# URBAN WETLANDS PROTECTION AND RESTORATION: IDENTIFYING REGIONAL PRIORITIES

Report from the December 2010 Workshop

City of New York
Parks & Recreation
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# URBAN WETLANDS PROTECTION AND RESTORATION WORKSHOP: IDENTIFYING REGIONAL PRIORITIES

Columbia University, **December 1st, 2010**

## REPORT FROM THE WORKSHOP

## INTRODUCTION

Multiple planning efforts are underway in the City of New York and in the New York, New Jersey Harbor Estuary region that affect the management, protection and restoration of our wetlands and riparian systems. Within New York City, several agency initiatives are well underway - the Department of City Planning recently completed a revised Comprehensive Waterfront Plan, and the Mayor's Office of Long Term Planning & Sustainability (OLTPS) is preparing the update of PlaNYC 2030 to be released April 22, 2011. A deadline has also been set to develop a comprehensive wetlands protection strategy for New York City by March 2012. In addition, the Green Infrastructure Plan published by the NYC Department of Environmental Protection (NYCDEP) is focused on reducing stormwater runoff from 10% of New York City's impervious surfaces in watersheds with combined sewer systems in an attempt to reduce combined sewer overflows, treat stormwater as a resource, and improve water quality. Wetland system creation, restoration and management is integral to reaching this goal. At the federal level, the Army Corps of Engineers (ACE), the New York/New Jersey Port Authority, the New York-New Jersey Harbor Estuary Program (HEP), and partners are revising and further developing the Hudson-Raritan Estuary Comprehensive Restoration Plan (CRP) to highlight restoration opportunities throughout the region. A common goal in all of these planning efforts is to protect the functions and values of urban wetlands and stream corridors in the metropolitan region and maximize the benefits of these natural areas. To achieve this ambitious goal, wetlands experts across the spectrum of disciplines, from researchers to practitioners, are needed to provide input into this process and to help develop a sound and cooperative strategy and framework for evaluating wetland conditions, prioritizing protection, management and restoration actions, and tracking and evaluating where improvement is needed and where we are successful.

## NEW YORK CITY WETLANDS

### *Extent*

The wetlands and riparian systems in New York City vary widely in size, type and condition, and include diverse functions from regionally critical habitat for local and migrating birds and fish to flood management and recreation for human communities. Current estimates of wetland areas in the City come from New York State Department of Environmental Conservation (NYSDEC) wetland mapping (1970s, 1990s) and from U.S. Fish and Wildlife Service National Wetland

Inventory (NWI) mapping (1970, 1990, 2004)[1]. According to the NWI maps, which provide the most recent and most detailed (minimum size of 0.25 acres) wetland inventory, the City has approximately 4070 acres of salt marsh and 1670 acres of freshwater wetlands (~30% emergent wetlands, ~29% open water, ~7% scrub/shrub, ~34% forested wetlands)[2]. The largest wetland complexes are found in Jamaica Bay and the Arthur Kill watersheds, where tidal wetlands dominate. The wetlands in the south and eastern sides of Staten Island, part of the Lower Bay watershed, are dominated by freshwater systems.

In the past century, roughly 85% of the coastal wetlands have been lost in the New York-New Jersey Harbor Estuary[3] and well over 90% of the freshwater wetlands in the city have been destroyed[4]. In addition to wetlands loss, hundreds of miles of riparian corridors were developed, headwater streams were filled and piped, and higher order streams were straightened and disconnected from their floodplains through the typical course of urban development. Comparing current stream mapping to historical mapping[5], between 40-90% of streams in New York City have been buried or filled at about a proportion equivalent to the impervious area in the landscape. The greatest intact stream length remains in Staten Island, but even there most streams have been extensively modified directly or indirectly. Since the Clean Water Act, the rate of wetlands loss has been dramatically reduced in NYC, as around the nation. Nevertheless, incremental filling of State unregulated wetlands (wetlands smaller than 12.5 acres) and development in the wetland buffer areas has continued. One analysis comparing current development to the regulated wetlands first mapped by New York State in the 1970s suggests 3-9% wetland area has been filled in Staten Island alone[6]. Incremental loss of salt marsh in New York City has also continued due to a variety of on-going environmental stressors and impacts. At seven wetland sites around the city, historic photo analysis from 1974 to 1999 and 2006 show loss rates of 1-2% of the total salt marsh area per year[7].

