From Possible to Preferable: Prioritizing Locations for Increasing Urban Tree Canopy in New York City

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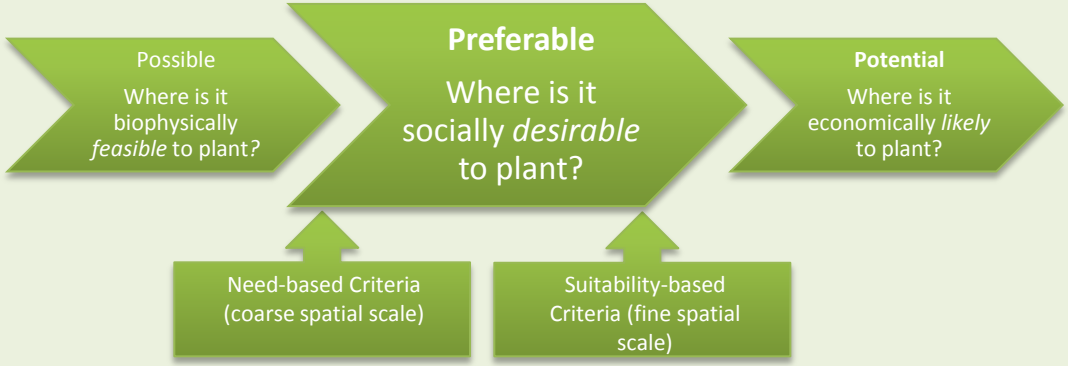
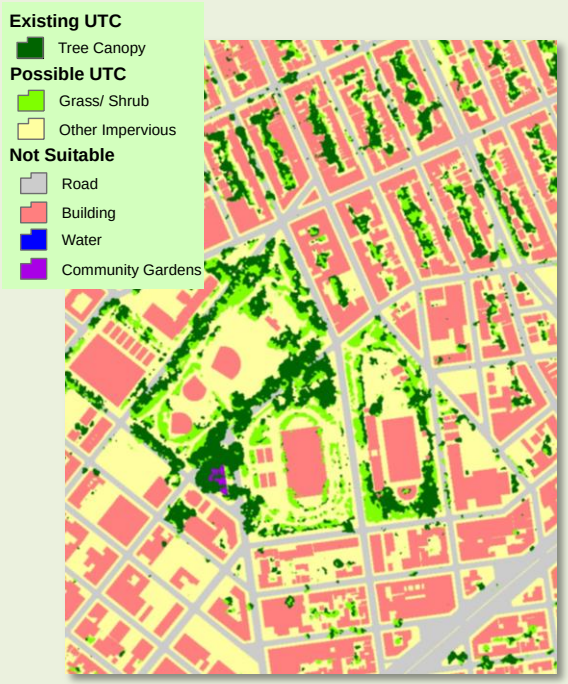
There are many ways to prioritize large-scale tree planting efforts like MillionTreesNYC. Organizations may wish to select certain criteria for systematizing their approach. What these maps and accompanying text offers is one such method. The term "variables" is used here to refer to measurements of specific chosen criteria for individual analysis.



These methods assess the ***need*** for tree planting and the ***suitability*** of sites for tree planting. Each tree planting organization's unique mission or mandate, their planting goals and constraints (or "focal site type") were considered in this prioritization analysis, because MillionTreesNYC is a public-private partnership. Maps were created to show where each organization may contribute to increasing urban tree canopy (UTC) while also achieving their own programmatic goals. These methods and associated custom tools aim to help decision-makers optimize the urban forest with respect to biophysical and socioeconomic conditions in a clear and accountable manner.



The 2006 paper entitled "A Report on New York City's Present and Possible Urban Tree Canopy" by Grove and others answers the questions: How much tree canopy **does** New York City have, and how much tree canopy **could** New York City have?

Together, these answers demonstrated what is *possible*– or biophysically feasible. The intent here is to answer what is *preferable*– or socially desirable. To do so two subsequent questions are addressed:

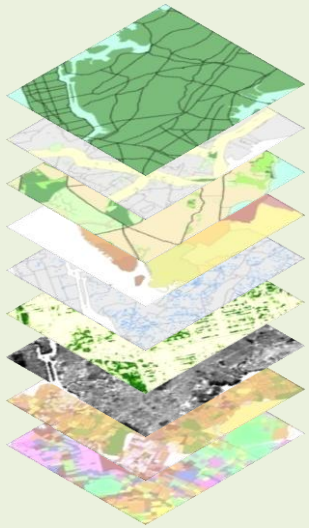
1) Where are the areas in greatest ***need*** of tree planting? That is, where are the areas that lack the current known benefits of trees in urban environments?

