

# Application of Ecosystem Goods and Services Assessment to Coastal Restoration Projects: Three Case Studies

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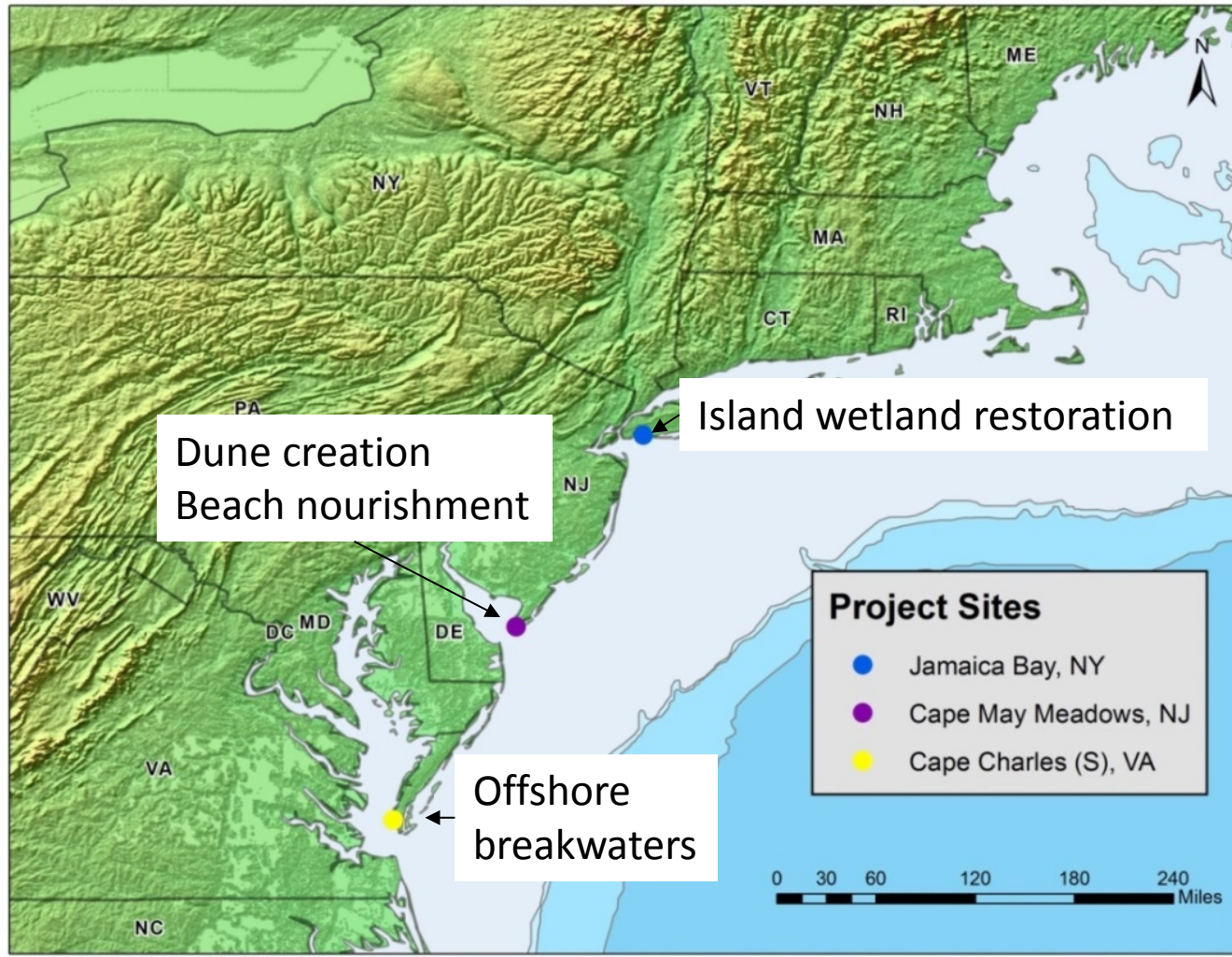