Today, most of the City's wetlands are smaller than 3 acres in size, an indication of how fragmented our wetlands are -- they are also hard to protect, as NYSDEC only regulates wetlands greater than 12.4 acres[8]. Further, about 25% (ca. 800 acres) of the NWI freshwater wetlands in NYC do not overlap with NYSDEC mapping, and thus may not be protected by New York State. About 25% of City streams do not lie within wetlands regulated under NYSDEC, and even those that are might not be afforded regulatory protection following wetland delineation in the field since they often do not support obligate wetland vegetation. Despite the potential for headwater, intermittent and ephemeral streams to receive federal protection as "Waters of the United States" under Section 404 of the federal Clean Water Act, restrictions on activities that impact these streams are often not enforced.

### *Management and Restoration*

[1] *Unpublished NRG 2010 calculations from NWIs and NYSDEC wetland maps; Ralph Tiner, personal communication.*
[2] Unpublished NRG 2010, calculations *from NYC NWI data layers.*
[3] Regional Plan Association *2002*
[4] *PlaNYC Wetland Regulatory Gap Analysis*
[5] Unpublished GIS analysis by Eymund Deigel, *personal communication*
[6] Unpublished GIS analysis by Eymund Deigel, *personal communication*
[7] Unpublished NRG 2010, Mushacke 2006, Hartig 2002, 2003
[8] Except where DEC determines wetlands are rare or of unusual value

Given the fragmented nature of our wetlands and riparian systems, protection, management and restoration is challenging from a political, logistical and educational perspective. NYC Parks' Natural Resources Group (NRG) advocates for conservation, protection, restoration and management of wetlands and riparian systems, and has worked with partner agencies, such as the NYCDEP, NYSDEC and ACE, to implement wetland restoration projects in the City ranging from 1-22 acres in size. The earliest protection and management actions emerged from natural area inventories that led to fencing and removing dumped cars from forests and wetlands. In the 1990s, wetlands restoration efforts in the City were driven by spill response or outfall remediation (Arthur Kill and Willow Lake). Restoration projects continue today focusing on re-establishing appropriate hydrologic regimes, soils, and native wetland vegetation communities through fill removal, re-grading, clean soil placement, native plant installation, erosion control and invasive plant management.

Cost effective opportunities for restoration are increasingly difficult to find today, with high costs (and sometimes environmental impacts) of fill removal, site constraints, limited space, and competition for land. The establishment of sound, sustainable management and restoration goals is particularly challenging in our highly urban context with on-going environmental stressors and often-conflicting objectives for restoration. To prioritize sites and types of projects for restoration in the future, we need to better understand the constraints and potential for restoring a variety of ecological and social functions, and how these can be functions can be measured and assessed.

We also need to better understand how wetland ecosystems are best managed and protected as part of our green infrastructure providing these ecological and social services. As any infrastructure, green infrastructure requires maintenance and protection – this is true of our native wetlands, as well as new constructed wetlands systems in the landscape. Together with seeking funding for wetlands restoration and protection, we need to apply for green infrastructure capital dollars that can help with stormwater retention and parkland restoration, furthering the cause of wetlands conservation.

## WORKSHOP OBJECTIVES AND FORMAT

The goal of the workshop was to identify the key components of a comprehensive wetlands protection and management strategy that could help provide the framework for addressing the challenges of prioritizing and integrating wetlands protection and restoration. The issues we aimed to address included: objectives for wetland and riparian functions and conditions; assessment needs and techniques; protection, management and restoration priorities; and data gaps. Speakers from NYC Parks, the NYC Mayor's Office of Long Term Planning and Sustainability, the NY/NJ Harbor Estuary Program, and the NYSDEC at the beginning of the conference provided a background about the city, state and federal programs and policies relating to wetlands and aquatic resource protection and restoration. Presenters from the Columbia University, the National Oceanic and Atmospheric Administration (NOAA), Rutgers University, the Delaware Department of Natural Resources (DEDNR), and the U.S. EPA described climate change impacts to wetlands restoration, approaches to analyzing and assessing wetland condition and adaptation opportunities, and restoration efforts to date. Four topics were identified for in-depth discussion in breakout sessions: wetlands assessment protocol, coastal restoration priorities and planning, urban freshwater wetlands and riparian restoration targets, and performance measures in urban wetlands

restoration case studies. Presenters started each session with case studies or other relevant examples. A moderator in each of the sessions led the participants in responding to several questions aimed at helping to identify the most important recommended steps for each topic. Following the breakout sessions, participants reconvened in a plenary session to summarize the discussions in the groups. The U.S. Army Corps of Engineers closed the workshop with a presentation on next steps for the Comprehensive Restoration Planning that will address issues raised in the workshop.