2) Where are the areas that are most ***suitable*** per planting partner? That is, where are the sites that most closely align with each planting partners' focal site type.

Need-based criteria are summarized at the neighborhood level, while suitability-based criteria are applied at the individual parcel level.

Tier 1: Need-Based Criteria

Need-based criteria are used to identify whether the benefits of trees can address a current need in the urban environment. Areas with high need based values are lacking many of the benefits that trees provide (see Table below for Urban Forest benefits considered). High rankings in need-based criteria are considered referable or desirable areas to plant trees. Tier 1 analysis data are summarized at the neighborhood spatial scale.



Cluster vs. Variable

Some Tier 1 criteria variables measure similar characteristics or a component of a thematic cluster. Therefore, some Tier 1 variables may become inadvertently double counted, and potentially over weighted. Sub-weightings subvert this problem. For example, percent sedentary, obese, diabetic and hospitalized asthmatics collectively constitute a public health cluster. Each of the four public health variables were assigned a weight of ¼ to give the overall public health *cluster* an equal weight.

Cluster	Variable Chosen	Rationale
Air Quality/Noise Pollution	Major Road Density	Planting trees in high traffic volume areas may mitigate some air pollution impacts. Major road density is used as a surrogate for traffic induced air and noise pollution.
Biodiversity	Ecological Corridor Density	Planting trees along and near ecological corridors will increase connectivity.
	Existing Habitat Density	Planting more trees in and near areas of existing habitat will improve the quality of the habitats and integrate them into the surrounding landscape.
Public Health	Sedentary Population (%)	Public health may be improved by planting trees and creating more walkable communities. These data identify areas of poor health by selected metrics.
	Obese Population (%)	
	Diabetic Population (%)	
	Hospitalized from Asthma (%)	
Water	Flood Density	Planting trees may ease the burden on existing infrastructure caused by floods. These data identify flooding hotspots.
	Percent Impervious Surface	Planting trees reduces impervious cover which may reduce flooding and summer heat.
Urban Heat Island	Maximum Average Surface Temperature	Trees lower summer surface temperatures. These data identify areas of high temperature that could benefit from tree planting.
Socio-demographic	Income	Tree planting and design provide positive impacts such as community empowerment and neighborhood beautification. These data identify neighborhoods of low income and high crime.
	Crime	
Population	Population Density	Trees are planted to improve environmental quality and to provide other public benefits. Therefore, planting were the most people are will optimize the benefits per tree planted.

Tier 1 Preferability: Need-based Criteria

Major Road Density

EDAW Ecological Corridor

Existing Wildlife Habitat

Public Health

Floods

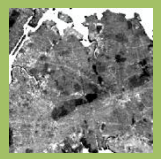
Impervious Surface

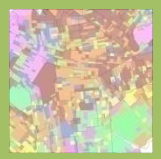
Urban Heat Island

Income

Crime

Population





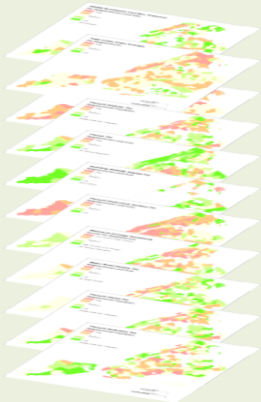
Data sets combined, aggregated, analyzed and summarized given unique characteristics of the particular variable.

