Modifying Street Tree Spacing to Maximize Canopy

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Recent modifications to the Village of Oak Park's planting program provided an opportunity for staff to more deeply evaluate this dimension of the program. Like other Departments within Public Works, Forestry must focus much of its energy on day-to-day operations, including assigning resources to complete annual tasks. Trees, in some ways, are very much like other elements of municipal infrastructure that are associated with streets. (i.e. asphalt, street lights/signs, and fire hydrants). That is, they have a "shelf life" and a particular cost associated with maintaining them over time. Additionally, trees specifications are designed to optimize contributions while minimizing costs over the life of a tree. Unlike the non-living elements of streetscapes however, trees provide increasing benefits to the community as they age. The notion of diminishing returns is one that foresters must face when evaluating mature trees, but this represents a relatively minor proportion of a tree's lifelong contributions.

Canopy

As urban forestry evolves in this country, it is moving more toward managing a system rather than focusing on individual trees. Consequent to the devastating effects of Dutch Elm Disease and Emerald Ash Borer, communities have heightened awareness of the positive as well as the negative long-term effects of choices made decades prior. While the day-to-day operational care centers on individual trees, the long-term program objectives and goals attend to developing a healthy, expanding, and sustainable canopy. Certainly, choices and decisions made today will have a substantial impact on future residents. Most of the tree issues that professionals contend with today were determined decades or generations ago. Literally, the high cost that the Village pays to maintain or mitigate the American elm or ash population results from a planting policy that was implemented in the distant past.

An expanding, healthy and sustainable canopy is the Forestry program's goal precisely because of the important environmental benefits it provides. These include carbon dioxide uptake, residential cooling, sound dampening, aesthetic and emotional dividends, and resource provision. These benefits are maximized when streets are dominated by mature canopy. Aesthetic stimulation is additionally provided through variation in size, color, and foliage. Trees also provide visual interest through the provision of vertical and lateral dimension to a streetscape. The Emerald Ash Borer outbreak has also made the end-use utility benefit of trees apparent. The removal of substantial numbers of trees has highlighted the necessity for and expanding potential wood utilization choices.

A critical question for communities today is "How can we maximize tree canopy?" The most direct path is to plan for an environment that optimizes tree health, crown size, and longevity. Four critical strategies that serve this purpose are:

1. Selecting appropriate species.
2. Optimizing air space, soil space and distance from infrastructure.
3. Assuring a healthy soil environment.
4. Maintaining trees maximum health for their lifetime.

Poor or short-sighted choices in any of the above domains results in a shorter life for a community's trees with numerous increased maintenance issues. Poor-quality species may require more intensive and frequent maintenance than other species. Related liability issues may also increase. Through carefully optimized spacing, trees will realize their forms more readily and achieve larger and healthier crowns. This will result in a more efficient environmental engine. Optimized spacing also improves tree longevity and health. While tree potential is maximized through these practices, limited resources can also be more effectively leveraged to sustain trees at the height of their potential.

Phases of Crown Development

Trees can be assigned one of four phases of crown development: immature, semi-mature, mature and senescent.

An immature tree is a recently planted tree. Its canopy is young and thus contributes little in the way of environmental benefits. The initial costs associated with new trees are high, but their maintenance expenses are low. Particularly, as trees in this phase are typically in excellent condition. The significant issues related to this phase are that appropriate placement, selection and care define a tree's role and potential burden for decades to come.

A semi-mature tree is one that has become established. Its canopy is young but expanding. The environmental contribution of the crown is growing, but it is not yet optimized. Maintenance costs and risk ratings remain relatively low in this phase. Trees are typically in good condition, and some may rate as excellent specimens. Appropriate, but minimal, care is required at this stage.

The mature phase is apparent when the tree's canopy is near or at maximum development. Environmental contributions are optimized at this time because the total leaf area and tree health is good. Crown density is also optimal. While maintenance costs are increasing, risk ratings are relatively low. The exception to this is in trees with structural defects, which can be more problematic because of the tree's size. Trees in this stage are typically in good to fair condition.

In the senescent phase, the canopy development is declining. Environmental contributions begin to decrease as leaf area and overall tree health diminishes. Crown density lessens and can become sparse at this stage, and maintenance costs increase significantly. Risk ratings increase, and trees are typically in poor or very poor condition. Most removals address trees in this phase. Senescent trees should be removed and replaced when they no longer contribute effectively, become an increasing resource burden, or risk potential is too great.

Regardless of age, a tree in any phase, because of physical or environmental impacts, can move into the senescent phase. The normal progression of tree development is from the immature phase to the senescent phase, as indicated in Graphic 1.

Graphic 1: Timeline of tree stages

The total life and average duration of each phase for a tree varies greatly between species.

To meet the overall goal of an expanding, healthy and contributing urban forest, communities need to maximize the length of time a healthy tree exists in the mature phase. Particularly, as the community receives the most benefits from this phase. During discussions of individual trees, the repercussions seem insignificant; however, for municipalities that manage a large number of trees, the issues become far more apparent and pertinent.

Spacing Issue

In evaluating a sample of block segments in Oak Park, the following issues were identified:

1. The average distance between trees is about thirty feet. Most of the species noted have mature crown spreads of fifty or sixty feet. The average spacing noted means that crown competition is significant.

2. Crown competition has suppressed crown development on a large portion of the population. This suppression means that crown contribution is never fully realized, and tree life is substantially shortened within the group of trees in question.

3. Crown competition has significantly increased the volume of deadwood in a substantial proportion of the trees.

4. A large number of trees are planted within five feet of water shut offs, street lights and fire hydrants. Repairs to any of these items that also requires excavation will negatively affect the adjacent tree. This affect will result in tree removals, diminished tree health, and shorter tree life.

All of the above issues result from inadequate spacing. This context is not uncommon, as most Chicago suburbs contend with similar issues. The solution is to develop and articulate strategies that place trees at optimal distances from each other and create an infrastructure that will allow crown closure while maximizing crown size.

100 Block of South Taylor

A simple assessment of the 100 block of South Taylor demonstrates some of the issues identified above. The block has forty-seven trees on it, including the trees on the intersecting streets at each end of the block up to the respective alleys. There are currently no available vacant planting spaces on this block. In addition, if each tree is considered independently of the others, only ten of the forty-seven would have room for a replacement if removed. Of the remaining

thirty-seven trees, two or more trees would have to be removed to gain one planting space. Four of the trees were identified as having senescent crowns. The Village can anticipate that these trees will be removed within the next five to ten years.

Discussion

The objective is not to create treescapes that rigidly expect all trees to be large at maturity, nor all trees to be spaced at fifty feet—the new distance the Village is considering. The importance of the varied vertical and lateral dimensions that trees provide cannot be overlooked. Smaller species allow for variability in the spacing distances, which can be narrowed depending on the tree species. Nonetheless, an emphasis should be placed on spacing large trees at their maximum distances and placing an emphasis on planting large trees. These recommendations reflect the greatest respect for a community's investment in its trees because they promise the greatest return on a shared investment. By assigning whether a tree can be replaced if removed along with the tree's current crown phase, the Village, through GIS, will be able to anticipate planting needs well into the future. This will enable the Village to plan a healthier and expanding canopy.