## SUMMARY OF RESULTS AND RECOMMENDATIONS

- A conceptual ecological model of wetlands and riparian systems for NYC is needed to guide policy and assessment.
  - Develop a conceptual ecological model for critical wetland systems and sub-systems.
  - Identify, as part of the modeling process, stressors, risks and controls on wetland conditions and function.
  - Identify target conditions for NYC wetlands.
  - Identify target functions for NYC wetlands and how they can contribute to and be protected by green infrastructure.
  - Clarify the gaps in the mapping and inventory of wetlands in NYC.

- The condition and function of wetlands in NYC needs to be described and assessed in a way that is clear, uniform, and useful for identifying and prioritizing restoration opportunities and evaluating restoration success.
  - Select metrics with clear, demonstrated relationships among measures of condition, management actions and objectives.
  - Establish reference, or best obtainable, sites/conditions to anchor and calibrate metrics.
  - Completely analyze data already collected to identify, potential reference sites, impacts and management implications.

- Coastal or tidal wetland assessment is a priority given the impacts of Sea Level Rise and requires coordination between researchers to agree on critical metric and improve our collective spatial understanding of wetland condition.
  - Develop objectives for tidal rapid assessment in field based on Delaware protocols.
  - Increase the spatial coverage of accretion and elevation data available
  - Assess potential horizontal migration opportunities using mapping techniques demonstrated by Rutgers in NJ, or TNC on Long Island and elsewhere.
  - Verify how tidal restoration designs are currently addressing this issue.

- Wetland restoration projects should develop from and be prioritized according to clearly identified needs, clearly stated objects, and science-based expectation of outcomes and performance.
  - Agree on performance metrics for restoration objectives and assure these metrics correspond with conditions assessment metrics that reflect functions of interest.
  - Coordinate with the Hudson-Raritan Comprehensive Restoration Plan and Restoration Feasibility Studies to develop consensus for criteria and metrics.
  - Coordinate with NYS DEC in developing metrics needed for assessment and

restoration to meet regulatory requirements for protection.

## ACTION ITEMS

- Initiate quarterly meetings in conjunction with the HEP restoration workgroup, inviting relevant experts and stakeholders from the Dec 1st workshop, to cooperatively set priorities and determine necessary steps, including:
  - Integrating comprehensive wetland protection restoration and management recommendations into the CRP framework.
  - Developing a conceptual model to describe NYC wetlands ecosystems and inform target conditions.
  - Identifying objectives (e.g. management and restoration goals) that a wetlands assessment that can be built upon.
  - Review appropriate conditions assessment protocols that can meet objectives identified
  - Identifying priority wetland ecosystem types, locations and projects.
  - Secure funding for wetlands assessment and monitoring, protection, restoration and maintenance.

- Meet with the ACOE, HEP and NOAA to develop clear definitions of information needed to assess restoration opportunities and track completed restoration projects:
  - Current impacts / degraded conditions.
  - Processes / actions through which degradation / impacts will be reversed.
  - Restoration/management targets habitat types and conditions.
  - Restoration performance standard metrics.
  - Anticipated maintenance and adaptive management needs.

- Develop criteria for selecting sites for additional SET installation and establish technical advisory group, beginning with conference call of SET users.

- Arrange for training on the Delaware Tidal Rapid Assessment Protocol to get a better understanding of the details of the methodology and applicability for objectives in NYC context.

- Seek mechanism and funding for improved elevation to be used in coastal inundation, hazard assessment and marsh migration analysis,
  - Work with Mayor's Office to determine extent to which existing LiDAR data covers coastal wetland areas and if and where data gaps exist for specific analyzes.
  - Review applicability of TNC analysis of Long Island Sound shorelines, including NYC at the far western edge of LIS for prioritizing salt marsh protection.
  - Determine data needs and funding mechanism to conduct horizontal marsh migration analysis to determine the few locations in NYC where this adaptation strategy may be feasible.

- Identify opportunities to promote green infrastructure in wetlands and aquatic system protection, as well as in the expansion of wetland system functions throughout the landscape.

## BREAKOUT GROUPS (A-D) SUMMARIES

## GROUP A. WETLAND RAPID ASSESSMENT PROTOCOLS (RAP)

*David Maddox, Moderator*
*Marit Larson and Amy Jacobs, Presenters*

**GOAL:** Discuss and agree upon feasible objectives for a Rapid Wetland Assessment Protocol (RAP) in support of wetland protection and restoration planning in our urban context.

