



Citywide Ecological Assessment: A Tool for Prioritizing Restoration and Management in New York City

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Introduction

New York City has 10,000 acres of natural areas: forests, wetlands, and meadows within the 30,000 city-park system. There are another 20,000 acres of parkland managed by federal, state, and other city entities (Figure 1). Natural areas are defined here as lands that are specifically set aside, protected, and managed to maintain biological diversity and promote passive public recreation activities.

The Natural Areas Conservancy (NAC) was launched in 2012 as a not-for-profit working in partnership with the New York City Department of Parks & Recreation (Parks) to protect, restore, and manage the expansive natural areas within the urban park system in New York City.

In 2013, the NAC initiated the first-ever citywide ecological assessment of natural areas to guide the creation and implementation of science-based decision-making tools to achieve conservation goals.

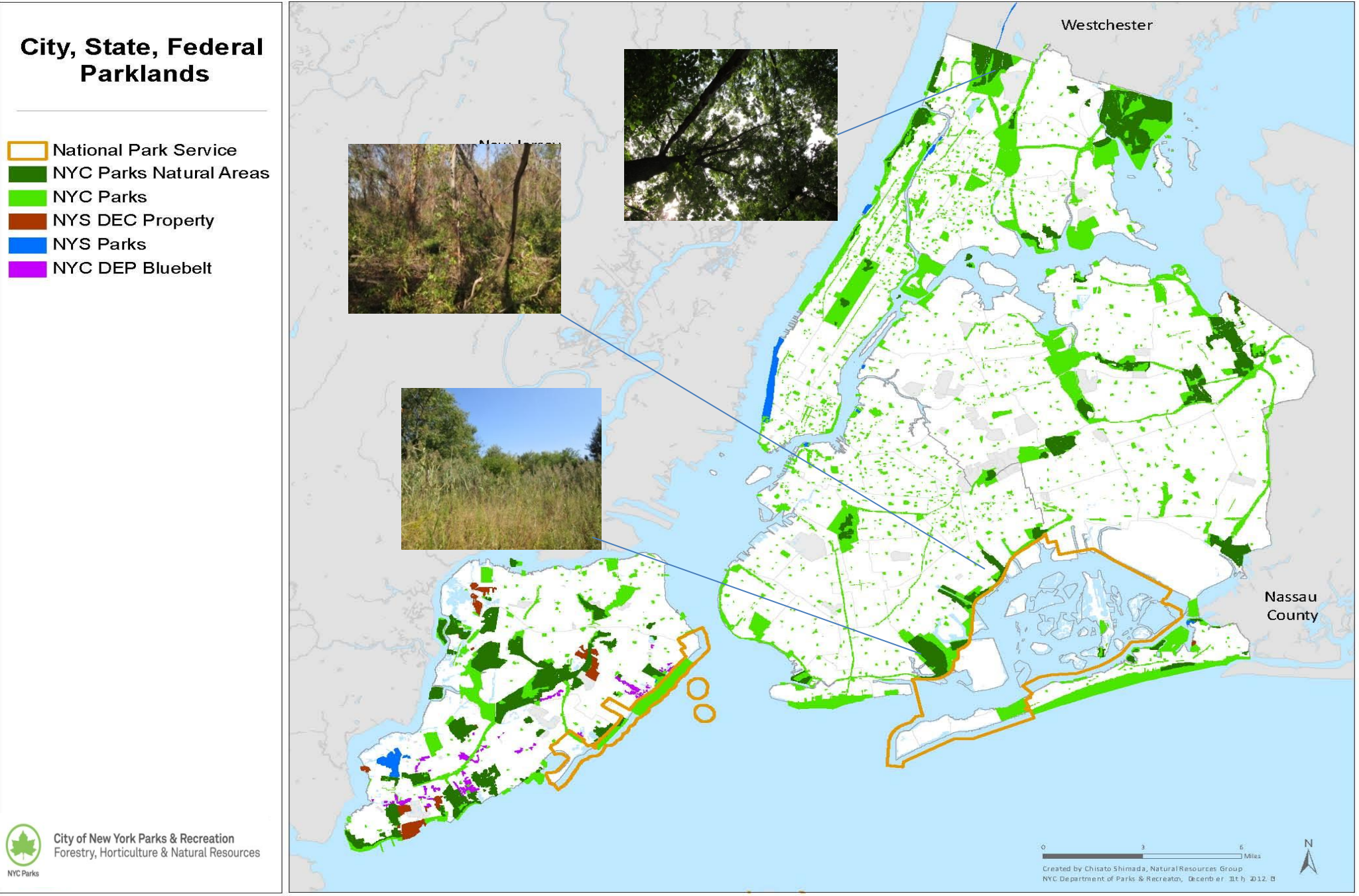


Figure 1. New York City Department of Parks and Recreation owns over 30,000 acres of parkland in New York City. 10,000 acres are considered natural areas.

