Restoring urban wetlands for increased coastal resiliency: needs and priorities in NYC

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Conference on Ecological and Ecosystem Restoration

July 28, 2014
Lost wetland values

**Habitat** — fish and horseshoe crabs spawning and rearing; bird feeding and nesting

**Water quality enhancement** — filtering, nutrient and pollutant absorption and uptake

**Recreation** — birding, walking, painting, fishing

**Storm and flood protection** — wave attenuation, storm surge reduction

**Climate regulation** — carbon sequestration
Hurricane Sandy inundation over historic wetlands
Goal: Restore and reconstruct marsh for habitat, water quality and other benefits

<table>
<thead>
<tr>
<th>Strategies</th>
<th>Tactics</th>
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<tbody>
<tr>
<td>Restore elevation, substrate &amp; hydrology</td>
<td>• Excavate historic fill</td>
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<tr>
<td></td>
<td>• Place clean sand to cap or reconstruct</td>
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<td>• Remove or breach berms</td>
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<tr>
<td>Restore and manage vegetation</td>
<td>• Control invasive plants (mechanically, chemically)</td>
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<td>• Remove anthropogenic marine debris</td>
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<td>• Remediate oil spills</td>
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<td>Reduce impacts</td>
<td>• Establish stable toe (erosion control)</td>
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<td>• Prevent dumping</td>
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<td>• Remove marine debris</td>
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</table>
Small scale salt marsh restoration
Fill removal, sand placement, berm breach

Calvert Vaux Pk (0.5 ac)
Pugsley Creek (1.2 ac)
Turtle Cove (2ac)
Soundview Pk w/ ACE (3.2 ac)
Large scale salt marsh restoration
Fill removal, sand placement

U.S.ACE & Parks: Gerritsen Ck (20 ac)
U.S. ACE: Jamaica Bay (>100 ac)
Completed coastal wetlands restoration / GI

Restoration in NYC since 1990:
>200 acres, >40 projects

- NPS
- City/State

Completed projects:
- Long Island Sound
- Arthur Kill
- Jamaica Bay

New York Harbor

NYC Parks
Next coastal restoration / GI opportunities?

Over 90 identified sites with coastal wetlands restoration / GI potential
- Local proposals (NY Rising)
- Regional plans (ACE CRP)
- Post-Sandy conceptual plans (RBD, ACE)

New context
- Increasing site constraints
- Vulnerability to SLR and other impacts
- Emphasis on coastal protection
Conceptual model for prioritizing sites

Synthesize data from landscape and field assessments (with additional metrics) to identify salt marsh most in need of management and restoration.
Framework for assessing restoration needs and opportunities

Field Analysis
- Ecological condition
- Anthropogenic impacts
- Elevation and erosion

Landscape Analysis
- Filled wetlands
- Recent historic loss
- Inundation modeling
- Marsh buffer conditions
- Hydraulics & geomorphology
- Socio-economic factors
Existing conditions: vegetation cover sampling

Long Island Sound

Jamaica Bay

Arthur Kill

NYC Parks
Mapped debris, fill and vegetation loss

Long Island Sound

Arthur Kill

Jamaica Bay
Long-term site-specific monitoring

Elevation Change and Accretion
(SETs - Surface Elevation Tables)

Vegetation (community type and above and below ground biomass indicators)

Erosion (lateral erosion at creeks and presence and rate of pool expansion)

Soil nutrients (nitrate and ammonia concentrations in soils)
Marsh restoration needs:

Boats

Treated wood debris piles

Miscellaneous floatable debris

Fill and construction rubble
Marsh restoration needs:

- Waters edge marsh loss
- Infrastructure impeding salt marsh
- Potential scour
- Tidal creek expansion
Opportunities for fill removal

Sunset Cove Park, Queens:
~7 acres of contaminated fill on historic salt marsh
Sunset Cove restoration project

Feasibility factors
- Fill height, extent and quality
- Community support
- Adjacent land use
- Ecological uplift
- Exposure

Remnant *Sp. alterniflora* edge at along the shore of our planned salt marsh restoration site.
Recent salt marsh loss

- Overlay 1974 salt marsh boundaries with 2012 mapping to calculate areas of marsh loss along the waters edge from 1974 to 2012

- Identify sites with greatest loss: 1974-2012

Example from Idlewild Park, Queens, NY
Feasibility of addressing marsh loss

Marsh loss (acres)

<table>
<thead>
<tr>
<th>SITE</th>
<th>0</th>
<th>10</th>
<th>20</th>
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<tbody>
<tr>
<td>Hutchinson Outer</td>
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<tr>
<td>Idlewild Outer</td>
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<td>Idlewild Inner</td>
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<td>Alley Creek Outer</td>
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<td>Pelham Bay Cove</td>
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<td>Spring Creek</td>
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<td>Pelham Turtle Cove</td>
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<tr>
<td>Saw Mill Creek Outer</td>
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<tr>
<td>Four Sparrow</td>
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<tr>
<td>Hutchinson Inner</td>
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<tr>
<td>Saw Mill Creek Inner 2</td>
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<tr>
<td>Fresh Creek</td>
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<tr>
<td>Pugsley Creek</td>
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<tr>
<td>Alley Creek Inner</td>
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<tr>
<td>Saw Mill Creek Inner 1</td>
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<tr>
<td>Arlington Marsh</td>
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<td>Westchester Creek</td>
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<td><strong>Average</strong></td>
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NYC Salt Marsh Trends Analysis, 1974 - 2012

Hutchinson River

Legend
- SAME
- GAIN, land_side
- GAIN, water_side
- LOSS, land_side
- LOSS, water_side
- POOLS
- RESTORED

NYC Parks
Inundation modeling

SLAMM (Sea Level Affecting Marshes Model): Alley Creek, LIS

What is percent likelihood of: Coastal Marsh Habitat Change Flooded Developed Land Open Water?
## Current priority sites

<table>
<thead>
<tr>
<th>No. of Sites</th>
<th>Total Size (ac)</th>
<th>Approx. Cost</th>
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<tr>
<td>25</td>
<td>117</td>
<td>$120,000,000</td>
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### Potential Restoration Tactics City-wide

- Landfill excavation
- Waterward Reconstruction
- Wrack/Debris Removal
- Lawn to Marsh Conversion
- Wave Break/Living Shoreline

NYC Parkland priorities in Jamaica Bay
Prioritization criteria

• **Political & community support**
  Regional plan, property type, committed NGOs, leveraging of related commitments / goals

• **Feasibility**
  Proof of concept, regulatory support, cost, construction access, technical complexity

• **Coastal resiliency value**
  Future change in inundation frequency, sustainability of design, inundation tolerance

• **Ecological value**
  Size, species of concern, connectivity to other coastal ecosystems
Partners

Natural Areas Conservancy
U.S. EPA, Region 2
NYS Dept. of State
NYS Dept. Environmental Conservation
U.S.ACE
NY-NJ Harbor Estuary Program
American Littoral Society
Jamaica Bay Ecowatchers
NYC DEP
New England Interstate Pollution Control Commission
Partners for the Delaware Estuary
NYC Parks interns
The Nature Conservancy

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