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Monitoring Forest Restoration Activities in NYC Parks

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Monitoring Forest Restoration Activities in NYC Parks

The New York City Department of Parks & Recreation (NYC Parks) owns 30,000 acres of property in New York City, 12,000 acres of this is natural areas, including 7,300 acres of forest. These forests have been monitored and managed since the Natural Resources Group was founded in 1984. The forests experience a variety of threats: some threats are a legacy of past land use and development, while others are continuous. Monitoring forest management practices has been occurring for decades and has taken many forms, including site-specific monitoring of restoration outcomes and system-wide monitoring to understand overall health and ecological trajectory. This case study contextualizes the various forms of monitoring and describes a recent and ongoing shift in monitoring protocols.

Keywords

urban forest monitoring, urban forested natural areas

INTRODUCTION

The New York City Department of Parks & Recreation **(**NYC Parks) owns 30,000 acres of property in New York City, 12,000 acres of this is natural areas, including 7,300 acres of forest. These forests have been monitored and managed since the Natural Resources Group was founded in 1984. The forests experience a variety of threats: some threats are a legacy of past land use and development, while others are continuous. Monitoring forest management practices has been occurring for decades and has taken many forms, including site-specific monitoring of restoration outcomes and system-wide monitoring to understand overall health and ecological trajectory. This case study contextualizes the various forms of monitoring and describes a recent and ongoing shift in monitoring protocols.

CONTEXT

NYC Parks Natural Resources Group was established in 1984, and one of its first initiatives was to map and inventory NYC's natural areas (e.g., forests, wetlands, and grasslands) using the Plant Formation Entitation method (NYC Parks 2014). This initiative revealed not only high quality habitat in need of protection but also degraded forests in need of restoration and management. Since the 1990s, NYC Parks has been monitoring the outcomes of forest restoration and management projects. Early efforts were typically site-specific and opportunistic. Examples include faunal and/or vegetation surveys at Inwood Hill Park, La Tourette Park, Pelham Bay Park, and Van Cortlandt Park, and rare plant monitoring in Staten Island. These monitoring projects demonstrated that forest restoration generally had positive outcomes for native vegetation cover and/or faunal (e.g., birds, salamanders) abundance at the site level. We also learned which restoration techniques were most effective at reducing invasive plant cover and increasing native species cover and diversity. In the 2000s, we started examining vegetation outcomes at restoration sites citywide. The MillionTrees Survival Study compared survival rates of tree plantings under different conditions citywide, and Past Planted Site Inspections helped us identify system-wide needs and priorities for site maintenance work each year. Scientists at the Natural Areas Conservancy, a non-profit partner of NYC Parks, performed a citywide ecological assessment that was not linked with any restoration projects but is a scientific plot-based assessment of all natural areas under a single protocol. NYC Parks is now transitioning to using a uniform monitoring protocol across all restoration and management areas, called the Rapid Site Assessment, which was developed by partners at the Natural Areas Conservancy.

GOAL

NYC Parks' early goals for monitoring forest restoration were to compare restoration techniques to determine what is most effective, and to understand the impacts of restoration projects on both flora and fauna. Moving forward, we have additional goals of tracking changes over time as we restore and manage the forest, and using uniform metrics to compare diverse forest areas across a wide geographic area. Some of our site-specific studies, such as the one in Pelham Bay Park, provided insight into the health of forests we restored (Simmons et al. 2016), and one of our long-term goals is to develop a sustainable method for determining forest health citywide,

potentially by revisiting a subset of nearly 300 permanent forest plots that were established in 2014 as part of the Natural Area Conservancy's Ecological Assessment (Forgione et al. 2016).