Characterizing New York City's Natural Areas

While Parks has carried out ecological inventories and natural area management across the city since 1984, ecological assessment data has never been collected across all natural areas using standardized methods. In 2012, NAC contracted with Spatial Informatics Group (SIG), in collaboration with the University of Vermont Spatial Analysis Laboratory (UVMSAL) to design, develop, and deploy a system capable of mapping “natural area” vegetation types for the City of New York based on the National Vegetation Classification Standard (NVCS) hierarchy. Data sets and imagery included 2010 high resolution natural color CIR aerial imagery, LiDAR data, NRCS Soil Survey data, National Wetland Inventory (NWI) wetland data and New York State DEC wetland mapping data. A resulting GIS data layer is currently developed in draft form with a limited accuracy assessment. Future ground-truthing, and vegetation sampling will produce a final Ecological Community Map to enable NAC and partners to have more accurate and detailed land-cover information for various analysis, planning, and decision-making activities, such as natural resource assessments, and management and restoration activities.

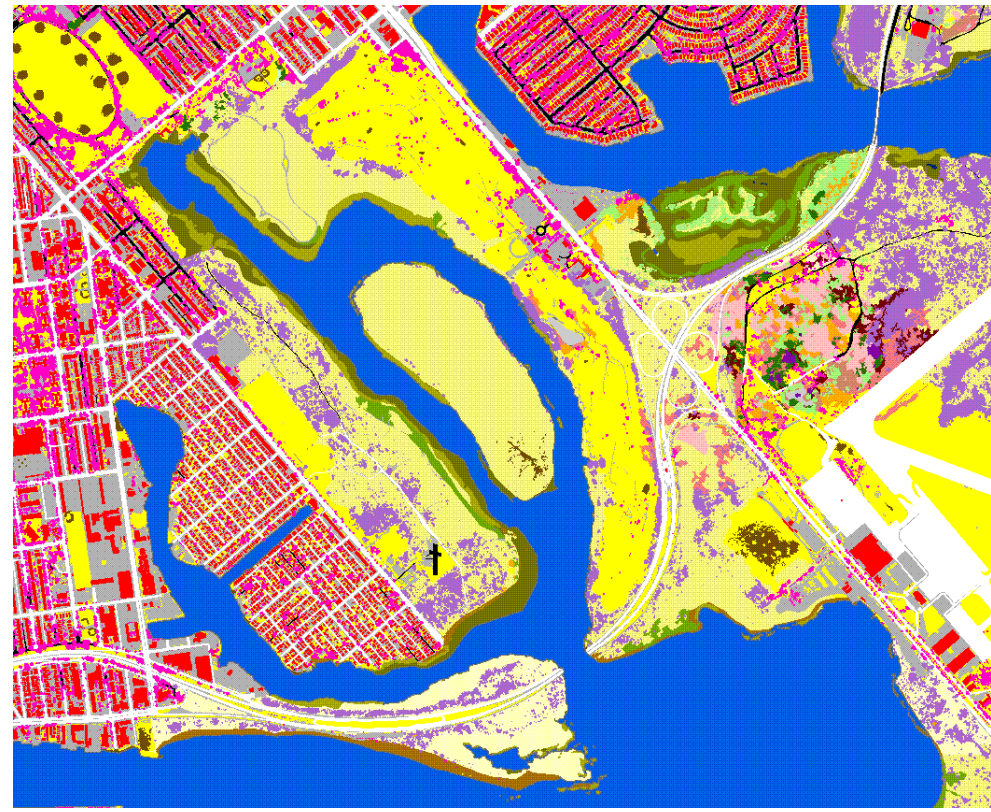


Figure 2. Draft Ecological cover map section of Jamaica Bay including Marine Park, Brooklyn, NY. Covertype classes are based on the National Vegetation Classification Standard. This map was derived using an object-based image analysis approach that integrates multiple imagery, topographic and vector datasets