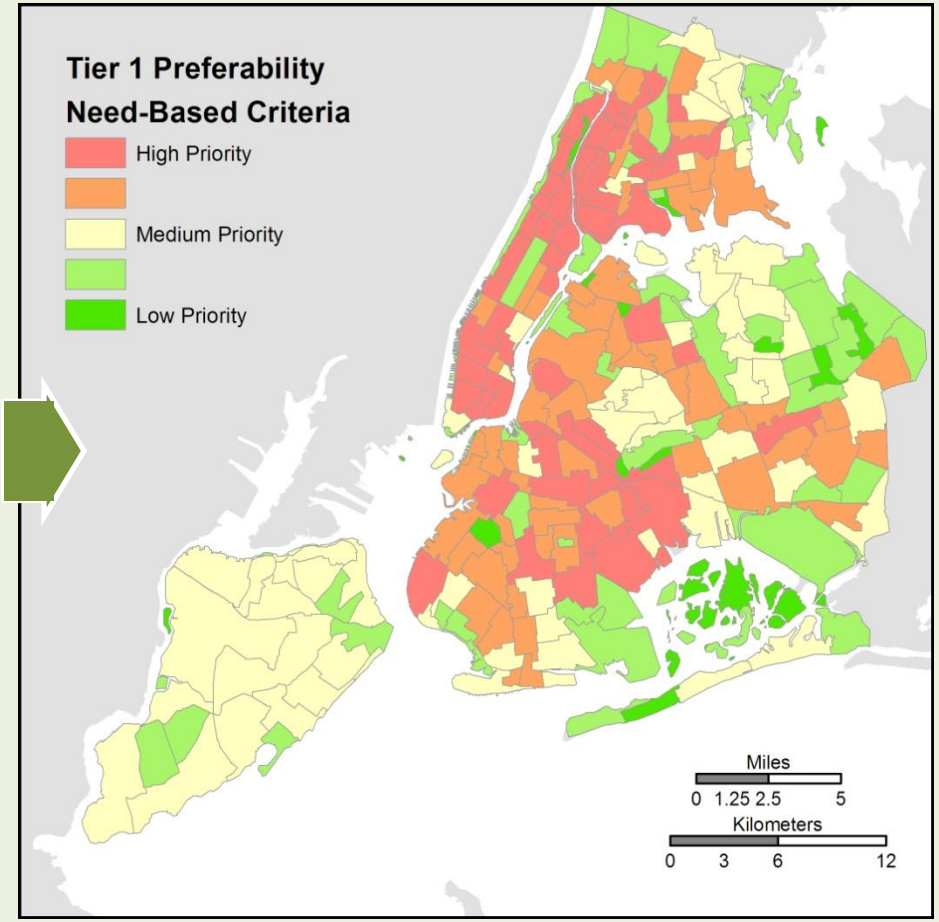
Variables standardized by with Z Scores:

$$z = \frac{x - \mu}{\sigma}$$

Where:
x is a raw score to be standardized
μ is the mean of the population
σ is the standard deviation of the population

Overlay and averaging of Z Scores





Tier 2: Suitability-Based Criteria

Once all neighborhoods were ranked based on their Need-Based criteria, three separate selections were performed to find sites *suitable* to each planting partner – New York City Department of Parks and Recreation's Natural Resources Group and Central Forestry & Horticulture divisions as well as New York Restoration Project. Parcels were selected based on criteria that are aligned with each organization's mission or mandate, their planting needs, and constraints – or what is collectively referred to as their "focal type". Those selected parcels were then analyzed using Forest Service's Urban Tree Canopy (UTC) Assessment protocols developed by University of Vermont, Spatial Analysis Lab in conjunction with the US Forest Service. UTC tools were used to compute the area per selected parcel that could possibly contain tree canopy: area that is not a road, a building, water, a community garden, or existing canopy (Figure 1). Then parcels were ranked based on their possible UTC. A final ranking for each planting partner was created. Tier 1 and 2 scores were combined and results are shown in Figures 2,3 and 4.

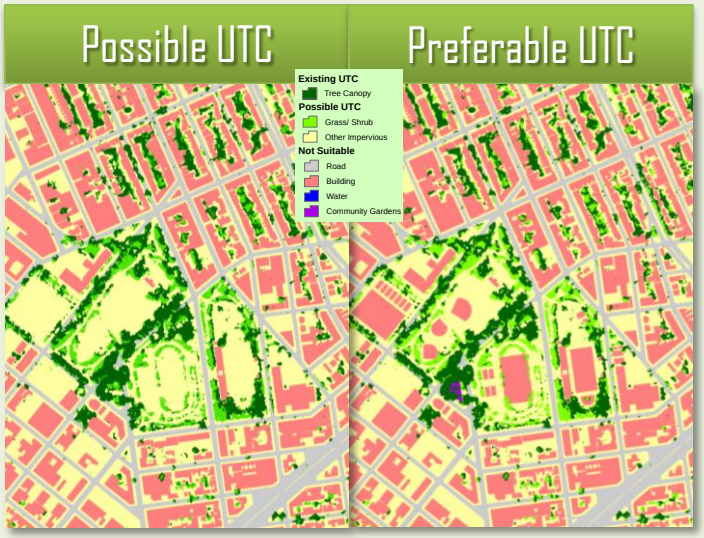


Figure 1. McCarren Park showing both Possible UTC and Preferable UTC. The right pane shows active recreation sites such as tennis courts and baseball fields classified as buildings, which are not possible plating sites.