# Project Description

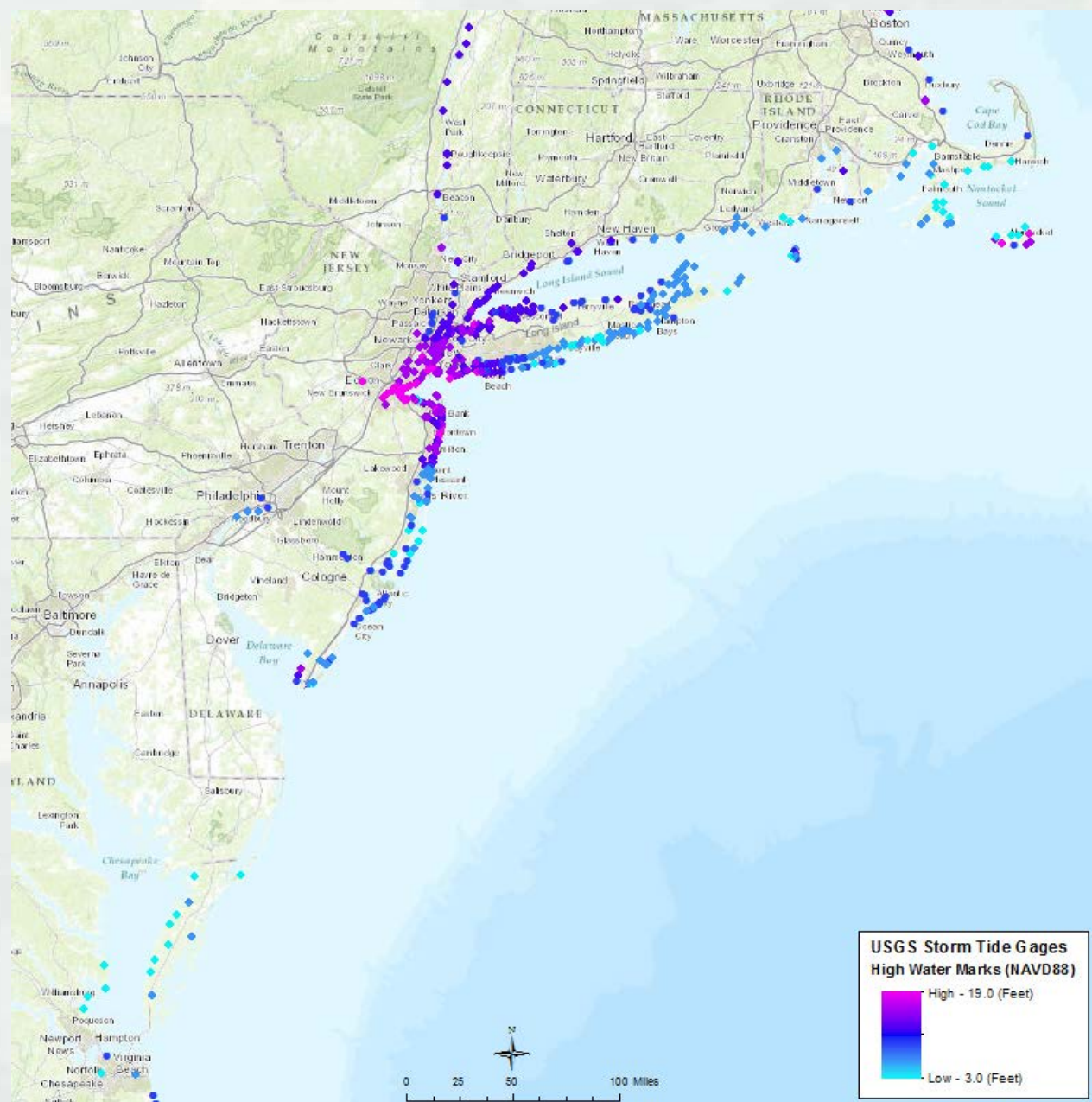
- Proof of concept analysis
  - Apply draft EGS framework
  - Test feasibility of measurement with current data and tools
- Demonstrate benefit assessment techniques
  - Performance relative to no-action baseline
  - Use evidence from an extreme event (Hurricane Sandy)
- 2 month analysis period