APPROACH

NYC Parks uses a combination of plot-based measurements and site-level assessments to track forest restoration outcomes. NYC Parks ecologists have historically used a combination of plot- or transect-based measurements of vegetation; breeding bird surveys; salamander coverboards to monitor salamander abundance, diversity, and health; and soil sampling. These protocols were selected for a number of reasons: vegetation surveys were used to directly measure effectiveness because our restoration and management efforts focus on the removal of invasive plants and/or planting of native species; breeding bird surveys were chosen due to concerns that restoration activities may negatively affect breeding bird habitat; salamander surveys were chosen because they are indicators of forest health; and soil sampling was used to separate impacts of restoration activities from underlying soil conditions. In general, the approaches used were determined on a case-by-case basis, and projects were initiated in response to direct requests from the community (e.g., concerns over the loss of bird habitat), from leadership within the agency (e.g., survivorship of planted trees), or requirements of funding opportunities (e.g., forest health outcomes of restoration in Pelham Bay Park).

Short-Term Effectiveness of Large Scale Planting Program

As NYC Parks began to plant dozens of acres a year under the MillionTreesNYC initiative, resource managers wanted to understand the survival rates and maintenance needs across these sites and prioritize management actions by field staff. A survivorship assessment was conducted from 2009-2013 to determine which planting strategies and site characteristics led to the highest survival rates (Simmons & Auyeung 2017). In addition to this effort, practitioners performed annual Past Planted Site Inspections between 2010–2014 to understand and prioritize their maintenance work. Field staff responsible for maintaining the sites took 2+ weeks out of the busy summer field season to collect data in sites across a specific geographic area. These data were collected using handheld GPS units and resulted in a large amount of data, including visual evaluations of the condition of planted trees and shrubs, canopy closure, invasive species, fence conditions, and other human impacts. The data from these inspections were occasionally reviewed by management to identify immediate priorities such as high percent invasive cover in a planting site, or the presence of especially problematic species like mile-a-minute, but the multiple years of data were never analyzed to detect change over time, or linked with management records to infer effectiveness of specific actions. Without a plan for analysis or specific metrics for informing management on the ground, these inspections were ultimately discontinued in favor of other methods that had a clearer plan for analysis and prioritization.

Establishing a Baseline to Understand General Change Over Time

In 2013 and 2014, the Natural Areas Conservancy performed a plot-based ecological assessment of all 7,300 acres of forested natural areas on NYC Parks' property (Forgione et al. 2016). This assessment now serves as a baseline for comparing one forest to another and is used to prioritize

work and advocate for investment in caring for the forest. 250 forest plots were established as permanent plots to be reassessed over a longer time horizon (e.g. 10 years) to assess change over time of the entire forest. In addition, a social assessment was conducted by the US Forest Service at the same time to determine the uses, values, and perceptions of NYC Parks properties, including natural areas (Campbell et al 2015; Auyeung et al. 2016; Campbell et al 2016).

Transition to Overall Effectiveness of Management

Using the plot-based ecological assessment as a starting point, the creation of the Forest Management Framework for New York City (Pregitzer et al. 2018) included the development of a protocol to assess all work areas before and after targeted management activities. This Rapid Site Assessment protocol is also being piloted to take the place of Past Planted Site Inspections in order to inform short-term maintenance and management needs across previously-restored sites, as it captures relevant data and also has the benefit of comparing forest threat across a wide range of sites, both restored and unrestored. The protocol is a blended approach of plot-based data collection to characterize forest type and woody species, and a site-wide assessment of invasive and native species cover and human impacts in general. We have collected two years of data and are trialing the use of this protocol for other monitoring sites and needs, layering in faunal monitoring or other more targeted data collection as desired.

