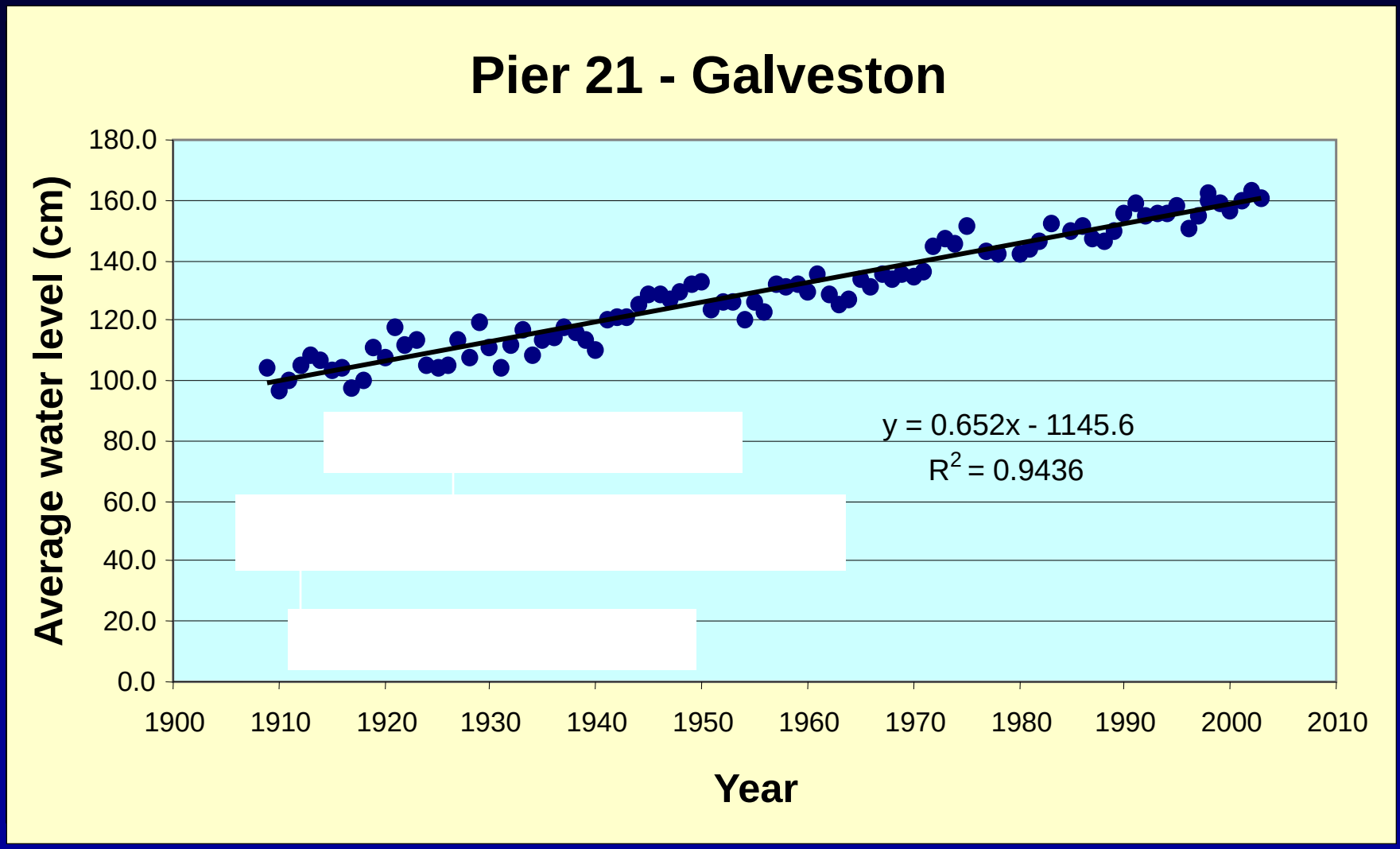
Increased intensity, duration, and extent of harmful algal blooms

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



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

<u>Maintain/restore wetlands</u>

- 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

<u>Preserve coastal lands</u>

- 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

<u>Invasive Species Management</u>

- Strengthen rules preventing introduction of invasive species (ex. Texas Noxious Plant List, 4 TAC §19.300, effective Jan. 2005)
- 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

National Conference

- 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

Coastal States Organization. 2010. The faces of climate change adaptation: the need for proactive protection of the nation's coasts. Coastal States Organization's climate Change Work Group.

Hale, L.Z., I. Meliane, S. Davidson, et al. 2009. Ecosystem-based adaptation in marine and coastal ecosystems.

U.S. EPA. 2009. Synthesis of adaptation options for coastal areas. Washington, DC, U.S. Environmental Protection Agency, Climate Ready Estuaries Program. EPA 430-F-08-024, January 2009.


THANKS FOR YOUR SUPPORT!
www.galvbay.org