# 3 Case Study Sites



# 1 Hurricane



# Streamlined Analysis Approach

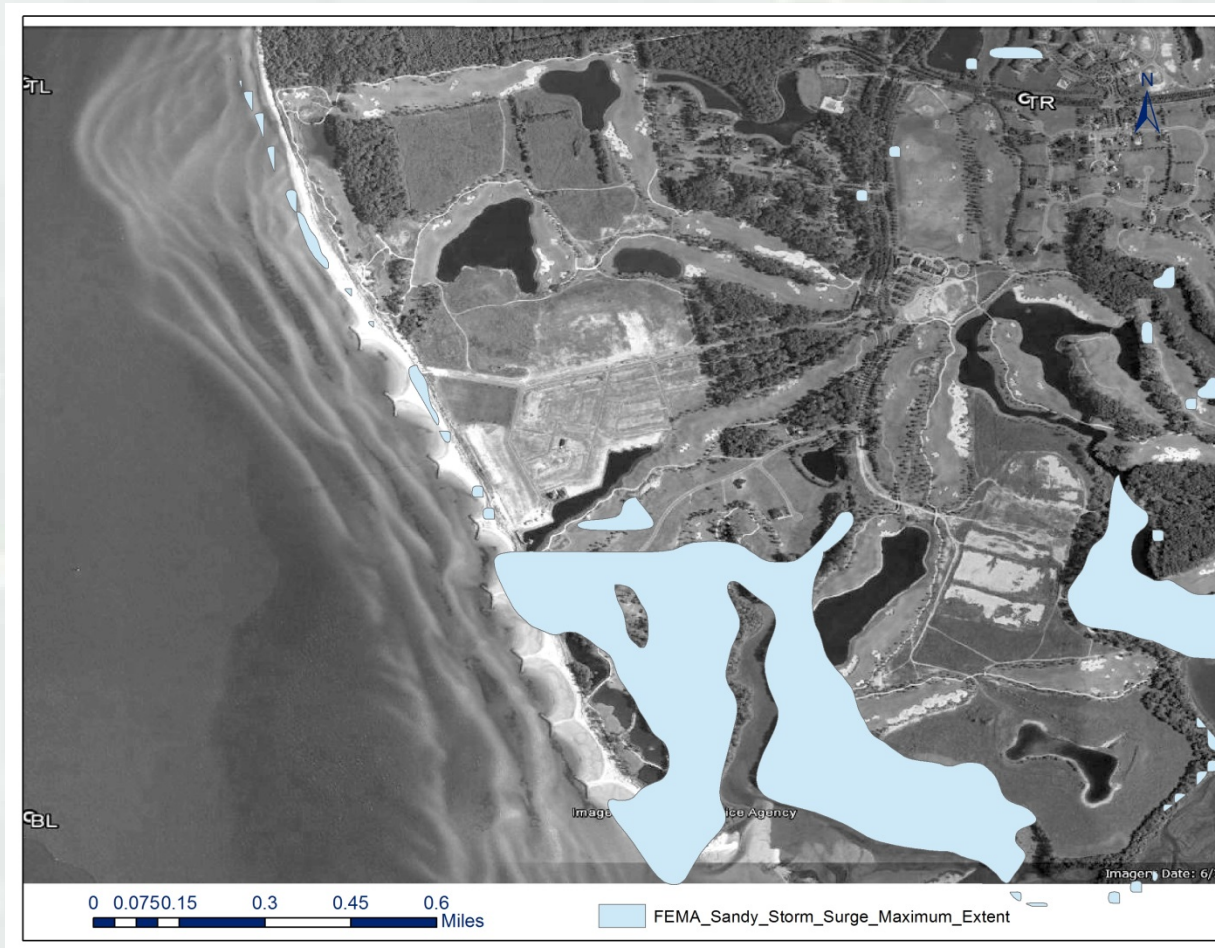
1. Identify EGS of potential interest
2. Choose the best benefit metrics
  - monetary values
  - quantitative benefit indicators
  - qualitative descriptors of benefits
3. Assess biophysical changes (**Response function**)
4. Assess per-unit value of changes for use services (e.g., value of a recreation day per user) (**Benefit function – Part A**)
5. Assess “market” size and extent (**Benefit function – Part B**)
6. Quantify importance of ecosystem sustainability services (**Ecoservice Production Function**)
7. Evaluate change in benefit metrics relative to the without project baseline