Citywide Ecological Site Assessment

In 2013, NAC developed methodology and implemented data collection in forests, grasslands, freshwater wetlands, and salt marshes to characterize the health and condition of existing habitats and communities within New York City. Protocols were standardized and are repeatable over time to assess change. This baseline dataset will be the first ever quantitative data characterizing community structure, composition, and condition across all natural communities in New York City. The measurements include tree health metrics, vegetation species, soil analysis, coarse woody material, and assessments of human usage and impacts. The resulting ecological health metrics will allow Parks to identify, prioritize, and track park protection, management and restoration. Study results will also allow for use as a baseline for other targeted ecological studies.

Developing the Framework for Sampling Methods

Key Ecological Attributes of Healthy Forests	Indicators	Measurement
Canopy dominated by native species	Relative basal area of native tree species	DBH, height, species of trees > 10 cm DBH (Fixed-area plot sample)
Canopy closure or landscape distribution of closed canopy %	% Canopy Closure	Camera transparency method and visual estimate of % canopy closure in fixed-area plot (4 photos/plot)
Healthy forest canopy	% trees with a healthy canopy	Dieback, discoloration of foliage, defoliation, & vigor class estimations of trees > 10 cm DBH (Fixed-area plot sample, USFS Standards)
Multiple vegetative structure levels	Vegetation life forms in the understory, midstory and overstory	Abundance and size class for tree, shrub, and % cover for herb and woody seedling sampling (Fixed-area plot and subplots)
Understory dominated % by native species	Relative cover of native species	% cover of all herbaceous plants and woody plants <2cm DBH (1m x 1m subplots)
Soil quality and chemistry suitable of supporting native plants	Healthy range of pH, Organic Matter, Macro & Micro Nutrients	Soil sample collected at each forest plot. Will be run in the lab for analysis.
Rich forest floor	Leaf litter and fine woody material on the forest floor.	20m point intercept for groundcover and leaf litter and duff depth, % cover in 1 x 1m plots
Limited deer herbivory, insect defoliation	Browse on vegetation, missing leaf tissue	% herbivory classes for understory plants and trees/shrubs (2-10cm DBH)
Native tree regeneration	Tree seedlings present in the understory.	Seedling Percent cover & individual count (1m x1m subplot)
Coarse woody debris inputs present	Percent cover & quality CWD	% cover (Line-Intercept samples), decomposition class for each piece (USFS standards).
Breeding bird species composition, levels (individuals, pairs, nests)	Breeding bird presence/activity/nest success	Breeding bird surveys
Limited encroachment, anthropogenic alternations	Dumping piles, desire lines, vandalism, trash	Distance and direction to paths, human use, and anthropogenic and ecological impacts measured within a 30m radius of plot center.

Figure 3. Forest Systems Framework. This example of an assessment framework identifies key ecological attributes of systems, indicators of condition, and field measurements that quantify the system's condition.



Preliminary Results

In the first year of a two year ecological assessment, upland/ forest data was collected from four parks in Brooklyn and in Van Cortlandt Park in the Bronx. Freshwater wetlands were evaluated in two parks in the Bronx and Queens. Salt marsh data was collected in 17 complexes in Queens, Brooklyn, and the Bronx. Breeding bird surveys were conducted in forests, grasslands, and salt marshes. Together this work comprises 35% of natural areas in New York City. In 2014, the remaining natural area habitats managed by Parks are being assessed. The initial data can be analyzed to compare unique habitat types and parks across the landscape.

