A New Method for Streamlining Tree Selection in New York City

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The purpose of this article is to share how the New York City Parks Department streamlined our system for making tree species selections for 25,000 street tree plantings a year. We hope that our system provides useful insights that can be adapted and customized to the needs of other cities undertaking street tree planting.

Background

The MillionTreesNYC initiative was catalyzed by research that shows on average, New York City street trees currently return $5.60 to the community for every $1 spent on management.[1] In the course of fulfilling the mission of MillionTreesNYC, NYC Parks Department foresters are tasked with designing planting spaces and selecting tree species for each site, then overseeing construction and community engagement.

Two factors that affect plant selection in NYC: to guarantee biodiversity, we use over 250 different tree species, cultivars, and selections grown under contract by tree nurseries in the region. Second, the planting sites that we survey have varying environmental constraints.

Selection can be a simple task on a tree-by-tree basis, but this is not efficient when it comes to making thousands of selections per season. We needed a decision making protocol to ensure consistency and accuracy throughout the urban forestry program, while considering the reality of our foresters' time constraints. We also wanted to optimize the net benefits of our tree plantings by systematically maximizing each planting site's potential.

Developing a Classification System for Street Tree Planting Sites

Our first task was to develop a classification system to distinguish the different street tree planting conditions we come across. Each site is its own habitat or biotope (a subsection of a biome) for a tree. We aimed to define the various environmental conditions that would set one street tree biotope apart from another.

This was a difficult task given the diverse landscapes of New York City. We had to choose the most significant criteria influencing a forester's selection decision. If we split hairs, we could have hundreds of different biotopes, but such a specific classification system wouldn't be very helpful to anyone in the field. But by framing the biotopes a little more broadly, they would be more easily identified in the field.

How did we determine the most significant and common criteria impacting tree selection? Many conditions are already held constant across the City for various reasons—for example, because of contract specifications. For instance, soil composition within the tree bed is uniform because each excavation is backfilled with a specified topsoil. There are also some conditions that vary, however uncommonly. For instance, the majority of planting sites will have a full-sun condition because streets are typically wide relative to building height, but some sites will be outliers with a partial-sun condition.

Additional major factors to consider: there is a dramatic range of how "urban" a planting site can be across the City—parts of Manhattan resemble a concrete jungle, while parts of the outer boroughs consist of single family homes with lush lawns and quiet streets. Another big factor is whether or not a planting site has overhead power lines; if such wires are present, only a small ornamental tree species would be chosen. (Most neighborhoods throughout the outer boroughs have electric power lines over one side of the street.)

A third major factor is the total soil volume available to the tree. Typically trees are headed for cut-outs that have been shaped and sized to accommodate both the tree and pedestrian traffic on the sidewalk. These cut-outs vary in size due to the fluctuating shape and size of the public right-of-way throughout the City, or to underground utilities, or to other safety and spacing guidelines that are used throughout the City. In some neighborhoods of the outer boroughs, trees are planted in extended lawn strips instead of in concrete cut-outs. This allows for extra rooting volume as well as other site condition benefits.

Definition of Criteria

The following is an overview of how we defined these three major criteria used to classify our biotopes:

<u>Site Condition</u>

A forester judges a site's degree of drought condition, soil compaction, and soil pollution, then provides a site condition rating.

Site Condition	Landscape	Urban (Residential)	Urban (Commercial)
Drought Condition Caused by surrounding reflective surfaces, lack of nearby lawns or mature trees, lack of irrigation	Low	Medium	High
Soil Compaction caused by truck and bus traffic, pedestrian traffic, passengers unloading from vehicles	Low	Medium	High
Soil Pollution caused by pedestrian waste, pet waste, vehicular pollution, road salt	Low	Medium	High

- A **Landscape** rating would be representative of a quiet street with a lawn strip for tree planting.

-An **Urban (Residential)** rating would be representative of a moderate-usage urban street with a sidewalk cut-out for tree planting.

-An **Urban (Commercial)** rating would be representative of a heavy-usage urban street with a sidewalk cut-out for tree planting.