**PREMISE:** To improve our management and protection of wetland and riparian systems and to set appropriate management and restoration objectives and priorities, we need to better understand the conditions and functions of wetlands in NYC and the urban metropolitan area. We need to know how conditions are changing over time, the relative condition of the different types of wetlands in the urban landscape, and the ecological and physical processes and stressors that are controlling their conditions and functions to make the best decisions for individual sites as well as for whole types of wetlands and riparian system. Given resource limitations, a program to conduct a comprehensive wetlands conditions assessment within NYC or the Hudson-Raritan Estuary Comprehensive Restoration planning regions may not be feasible. However, we may be able to obtain meaningful information about the numerous wetlands in the estuary watersheds using a rapid assessment protocol (RAP). A RAP should be compatible with regional datasets, so that there might be consistency across programs, and should both inform and be informed by planning efforts and regional management questions.

## GROUP A. RESPONSES TO QUESTIONS

1. **What is the primary goal for conditions assessment and how do we want to use the information?** *To identify wetlands for protection? Identify or prioritize wetlands for restoration? What management questions do we want to answer or decisions do we want to make?*

    - Inventory / Survey: document distribution, abundance and change (from existing mapping) in wetland type and area.

    - Document relative condition (using metrics that incorporate indicators of function) defined as departure from reference (best reasonably obtainable conditions) and identify impaired functions (e.g. loss of ecosystem services). Determine condition of:
        1. Wetland types (coastal, freshwater emergent, swamp forest, scrub-shrub, open water). Which wetland types are typically in best condition / most resilient?
        2. Significant wetland areas / complexes (Jamaica Bay, Arthur Kill, Pelham Bay, Alley Creek, Greenbelt, Blue Heron). Which significant regions are in the best condition and within these regions where should we focus our attention?

- Identify sites for management actions and conditions (associated with functions) where interventions are possible / needed to impact specific ecosystem services.
    Actions such as: facilitate horizontal migration by preserving buffer or removing road or culvert; remove invasive plants; increase riparian buffers; excavate fill; limit access.

2. **What kind of sampling design do we need?** Do we survey all wetlands? Statistically sample condition? Focus on a subset of wetlands for those specific management questions?

    For the purposes of an inventory or survey, or characterization of wetland types across the city, a sub-sampling design would be used (probably some form of stratified sampling). To document wetland conditions in a region or subwatershed of interest, all wetlands might be sampled. The sampling design must be developed based on the objectives for the assessment program.

3. **What is a minimum set of metrics that should be applied equally and consistently across sites in the region?**

    Conditional and functional assessment protocols developed across the country provide examples of detailed lists and rationales for choosing metrics. These references should provide the source of metrics selected for the assessment objectives prioritized in NYC. Ultimately, the metric chosen will depend on the final goals of the monitoring and the critical drivers and states identified for the wetland ecosystems of interest.

## GROUP A. PRIORITY NEXT STEPS

- Develop a conceptual model for relevant NYC wetland systems and subsystems
    - Convene relevant experts and stakeholders and hold a workshop to create a useful ecological conceptual model of relevant NYC wetland systems.
    - Define the ideal state (or best obtainable, i.e. "target") for NYC wetlands (consider wetland type, distribution, condition, function, controlling processes and management).
    - Identify conditions/state, and the most important controlling factors, stressors, or drivers that cause change, for each wetland type.
    - Relate management goals to beneficial use / ecosystem functions.
- Refine the goals for wetland assessment in NYC based on the conceptual modeling workshop and management goals and develop a useful and actionable protocol.
    - Use the model and the assessment goals to define the metrics:

        - Develop a clear relationship between these measures of condition and the goals
        - Use different stressors to create stratified scores that are specifically tied to different goal
        - Develop sound criteria for selecting appropriate actions
        - E.g. if the objective is to determine where to actively manage, select conditions/stressors to measure which are likely to be most affected by management actions (both positively and negatively).

    - Evaluate assessment methods developed in DE and CA and determine which metrics and what methods work with our model and assessment goals.

    - Make sure that selected stressors/metrics can be effectively/consistently measured rapidly if they are to be part of the rapid assessment (responsible, sensitive, redundant)

    - Establish reference, or best obtainable, sites/conditions. Metrics based on these reference conditions should:
        - Suggest targets for improvement after management
        - Serve as a proxy for function (based on an empirical relationship between condition and function (e.g. Level 3-4 monitoring under the DE DNR protocol)

- Completely analyze data already collected to identify, for example: potential reference/best obtainable sites, potential invasive plant removal needs, or, impaired water quality.