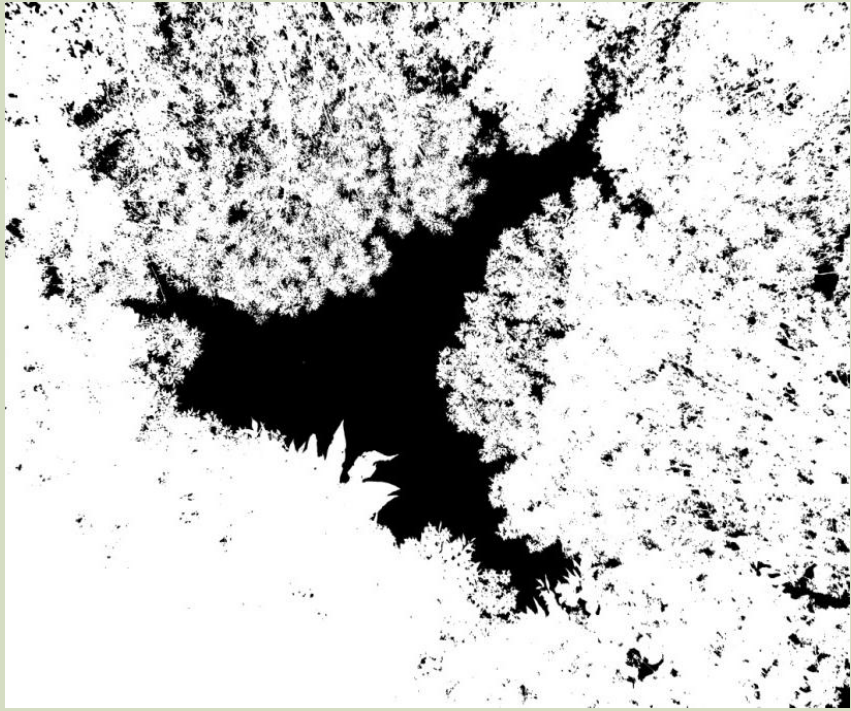
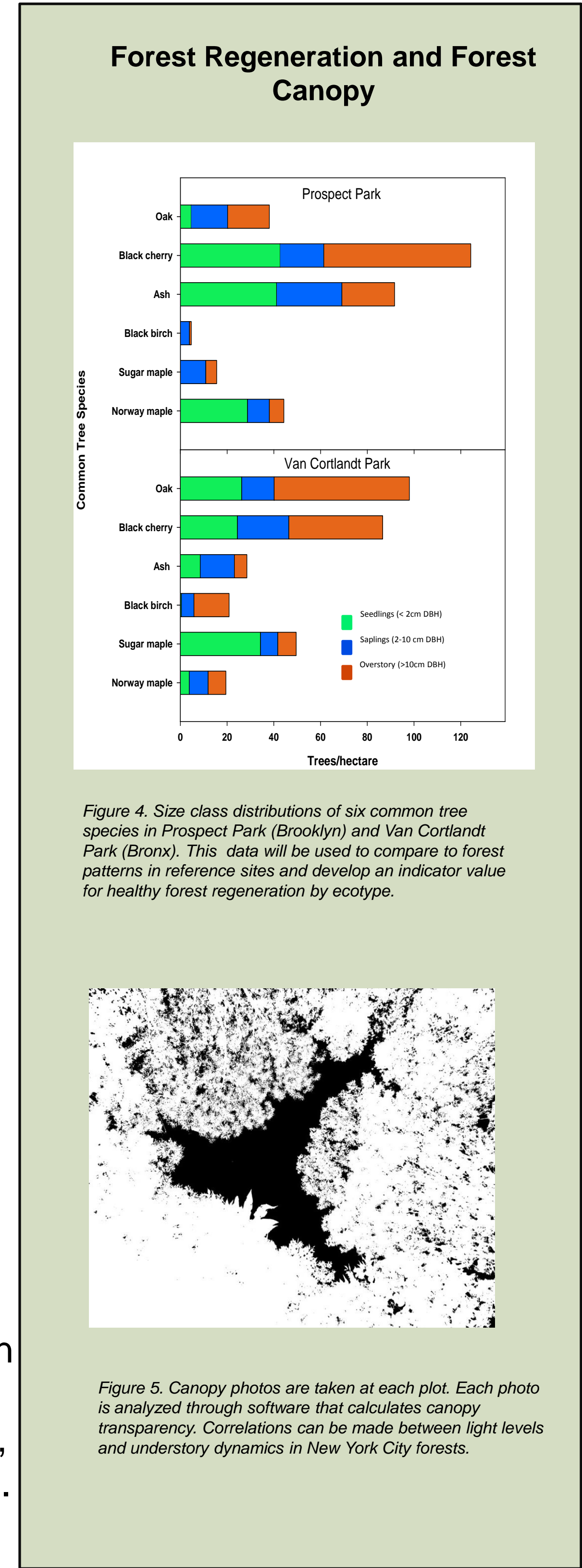


Figure 5. Canopy photos are taken at each plot. Each photo is analyzed through software that calculates canopy transparency. Correlations can be made between light levels and understory dynamics in New York City forests.