# EGS Analysis Summary

Service	Biophysical	Unit Value*	Market Size	Final Metric
Property protection	<ul style="list-style-type: none"> <li>- Area protected</li> <li>- Days of road closure</li> </ul>	<ul style="list-style-type: none"> <li>- Property value</li> <li>- Critical infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>- Homeowners</li> <li>- Commuters</li> </ul>	<ul style="list-style-type: none"> <li>- Property \$ value (built)</li> <li>- Commute time avoided</li> </ul>
Property enhancement	<ul style="list-style-type: none"> <li>- Change in beach width</li> <li>- Change in erosion rate</li> </ul>	<ul style="list-style-type: none"> <li>- % enhancement to current value</li> </ul>	<ul style="list-style-type: none"> <li>- Beach-adjacent properties</li> </ul>	<ul style="list-style-type: none"> <li>- \$ value of property enhancement</li> </ul>
Recreation - birdwatching	<ul style="list-style-type: none"> <li>- Change in bird habitat &amp; viewing areas</li> </ul>	<ul style="list-style-type: none"> <li>- Consumer surplus / day</li> </ul>	<ul style="list-style-type: none"> <li>- Recreators within driving distance</li> </ul>	<ul style="list-style-type: none"> <li>- \$ value recreation</li> </ul>
Recreation - beach	<ul style="list-style-type: none"> <li>- Change in beach width / erosion rate</li> </ul>	<ul style="list-style-type: none"> <li>- Consumer surplus / day</li> </ul>	<ul style="list-style-type: none"> <li>- Recreators within driving distance</li> </ul>	<ul style="list-style-type: none"> <li>- \$ value recreation</li> </ul>
Ecosystem sustainability	<ul style="list-style-type: none"> <li>- Habitat metrics</li> <li>- RTE species / ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>- Species rarity</li> <li>- Ecosystem rarity</li> </ul>	<ul style="list-style-type: none"> <li>- Nation / Ecoregion</li> </ul>	<ul style="list-style-type: none"> <li>% rare habitat/ ecosystem protected</li> </ul>
Climate mitigation	<ul style="list-style-type: none"> <li>- Net CO2e sequestration</li> </ul>	<ul style="list-style-type: none"> <li>- Social cost of carbon</li> </ul>	<ul style="list-style-type: none"> <li>- Nation</li> </ul>	<ul style="list-style-type: none"> <li>- Tons CO2</li> <li>- \$ value</li> </ul>