<u>Vertical Clearance</u>

Wires	Wireless
Pole to Pole electric wires less than 30' overhead	No wires at all, communication wires only, or wires connecting building to main lines across the street

-The vertical clearance criterion determines whether an "underwire" (dwarf or ornamental) tree is needed.

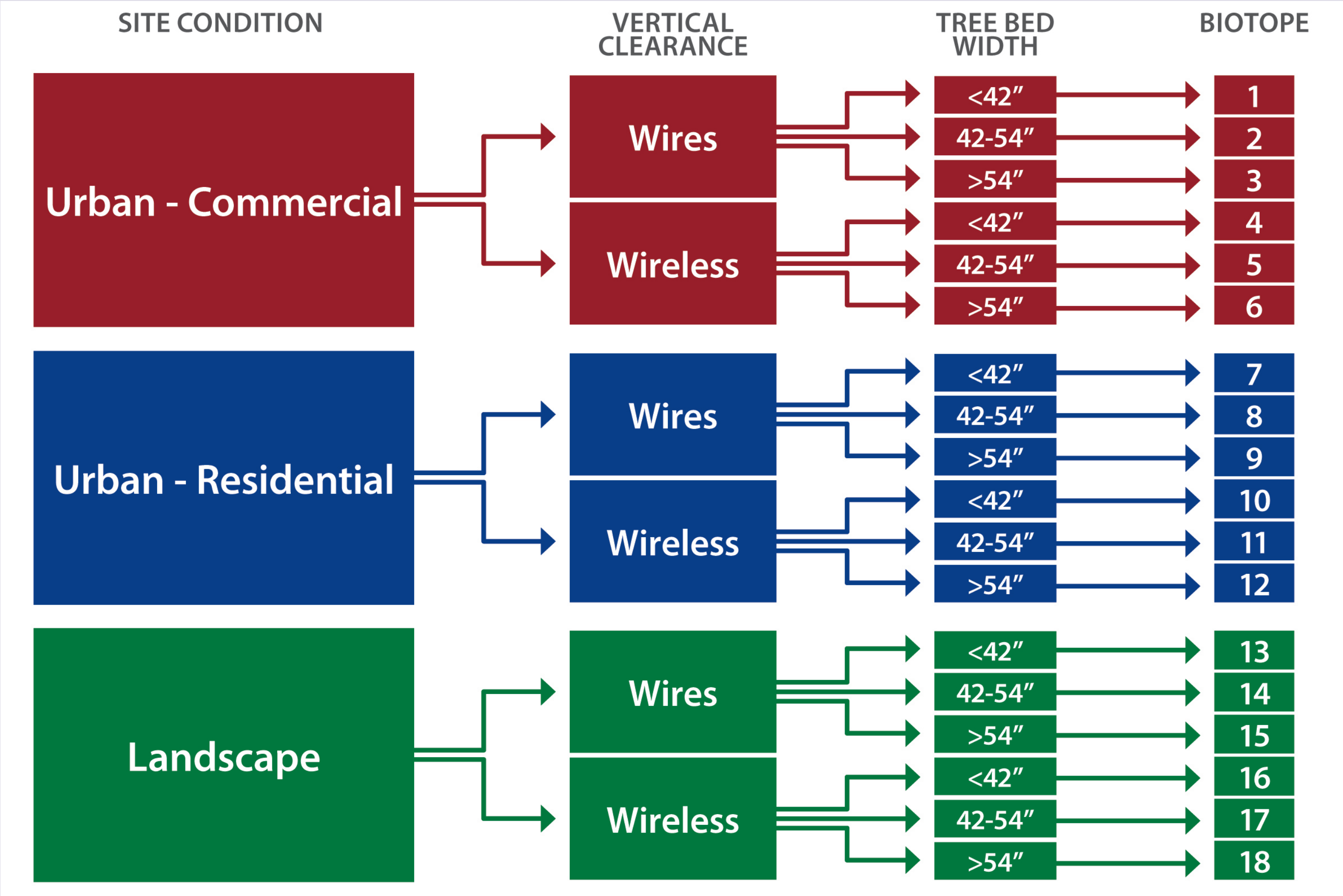
<u>**Tree Bed Width**</u> (distance perpendicular to curb):

< **42**" vs. **42**" to **54**" vs. > **54**"

-This last criterion is an indicator of total soil volume. Because most tree beds are rectangular to accommodate pedestrian flow, tree bed width (distance perpendicular to curb) is the limiting factor for how big a tree trunk can get without causing sidewalk heaving.