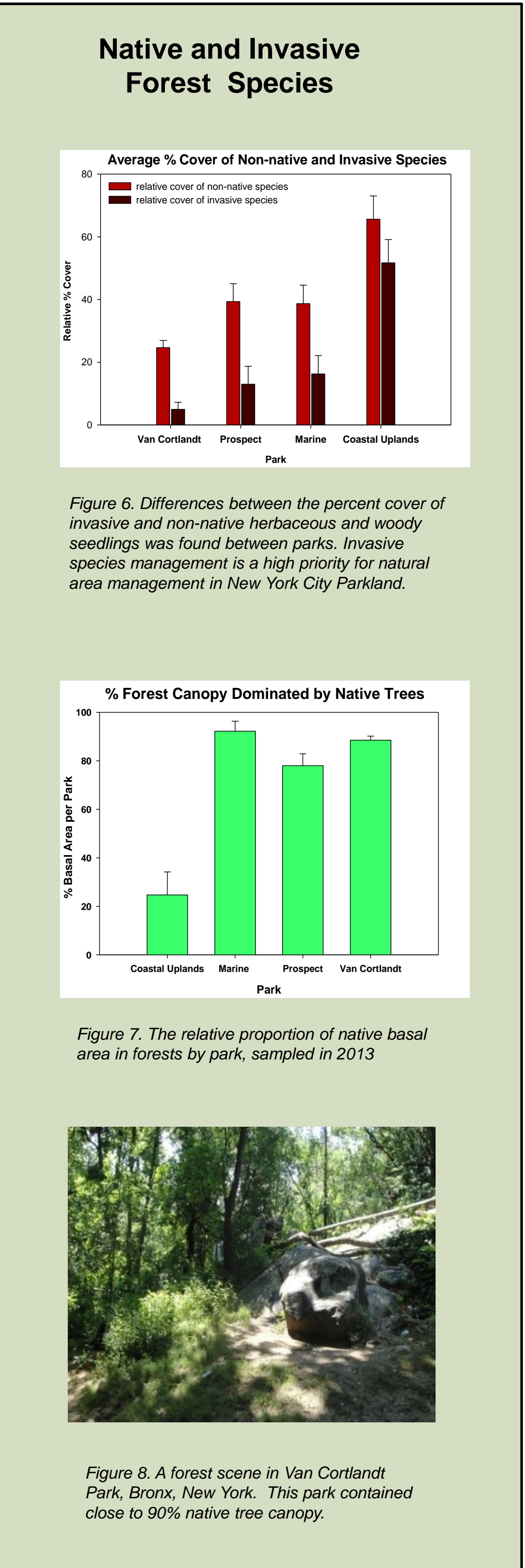


Figure 8. A forest scene in Van Cortlandt Park, Bronx, New York. This park contained close to 90% native tree canopy.

Salt Marsh Assessment

NAC's city-wide salt marsh ecological assessment (NACSMA) is being conducted in tandem with a complementary analysis of salt marsh vulnerability to sea level rise being carried out by NRG. The study protocol utilizes vegetation sampling and soil characterization (vane strength). Soil shear vane strength is collected in plots containing *Spartina alterniflora* and *Spartina patens* (two dominant marsh species in NYC marshes). Soil shear vane strength will be used as an indicator of belowground biomass, root health and production. This data set will be used for guiding management and restoration as well as creating a baseline data set for future monitoring.



Figures 9 and 10. Sampling Vegetation Percent Cover and Shear Vane Strength in Salt Marshes

Using Assessment Data to Inform Management

The NAC Ecological Assessment framework identifies key ecological attributes of systems, indicators of condition, and field measurements that quantify the system's condition -- shown above for Forest Systems (Figure 3). The resulting indicator values define a range of conditions from stressed and degraded systems to healthy systems. By evaluating and ranking natural areas, the Ecological Assessment can be used by natural area managers and planners to:

- Provide a mechanism for selecting restoration and management projects based on ecological value, sustainability and cost
- Create an approach to conservation, restoration and management that can be used in urban natural areas
- Create indices of health to monitor the effectiveness of restoration and management over time
- Use data and research to strengthen public policy and programming that support conservation
- Strengthen conservation partnerships and infuse data-driven decision making into planning and management.