- Propose a plan for coastal wetland assessment

    - Focus on sub-set of goals that can be achieved with limited available staff resources and partnerships

    - Schedule tidal wetlands rapid assessment protocol training with DE DNR.

## GROUP B: COASTAL WETLANDS RESTORATION & PROTECTION PRIORITIES IN FACE OF SLR

*Aaron Koch, Moderator*
*Nicole Maher, Richard Lathrop, Presenters*

**GOAL:** Identify partners, data needs and strategies for assessing short and long term coastal wetland vulnerability and adaptability to sea level rise (SLR)

**PREMISE:** To maintain healthy urban wetlands in the face of sea level rise, we need to understand which wetlands are likely to be vulnerable and how we might improve the resilience of these areas through restoration or protection efforts. There are multiple inundation mapping and storm-modeling efforts already occurring in the region by various agencies under various jurisdictions with different objectives. We need to be clearer about what these scenarios mean for short and long-term wetland vulnerability, what our options are to protect them, and what this means for the way we manage and prioritize efforts. Part of the effort to understand what these scenarios mean will be to monitor a variety of wetlands with different known influences and evaluate their ability to keep up with SLR. Evaluation of wetland viability will likely be easier in areas where sediment elevation (SET) tables are being installed, as it is very difficult to determine solely by visual assessment whether or not a marsh has enough "elevation capital" (an apparently healthy marsh could in some cases be highly vulnerable to SLR). Our options to protect marshes include removal of barriers to upland migration, shoreline realignment (retreat), and enhancement through sediment trapping, or even beneficial use of dredge material to augment subsiding marshes.

## GROUP B. RESPONSES TO QUESTIONS

1. **What do we need to know (what parameters should be measured) to assess tidal marsh vulnerability and maximize protection & functions of coastal wetlands?** Who is collecting this information now?
    - How extensive are our tidal wetlands—an updated wetland inventory is needed
        - The current National Wetlands Inventory (NWI) produced by US Fish & Wildlife Service is based on aerial photographs from the mid-1990s for Staten Island and the Bronx and from 2004 for Brooklyn and Queens.
        - NYSDEC wetland mapping was redone in 1999; however only the 1974 mapping is official for jurisdictional purposes.
    - How vulnerable are our wetlands to sea level rise (SLR) – this requires information on sediment inputs, accretion rates, belowground, etc.
    - If our local marshes cannot keep pace with sea level rise can they shift inland (including through impediments removal) to ensure long term habitat survival.

- Two models to assess salt marsh habitat vulnerability were discussed. The Rutgers model could likely provide a quicker, larger-scale assessment of vulnerability whereas the TNC approach may be better for finer resolution applications.
    - The Nature Conservancy (TNC) in Suffolk County, in partnership with NOAA's Coastal Services Center, Columbia's Center for Climate Systems Research/GISS, Pace's Land Use Law Center, and the Association of State Floodplain Managers, is using LiDAR data, multiple sea-level rise scenarios, and geo-referenced aerial imagery to show likely range of inundation and impediments scenarios.
    - Richard Lathrop, at Rutgers, demonstrated a GIS technique for assessing vulnerability, applying a 500 m buffer retreat zone surrounding marshes. If there is a constraint (e.g. "developed" land cover or roads) along this buffer, that portion is categorized as "limited by development constraints." SLR scenarios are overlaid onto these maps to show areas where impediments and sea level rise combine to create high vulnerability.

2. **How we can leverage or add to existing monitoring, modeling and mapping efforts to get this data?** (e.g. SET monitoring network, SLAMM model, filling gaps in LiDAR data)
    - Models
        - Evaluate if the Rutgers and TNC models can be used for a coarse initial vulnerability assessment without more detailed elevation data.
        - Sea Level Affecting Marshes Model (SLAMM) can be added to the TNC model to include accretion rates to incorporate a more accurate idea of vulnerability.
    - Elevation data
        - Use SETs to determine a wetland's "elevation capital." NPS has several years of data from SET benchmarks in Jamaica Bay. NYCDPR has started to collect data from SET benchmarks at Pelham Bay Park and Udall's Cove Park.
        - It was noted that there is still a great deal of uncertainty associated with LiDAR data when applied to marsh elevations. The error margin can be larger than expected.
    - Identify where coastal / tidal restoration efforts can be aligned with city flood protection efforts and provide a potential source of funding in the future.
3. **What viable strategies are available for adapting to SLR** (sediment nourishment, landward migration, adjustments to restoration design, etc.)**?**
    - Removal of impediments for priority marshes. Using proposed Rutgers and TNC mapping tools, impediments could be prioritized for removal.
    - Shoreline realignment (aka shoreline retreat): initiatives needed to identify areas where planning and zoning should be changed to prevent future harm to both wetlands and structures.
    - Sediment nourishment projects including through beneficial reuse of dredged material (e.g. NPS with ACE and other federal and state partners are augmenting marshes at Elders Point East and West to restore subsided marsh islands).