Results

In total, there are 18 different possible combinations of these three criteria (site condition, vertical clearance, and tree bed width); thus, these are our 18 different street tree biotopes for New York City.



Example Photos

Biotope 3: Urban-Commercial, Wires, Tree Bed > 54″

Biotope 11: Urban-Residential, Wireless, Tree bed 42″ – 54″

Biotope 18: Landscape, Wireless, Tree bed > 54″

Developing Tools

In order to make this system field ready, we needed to develop a master spreadsheet that identified the distinguishable features and tolerances of all the 250+ tree species on our planting list. (You can download this spreadsheet here: *http://www.nycgovparks.org/trees/street-tree-planting/steps*. Under Step 1: Survey, see the hyperlink for "data sheet.") Each row represents a different tree species and each column represents various categories of a tree's biological qualities (drought tolerance, flood tolerance, shade tolerance, form, leaf color, etc).

These data were drawn from USDA Fact Sheets and other relevant sources written in an urban forestry context. Each column is filterable, so a forester can find a tree species fitting various specific criteria in a matter of seconds. You will notice that our department added some columns customized to our own needs; you may want to tailor this spreadsheet to your own program's needs.

Combining the science-based research collected in this spreadsheet with additional first-hand field knowledge, it was possible to assign these tree species to their most appropriate biotopes (see columns in far right). We used an "x" to signify the first choice, and an "m" for the "maybes," or secondary choices. The process of choosing which tree species corresponded to each biotope was quite challenging and underwent many revisions. The trees needed to be distributed based on their biological tolerances to match the given site conditions. The lists also had to be generous enough so that foresters had realistic options given nursery availability. Plus, some biotopes are more commonly found in the field than others, so tree species choices had to reflect that distribution. Last, we wanted to assign trees to biotopes where they would be put to best use relative to all their other biotope options (considering factors of tree growth potential, longevity, and site potential).

Application

Using this methodology, we are able to approach a planting site and classify it as a certain biotope fairly efficiently. When the forester comes across one of the less-common environmental constraints (e.g., being in a coastal flood zone), the spreadsheet can be filtered by this criterion, which further refines the tree species list for that biotope. Since it is common for surveying to take place months before a forester knows nursery availability, this classification system can come in handy. During the site visit, the forester can assess the three criteria for determining the biotope, make note of that biotope number, and document any additional environmental constraints. Then, species can easily be retrofitted to the site listing at a later date.

Guidelines for Field Use

Step 1: Approach your potential tree planting site.

Step 2: Measure distances from surrounding buildings, trees, and other infrastructure to find the most suitable location for the new tree.

Step 3: Assess the site condition by taking a 360 view of the streetscape and how it is used.

Step 4: Score the site on drought condition, soil compaction, and soil pollution and determine its site condition rating as either Urban-Commercial, Urban-Residential, or Landscape.

Step 5: Determine whether or not the site has overhead pole-to-pole electric wires.

Step 6: Determine and measure the most appropriate tree bed width and length.

Step 7: Use information regarding site condition, overhead clearance, and tree bed width to classify the site as a specific biotope (1–18).

Step 8: Make note of any additional environmental factors that could influence tree species selection.

Step 9: Using data collected during the field visit, filter the master spreadsheet and match tree species to corresponding biotopes and site conditions.

Using this process, foresters will be collecting information on the distribution of biotopes across the City. These data can be analyzed and used to inform tree procurement decisions for future years.

Conclusion

By developing a methodical system based on scientific research, we to hope maximize the efficiency and effectiveness of our street tree planting program, as well as demonstrate accountability and transparency to the public we serve. While many citizens are primarily focused on the aesthetic results of our tree planting operations, we hope this set of documented protocols will portray street trees as growing, living, green infrastructure that provide quantifiable environmental benefits to our city.

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[1]Peper et al. *New York City, New York Municipal Forest Resource Analysis.* Center for Urban Forest Research, USDA Forest Service, Pacific Southwest Research Station, 2007.