# Biophysical Metric for *Storm Surge Protection* Sandy Storm Surge at Cape Charles South



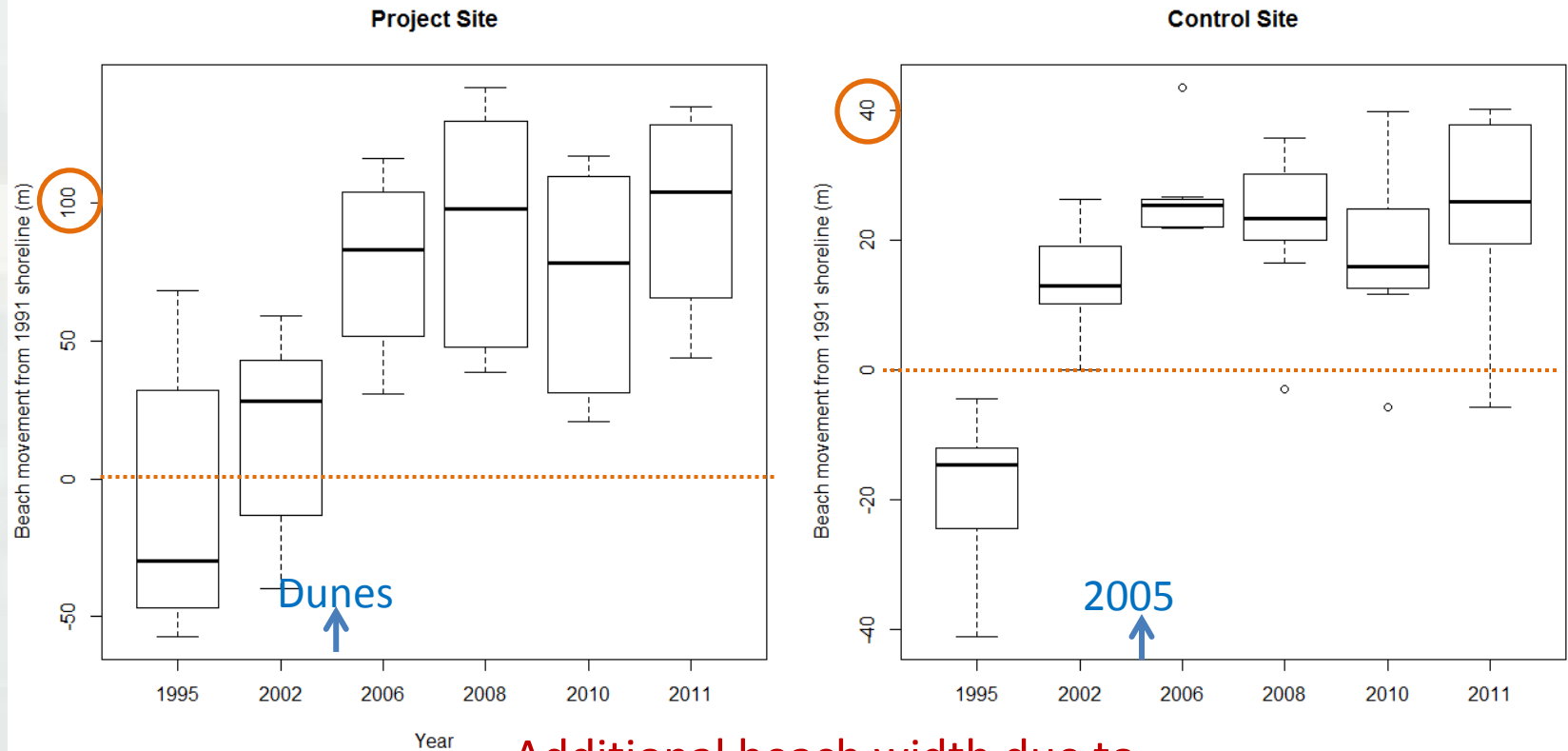
# Biophysical Metric for *Property Value Enhancement* Cape May Meadows





# Biophysical Metric for *Property Value Enhancement*

## Beach Movement at Cape May



**Additional beach width due to project = ~14 m (2005 – 2011)**

Movement = distance that shoreline edge has moved relative to the 1991 shoreline. Positive values are accretion and negative values are erosion. The project dunes were completed in 2005 and other improvements completed in 2007.

# Biophysical Metric for *Protecting Critical Infrastructure*

## Change in Horizontal Fetch at Cross Bay Bridge, JB



# Per-Unit Value of *Property Value Enhancement* Application of Economic Benefit Transfer

## Assess available data and models

- Literature search for primary valuation studies
- Search for benefit transfer function (i.e., meta-model)