- Using living shorelines and breakwaters in restoration designs was not discussed explicitly, but could hold promise for certain sites for attenuating wave energy. These tactics cannot combat SLR, but may build resilience by reducing erosive action in certain areas on a case-by-case basis.

4. **How should we prioritize candidate sites for the above strategies - restoration, upland protection, or other action** (e.g. SLR inundation, distance from to first landward migration barrier, sites with most Targeted Ecosystem Characteristics - TECs, etc.)?

   Prioritization should take into account subsidence rates, the ecosystem services provided by that marsh (including public education), and the restoration/protection potential.

## GROUP B. PRIORITY NEXT STEPS

- **Improve our understanding of the effects of SLR on marshes harbor-wide**
  - Advance elevation and accretion data and understanding in tidal marshes.
  - Increase coordination between existing accretion, nutrient loading, and sedimentation-transport research to improve our collective spatial understanding of wetland condition vulnerability.
- **Determine viable adaptation strategies for the long term**
  - Examine and review existing policies to determine if new policies are warranted for:
    - Proactive planning and reactive post-disaster realignment options for surrendering low-lying built areas to new marshland.
    - Shoreline realignment (retreat) or rolling easements if appropriate in NYC.
    - Citizen education about climate change adaptation.
    - Streamline opportunities for conducting beneficial reuse of dredged material. Elders Point Marsh is a case study for difficulties and successes.
    - Evaluate ways to minimize impacts and expand potential benefits from harbor deepening on restoration activities.
  - Identify impediments to upland migration of salt marsh
    - Develop a proposal to use Rutgers model for a larger-scale assessment of vulnerability, or a model similar to that used by TNC in Suffolk County for a smaller pilot area.
    - Assess the feasibility of removing or minimizing certain impediments through removal or new or upgraded infrastructure (such as culverts).
- **Identify restoration and protection priorities.**
  - Informed by data highlighted in priority action #1, determine best-bet actions for continuing to restore degraded and protect healthy wetlands over the long-term.
  - Review current restoration methods to determine whether targets, designs or protocols need to be changed to reduce or delay adverse SLR impacts.
  - Analyze where flooding and inundation of wetlands from SLR can cause severe economic impacts and consider applicability of sediment nourishment (such as occurred at Elders Point).

## GROUP C. PROTECTING AND RESTORING URBAN FRESHWATER STREAMS AND WETLANDS

*Ellen Pehek, Moderator*
*Ellen Pehek, Shandor Szalay and Lance Butler, Presenters*

**GOAL:** Develop criteria for prioritizing urban freshwater wetlands & riparian restoration – what functions and values are we trying to protect and achieve.

**PREMISE:** From both **w**ithin NYC and the Hudson-Raritan Estuary there are thousands of acres of relatively small freshwater wetlands (from <1 to over 12 acres in size), or roughly 2% of the pre-European wetland extent. Depending on their size, configuration, condition, level of disturbance, hydrogeomorphology and position in the landscape, these wetlands provide a variety of functions including refuge, rearing, breeding and forage habitat for myriad aquatic system dependent and upland species, forage sites, corridors for wildlife passage, ecological biodiversity, seed banks, cooling, water quality polishing, storm water detention and retention, and passive recreational habitat. To best manage these diverse, fragmented, wetlands and riparian areas that often do not receive full regulatory protection due to their small size, we need to prioritize our management objectives and strategies.

## GROUP C. RESPONSES TO QUESTIONS

1. **What functions and values are most critical in our urban freshwater wetlands & riparian systems** (e.g. species specific habitat, biodiversity, stormwater capture/filtration, cooling, passive recreation, aesthetics, etc.)? Do these functions and values ever conflict?