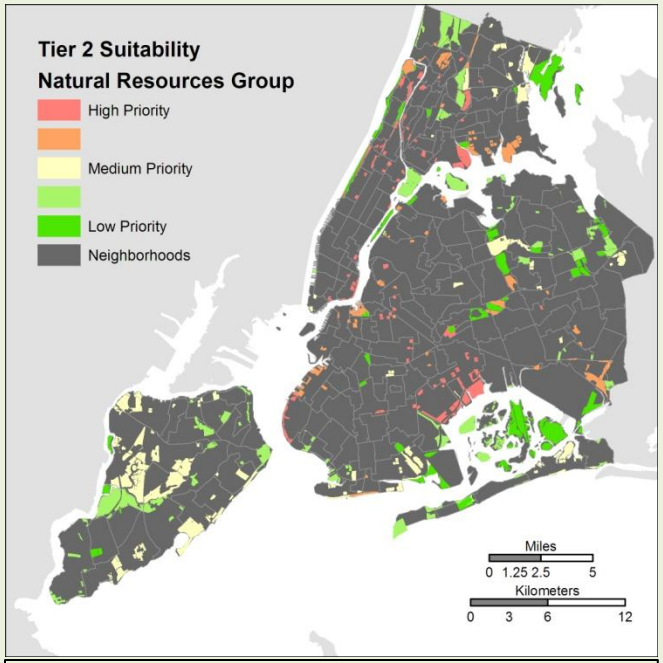


Figure 2: Public land greater than 10 acres evaluated for need and suitability. Airports, Central and Prospect Parks, and Golf Courses were excluded. Park features like baseball fields were classified as buildings, and were not be considered for planting. Community gardens were also excluded.

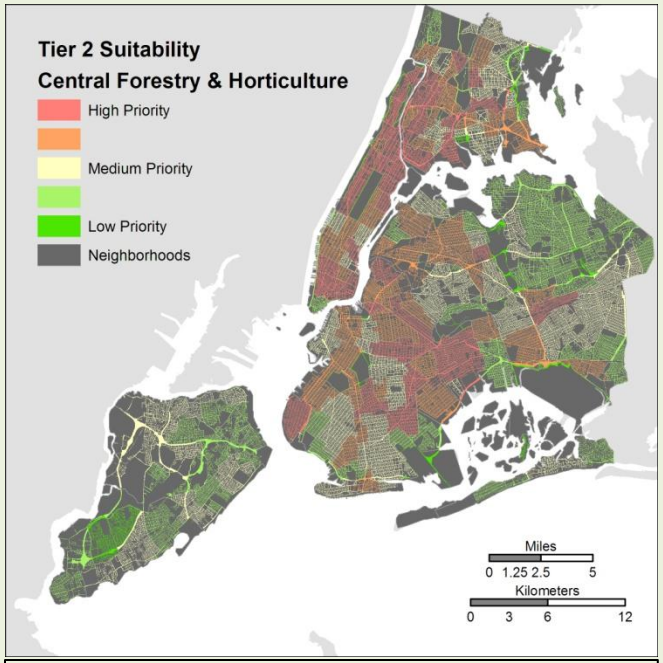


Figure 3: public-right-of-way(PROW) evaluated for need and suitability for planting street trees.

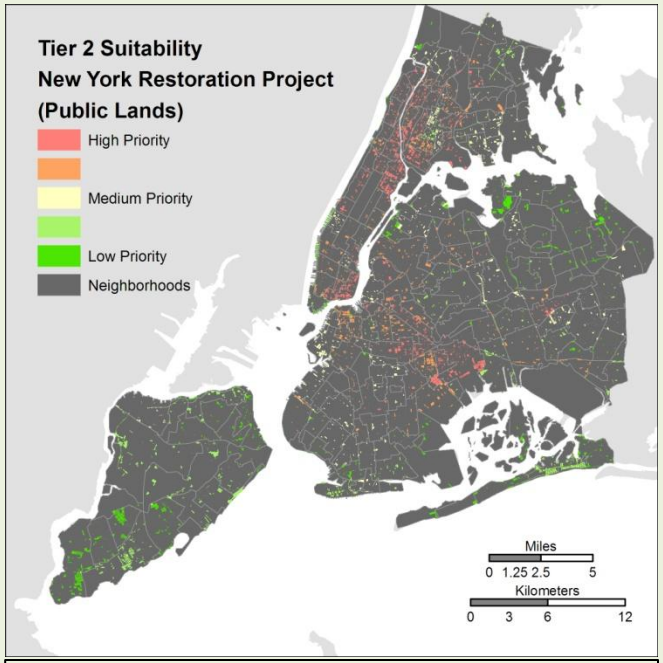


Figure 4: Parcels 10 acres or smaller and publicly owned evaluated for need and suitability.

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