## Develop transfer method

- Transfer function
- Average of relevant studies
- Single comparable study

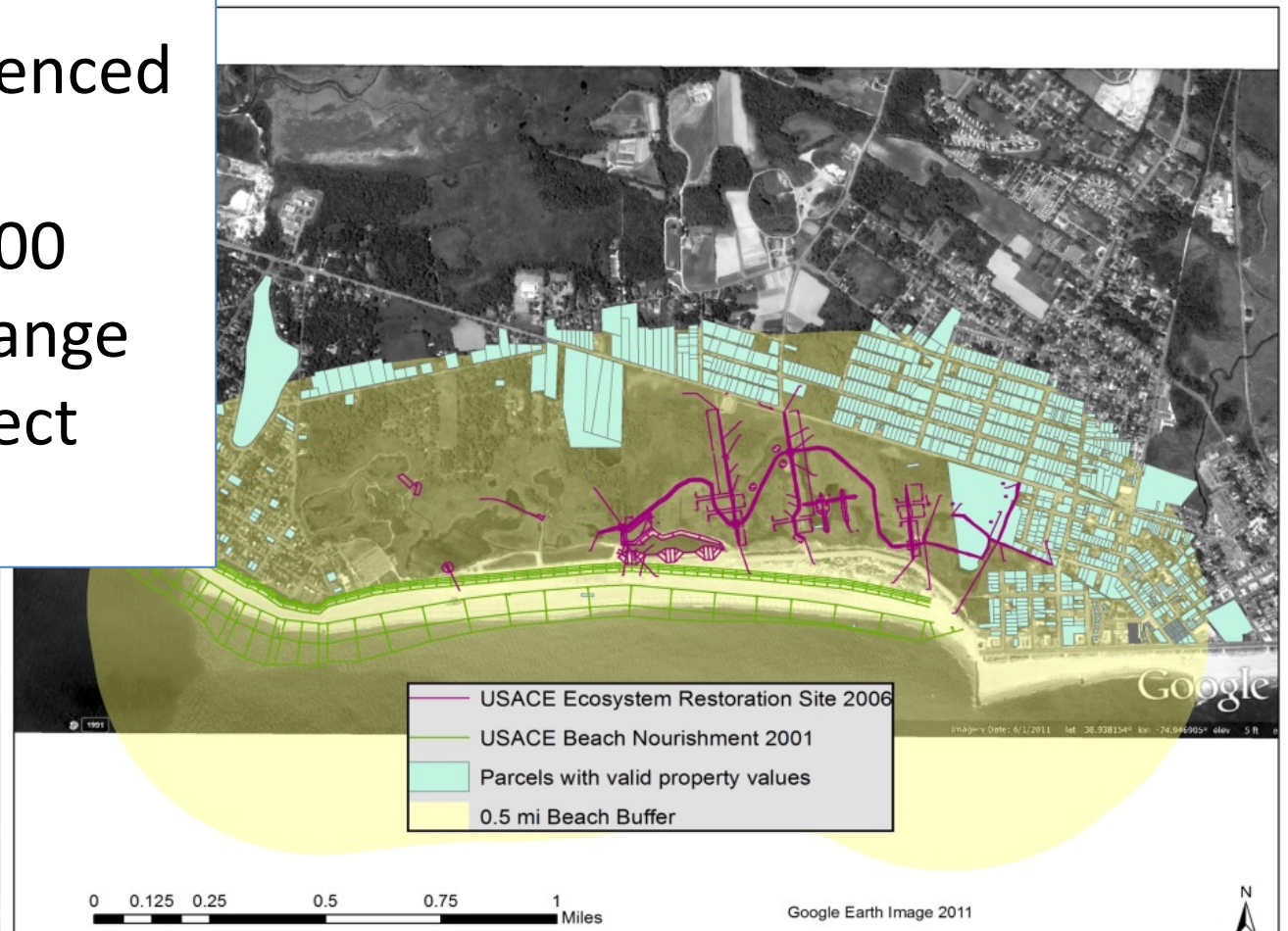
## Assess value per unit of biophysical change

- Value enhancement is a non-linear function of beach width
- 0.3% increase per foot of beach for all homes within a ½ mile buffer