    - Habitat for specific species and communities of species
        - Dusky and spotted salamander take refuge in the cooler micro-climate of seeps and springs, particularly in an area influenced by the urban heat island effect and/or global warming
        - Disturbance tolerant species, such as beaver, thrive in naturally accumulating fluvial sediment in floodplains.
        - Wood frogs live in small, isolated pools, which can be unique to urban areas.
        - Small wetlands can support locally rare species, such as salamanders, in urban areas

    - Habitat diversity, connectivity, and energy regulation
        - Ecological dynamism associated with fluvial systems can create new habitat niches and increase habitat diversity.
        - Natural wetlands, even in urban environments, provide needed space the green infrastructure, such as bio-retention basins, cannot provide.
        - Riparian or wetland corridors increase access to habitat space for certain species.
        - Headwater streams provide organic matter processing, and regulation of nutrients, water and sediment downstream.

    - Stormwater and water quality management through retaining natural drainage corridors and depression storage provided by wetlands helps:

- Slow flow and reduce erosion power
- Retain stormwater in the landscape for plant uptake and habitat value
- Reduce flooding locally and downstream
- Save money on gray infrastructure.
- Improve water quality by mechanical filtration and biogeochemical processes.

- Public health?

- Educational benefits
  - show wetland value and functions to urban residents
  - provides opportunity for outdoor education

- Stormwater management is often seen as the main goal, with biological systems, ecology, & habitat as ancillary benefits. This creates a conflict because sedimentation supports specific species, but dredging is needed to keep stormwater flow at the desired level for stormwater management. Dredging disrupts biological development- sets the grow clock back to zero.

2. **What processes/stressors/ impacts impair these functions and values?**
   - Development that disturbs the hydrologic regime the more frequent and higher volume flows.
     - Some regulation of new development requiring stormwater retention onsite can help mitigate impacts. Problem is laws can have loopholes—as they do in Pennsylvania.
     - Funding is limited; public development can fund BMPs to help deal with stormwater.
     - When space is constrained, values have to be weighed and choices made
   - Climate change
   - Dumping and encroachment (including fragmentation)
     - ATVs
     - Not well defined boundaries and trails
   - Invasive plants
   - Eutrophication, as result of point and non-point sources and sedimentation
   - Deepening or flooding of emergent wetlands

3. **What are the most promising restoration and management strategies that address these stressors/impairments?** When should these strategies be applied?

   - Creating wetland and CSO maps, analyze and target:
     - Wetlands and riparian areas to be protected, such as headwater streams
     - Wetlands for stormwater management
       - Stormwater utility could be created to pay for wetland maintenance
       - Private funding for maintenance, such as NYCDEP's Adopt-A-Bluebelt program
       - Contractor maintenance of wetlands to meet stated goals
       - Appropriate design:
         - Keep the stormwater receiving area small
         - Build sedimentation and accretion into the system

        - Consider size of wetland vs. size and sediment load in watershed to achieve suitable degree and rate of sedimentation for biological communities.
    - Seeps, wetlands, and springs identified through thermal energy mapping. Used in Philadelphia to detect leaks in pipe infrastructure. It creates a heat signature for different types of wetlands that make them readily identifiable.
- Land acquisition strategies for protection
- Education- educate the public about the ecological and biological value of wetlands
    - Aesthetics- show how beautiful wetlands can be
    - Identify neighborhoods by watershed so that everyone knows what watershed they are in, and conduct outreach and education by watershed. Philadelphia has a good example of how this has been done.

## GROUP C. PRIORITY NEXT STEPS

- Identify, inventory and map freshwater wetlands (determine if mapping is adequate).

- Assess wetland quality (condition or function).

- Promote importance of freshwater wetlands as green infrastructure, and as beneficiary of green infrastructure:

    - Natural wetland benefits/ecological services should be quantified to extent possible, and protected and managed as a resource.

    - Constructed wetland should be promoted for water quality, flood management, and other ecological services; Stormwater must go into an off-line system before going into an existing wetland so that nutrient and sediment loading does not degrade existing native wetlands.

- Consider opportunities for community education; e.g. naming wetlands make people care more about them.

- Advocate for next steps for wetland protection under NYC's Wetlands Transfer Task Force (WTTF).

- Create goals, target sites, and quantifiable restoration or protection targets.

- Consider freshwater wetlands in their watershed context and create additional geographic and community zones for concentrated restoration efforts.

## GROUP D. URBAN WETLANDS RESTORATION CASES STUDIES: DEFINING AND MEASURING SUCCESS

*Michael Feller, Moderator*
*Sven Hoeger, Terry Doss, Peg McBrien, Bill Young, Presenters*

**GOAL:** Identify key criteria and measures of success (or failure) for restoration projects using examples of salt marsh, shoreline, and freshwater wetland restoration projects in the urban NJ/NYC environment.