Site-Specific Monitoring & Monitoring Indicator and RTE (Rare, Threatened, Endangered) Species

Site-specific monitoring continues to be important for understanding management questions unique to a specific site in addition to monitoring faunal responses to forest restoration and the health of rare, threatened, and endangered plants in forests. Much of this monitoring depends on available funding and resources. For example, the NYC Parks received mitigation funding to manage and monitor *Pycnanthemum verticillatum*, a New York state-listed plant, after a developer built a large shopping mall over much of the plant's habitat (Carden 2018). Through collaborations with the US Forest Service and academic researchers, we are also monitoring the outcomes of afforestation, or creating forests in areas that historically were not forested habitat, such Freshkills Park, a former landfill, and Kissena Corridor Park, a formerly filled wetland (Oldfield et al. 2014; Oldfield et al. 2015). We also continue to use faunal indicators (e.g., presence of habitat-specific birds and amphibians) to track outcomes in forested areas that are home to historic or current populations of rare or sensitive species.

RESOURCES

NYC Parks has historically monitored restoration areas using in-house funding and staff from two teams within the Natural Resources Group, which fluctuates over time. The Forest Restoration team is a group of 15–20 practitioners with training in ecology and natural resource management and are incredibly skilled in plant identification and restoration techniques. The Conservation Team is a smaller group, composed of 5-10 ecologists and wildlife biologists, and plays an important role in study design and data analysis. In addition to funding from the City, we have received grants, such as a National Science Fund Urban Long-Term Research Area

Exploratory Award to monitor forest restoration outcomes at Pelham Bay Park. We currently partner with the Natural Areas Conservancy on Rapid Site Assessment, through a program that engages local college students from City University of New York in an internship program on ecological data collection. Every year, 15 students and a coordinator collect monitoring data across hundreds of acres of forest sites. NYC Parks staff are also trained to perform this assessment and are involved in the data collection as well, to supplement the work of the student interns.

KEY RESULTS

- Forest restoration actions are having their intended results. For example, planted trees have an 80% survival rate after 2 years based on the MillionTrees Survivorship Assessment (Simmons & Auyeung 2017). A study at Pelham Bay Park found that restored areas had greater native basal area and foliage height diversity—a proxy for forest structural complexity (Simmons et al. 2016). This was similar to a citywide study done by a collaborator who found that restored areas had greater native tree recruitment and a more complex forest structure (Johnson & Handel 2016). This same citywide study also found that the level of management intensity correlated with positive forest restoration outcomes.

- System-wide monitoring is a large effort and collaboration has proven to be valuable in helping NYC Parks carry out this work. Without collaboration, natural resource management staff are pulled from their invasive plant removal and restoration work to perform monitoring outside of their normal duties.

- Plot-based monitoring using randomized plots is informative for assessing the average health or condition of a particular site or the system as a whole, and for comparing different forest restoration strategies. However, when deciding exactly where within a site to allocate resources or the specific intervention(s) needed on the ground, rapid and qualitative metrics that apply to the site as a whole (e.g., invasive cover is above a certain threshold at a site) are often more relevant to managers than time intensive and quantitative metrics that were extrapolated from randomized plots within the site (e.g., invasive cover is X% on average within a site).

- NYC Parks has historically struggled with incorporating monitoring data into adaptive management. Balancing professional judgement and the information provided by data collection and analysis continues to be a challenging endeavor. Empowering practitioners to do the monitoring themselves was one effort to mitigate for this, but did not alleviate the struggle completely due to issues such as timing, heterogeneity, and scale. On-the-ground conditions can change rapidly and management decisions may have to be made before data are available or analysis is complete. For long-term management decisions, urban forests are highly heterogeneous, so selecting uniform metrics that would be useful across sites over time can be a challenge and collecting fine-scale information at a system-wide level requires significant time and resources.

- Monitoring is essential for communicating the needs and our successes of forest management to the public. The ecological assessment from the Natural Areas Conservancy was used to create a Framework for Forest Management that outlines financial needs and ecological goals for forest resources in New York City (Pregitzer et al. 2018). This plan was successful in advocating for funding for NYC Parks' forest management work. The US Forest Service's social assessment also found that over half of park users surveyed visit the natural areas of parks, which highlights the importance of these areas for New Yorkers (Auyeung et al. 2016).

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