# Market size analysis

## *Property Value Enhancement*

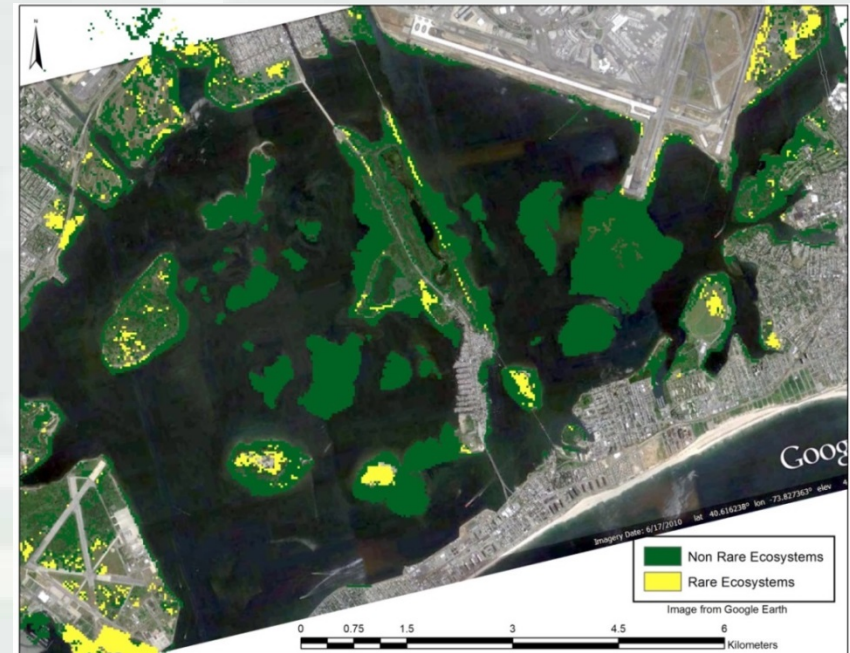
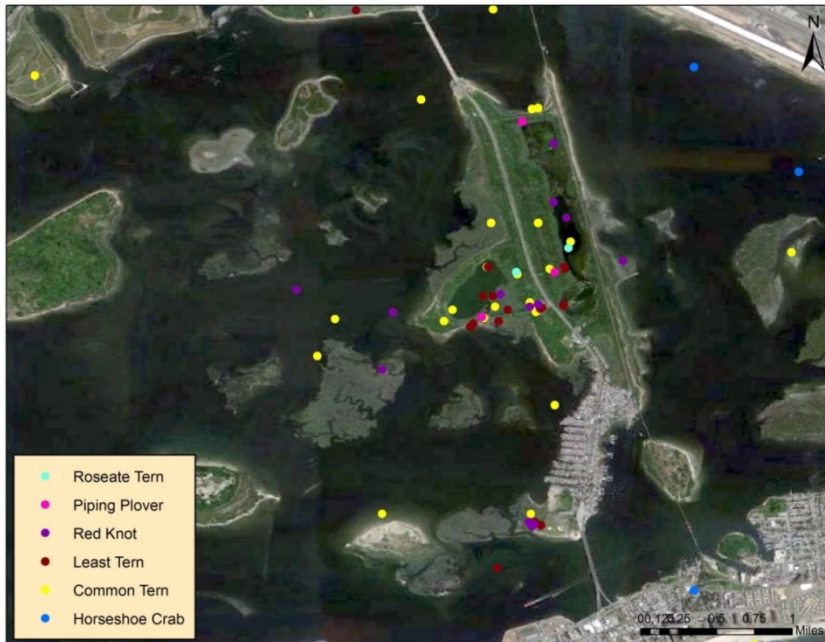
- Value of beach-influenced parcels  
\$574,554,000
- Value of change due to project  
**\$1,724,000**