**PREMISE:** Wetland restoration projects are mainly conducted to satisfy compensatory mitigation, grant-funded ecosystem and habitat creation or enhancement programs, or as water quality infrastructure. The criteria for measuring success in NY are derived from the NY Department of State wetland monitoring guidelines that prescribe five years of monitoring of flora and fauna. Are existing monitoring schemes suitable for assessing success of projects in the following CRP TECs: 1) Coastal Wetlands, 2) Shorelines and Shallows; 3) Enclosed and confined waters; and 4) Tributary Connections)?

### RESPONSES TO QUESTIONS

1. **What are our main goals, region-wide for wetlands restoration** (i.e. to what end are we restoring)?
    - Restore maximum functions and values as determined from reference site comparisons. Characteristics may include provisions for key species. Crucial is maintaining the appropriate hydrologic regime.
    - Goals for salt marsh restoration are often general and diffuse relating to landscape- and region-scale habitat and water quality issues.
    - Fresh water wetland restoration goals are often particular landscape- and site-scale water quality criteria including flow attenuation, pathogen reduction, nutrient and sediment capture, etc.

2. **In the light of our experience (case studies), how should we define and measure success for wetlands restoration in the ultra-urban environment?** What are the primary performance standards by which we should measure success (ideally standards relevant to goals for habitat and for ecosystem services)? Over what timeframe?
    - Survivability and colonization of planted species;
    - Mortality and decrease in plants targeted for removal;
    - Dynamics equilibrium within acceptable ranges (i.e. sediment accretion, slope erosion, or channel migration);
    - Colonization by or benefit to target plant and animal species; and
    - Specific program goals such as explicit water quality criteria.

Responding to needed timeframe—because wetland restoration is an evolving science there is inadequate information to determine if three to five year monitoring requirements is

appropriate. While initial monitoring helps determine if early restoration targets are met, the longer term stability of a site may not be assured.

3. **What are the major barriers to achieving performance standards for each of the 3 TECs discussed here?** Now? In the Future? Why?
    - Disturbance to the system from adjacent land;
    - Invasive species can be more problematic in brackish and freshwater marshes than in salt marsh restoration where salinity is limiting resulting in less vulnerability to invasive species.
    - Lack of personnel resources for needed maintenance and management (e.g. early invasive vegetation management);
    - Major barrier is space for inland migration. Steep slopes, roads, other infrastructure limits extent of wetland flux;
    - Herbivory.

4. **What are our main goals, region-wide for wetlands restoration** (i.e. to what end are we restoring)?
    - Flood control;
    - Habitat improvement;
    - Water quality protection and enhancement;
    - Visitor experience (recreation, education).

5. **In the light of our experience (case studies), how should we define and measure success for wetlands restoration in the urban environment?** (How will we quantify the results of our efforts?) Propose 5 performance standards by which we should measure success (ideally standards relevant to goals for habitat and for ecosystem services).
    - Plant percent cover and species distribution;
    - Invasive species recruitment;
    - Indicator species status;
    - Water quality criteria;
    - Target wildlife inventory.

6. **What are three priority recommendations for better evaluating restoration success?**
    - Three priority recommendations:
    - Begin with good baseline data reflecting existing site conditions;
    - Use a reference site/system to develop clear goals;
    - Develop site-specific monitoring plans employing explicit performance standards geared toward adaptive management practices.
    - Formulate consistent, reproducible, practical site management guidelines built with consensus between partners and stakeholders.

## PRIORITY NEXT STEPS

- Develop a functional assessment methodology manual based on the best of existing protocols, for example Evaluating Planned Wetlands (EPW), NY/NJ Harbor Estuary Program monitoring guidelines (HEP), NY Department of State (DOS) and others.

- Develop the methodology as a product of consensus created by working group of scientists and practitioners and be based on measurable metrics related to characteristics of reference site.

- In the methodology development, place equal emphasis on the relevant, reproducible monitoring data, as on ensuring that the methodology is practical and easily implemented.

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(Continued below)

Breakout Groups Topics: A. Wetlands assessment objectives; B. Coastal restoration priorities and planning; C. Urban freshwater wetlands & riparian restoration targets; D. Urban wetlands restoration case studies – defining and measuring success

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Breakout Groups Topics: A. Wetlands assessment objectives; B. Coastal restoration priorities and planning; C. Urban freshwater wetlands & riparian restoration targets; D. Urban wetlands restoration case studies – defining and measuring success