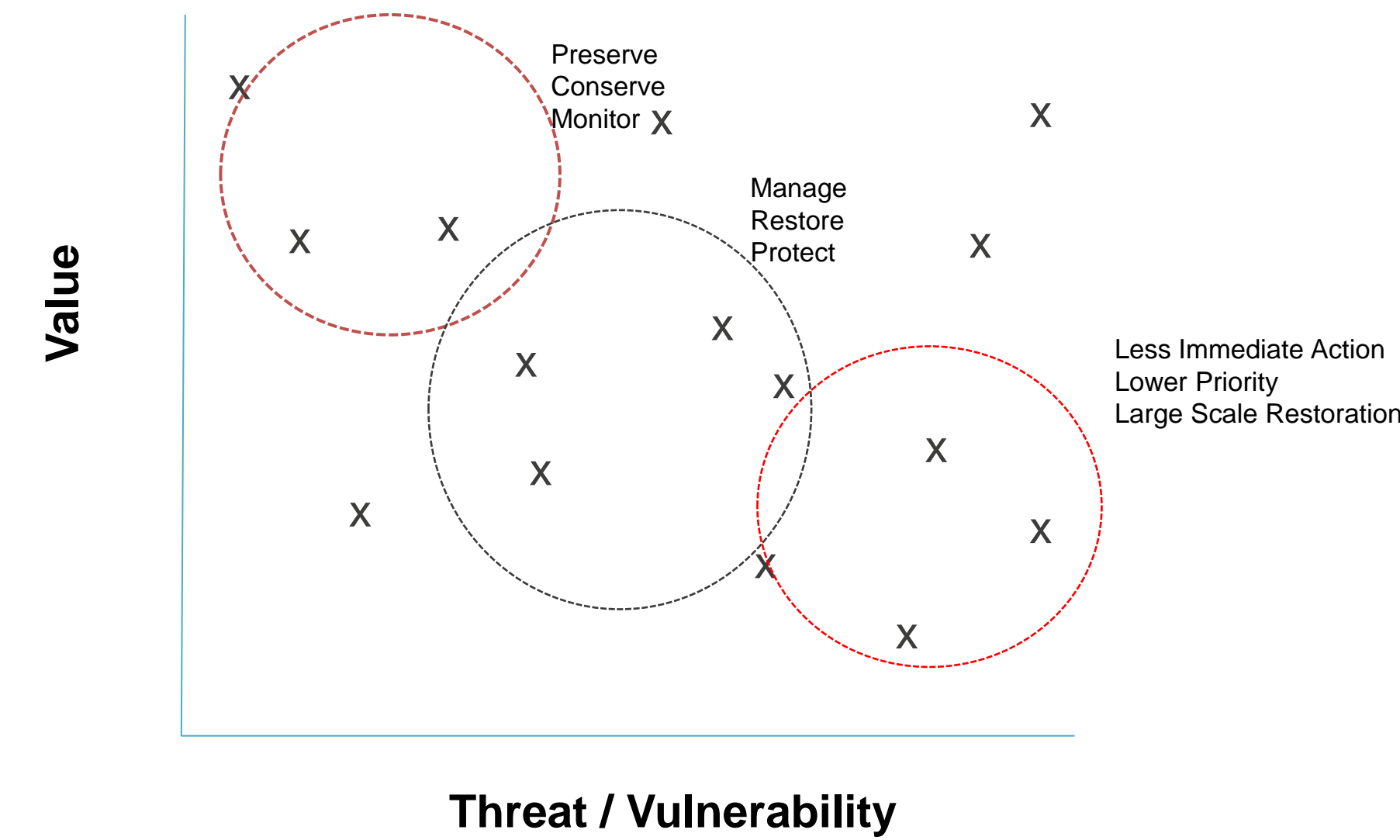


Figure 11. Data from the ecological assessment informs a prioritization tool to map the ecological values against the threats and vulnerabilities found commonly in urban natural areas. Our goal is to use the data from the ecological assessment to develop a structure to rate and prioritize habitats or regions within our natural area matrix. Understanding where study areas fall along the range of values will help focus resources to manage, protect, or restore natural areas.

The short and long term goals of the ecological assessment's comprehensive, integrated approach serve to promote the mission of the NAC and Parks by providing tools for the effective stewardship of the City's natural areas to create a healthy, safe, and resilient New York City.

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