# Non-monetary Benefit Indicator for *Ecosystem Sustainability* Jamaica Bay

**Species Biodiversity**  
BISON database

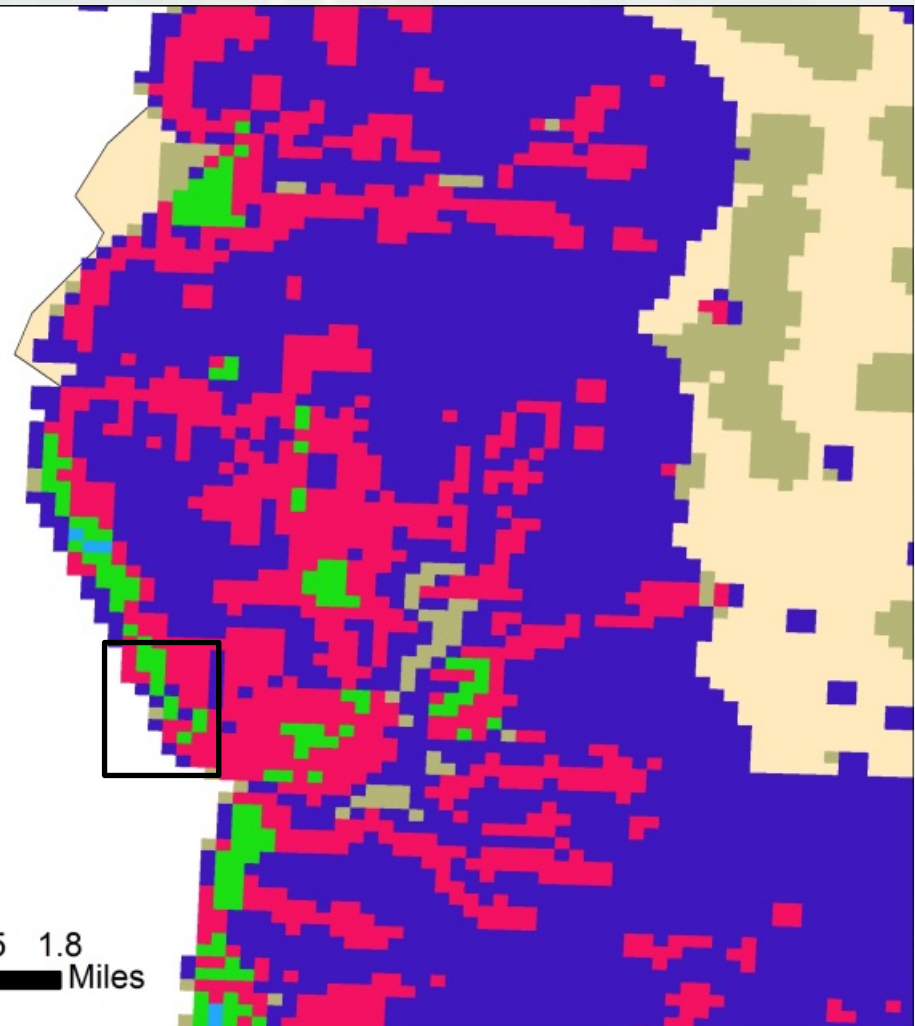
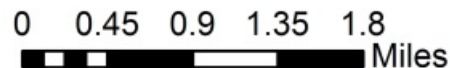
**Ecosystem Diversity**  
EPA EnviroAtlas



# Non-monetary Benefit Indicator for *Ecosystem Sustainability* Cape Charles South

Conservation  
Priorities  
(Landscape Chesapeake)

~8 acres in highest priority  
categories (4-5)  
within or adjacent to project



# Jamaica Bay Results

Ecosystem Service	Biophysical Change due to Project	Per-Unit Value	Market Size	Benefit Metric
Property protection	Not measurable from available data.			Property value as estimated by planners.
Critical infrastructure	161.4 acres of islands added. Horizontal fetch to the bridge reduced 54% and 64% when wind comes from the W or SW.	6.2 miles additional travel distance (if bridge damaged); 9 minutes of additional travel time / commuter (non-rush) and 18 minutes (rush)	Travelers using Cross Bay Bridge = 20,093 travelers per day	Total commuting time saved: <b>4,000 hours per day</b> of bridge closure
Property value enhancement	n/a			
Recreational beach use	n/a			
Recreational birdwatching & wildlife watching	161.4 additional marsh acres	Change in consumer surplus due to increased marsh area $\$76.34 * 7\% = \$5.34$	43,276 user days annually	<b>\$231,000</b> annual consumer surplus from wildlife watching
Ecosystem diversity	124 acres of Northern Atlantic Coastal Plain Dune and Swale added			Area of rare ecosystem added: <b>124 acres</b> Area as % of ecoregion: <b>0.2%</b>
Terrestrial species diversity				<b>25 SOC species; 86% of species of concern represented</b>
Conservation Priority	n/a			
Climate Regulation & Risk Reduction	287 metric tons CO <sub>2</sub> e sequestered per year (1.78 metric tons CO <sub>2</sub> e/acre salt marsh)	\$28- \$100 / metric ton		Total annual value of Carbon Sequestered <b>\$8,000 - \$29,000</b>

# Take Home Points

1. Public databases and state of the science are sufficient to produce reasonable metrics of relative site benefits
  - Comparable and generalizable - but not precise
  - Tailored to location conditions (but not site details)
2. Data for establishing *changes* due to project occasionally require use of “heroic” assumptions
3. Methods and metrics are designed to be transferable

