ARBORMETRICS
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The Right Tree in the Right Place – 30 Years of Compatible Results

Electric utilities in the United States spend well in excess of $2.0 billion annually pruning and removing trees in an effort to keep vegetation from interfering with overhead power lines. In urban areas, periodic directional pruning is often the preferred practice used to avoid interference between trees and power lines. Even with regular maintenance, trees continue to be a leading cause of power interruptions for electric utilities, even during normal weather conditions. In addition to the cost of maintenance and impact on the reliability of electric service, utility pruning practices often diminish the benefits desired of urban trees and lead to complaints of misshapen or unattractive trees along residential streets and roadways.

As far back as 1912 it was recognized that tall-growing tree are not compatible with overhead power lines. "…the planting of trees in direct alignment with existing overhead lines is unwise...Where plantings must be made under overhead lines which have been permanently located, high growing shrubbery and dwarf trees can often be used with good results (Plate 57 – Choke cherry, wild crab, red twig dogwood, and elder shown here are some of the species which will develop naturally under overhead lines without serious interference)."[1]

"There is one case of the evil of overhead wires that cannot be overcome except by their removal, and that is where young trees grow under a web of wires. The young shoots cannot force themselves between the wires, but become stunted, and the result is an abnormally shaped, flat-headed tree. The most horrible butchery occurs when a large, wedge-shaped space is taken out of the centre of beautiful trees to allow the passage of wires. The damage is beyond repair, and it would be better to cut the trees down entirely than to leave permanent eyesores."[2]

For over 100 years, textbooks have cautioned against planting tall-growing trees under power lines. Yet tall-growing trees are planted and allowed to grow beneath high-voltage power lines throughout North America. There are countless examples of plans created by landscape architects and municipal arborists that ignore the long-term spatial need of the tree species selected for particular sites. The state road widening project, illustrated in Figure 1, which necessitated the topping of the honeylocust (*Gleditsia triacanthos inermis*) at the time of planting in order for them to fit beneath the power lines, is but one example of poor planning and inappropriate species selection.

Figure 1. *Gleditsia triacanthos inermis* topped at time of planting to fit underneath 12,000 Volt power line.

[1] Blair, G. D. *Tree Clearance for Overhead Lines*. 1940. 1st ed. Chicago: Electrical Publications, Inc. p 119.
[2] Solotaroff, William. *Shade-Trees in Towns and Cities*. 1912. 1st ed. New York: John Wiley & Sons. p. 148.

However, many examples can be found of appropriate planning and selection of the right tree for the right place. Many municipal street tree planting sites are constrained by narrow planting areas between curbs and sidewalks, by driveways and water lines. Selection of appropriate trees to plant under overhead power lines given all of the other constrains can be challenging. Appropriate plantings in Chicago suburbs over the past 30 years demonstrate that there are trees that can be selected to fit the space and make an effective contribution to the urban landscape. Trees planted in the Chicago suburb of Downers Grove beginning in the mid-1970's followed a policy of avoiding future conflicts between trees and overhead power lines. Various crabapple cultivars, (*Malus* 'Van Eseltine', 'Sentinel' and 'Centzam' – trade name 'Centurion') with generally upright form were planted under power lines along village streets. Figures 1 and 2 illustrate some of these trees after 30+ years.

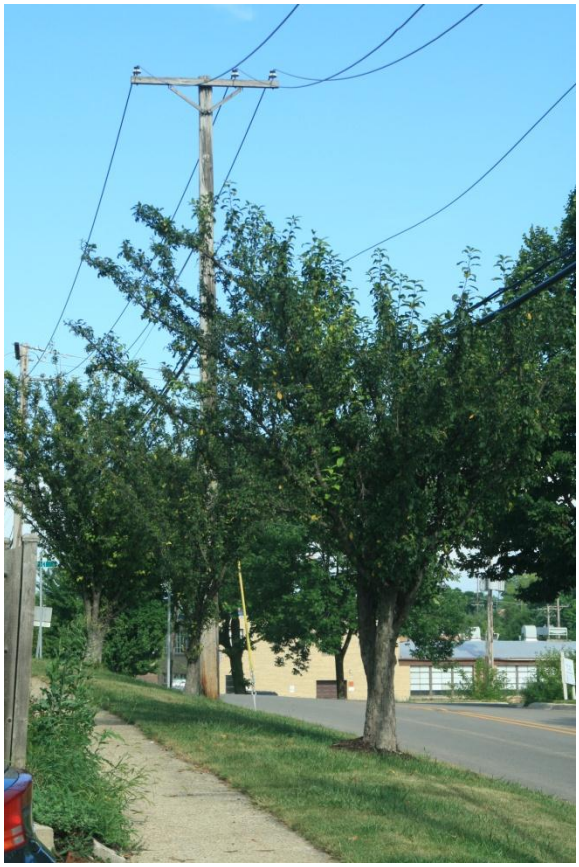

Figure 2. August 2011 photo of *Malus* 'Van Eseltine' planted in the Village of Downers Grove in 1976.

Figure 3. August 2011 photo of *Malus* 'Centurion' planted in the Village of Downers Grove in 1983.

The selection of crabapple cultivars that tend toward more upright forms was designed to help avoid conflicts with pedestrian use of sidewalks, avoid conflicts with snow plows and other trucks on the street and provide reasonable sight lines for divers. Crabapple selection included reasonable resistance to crabapple scab and good fall/winter fruit retention. Spring flowers are a bonus, and one which generates compliments from homeowners, as reported by municipal foresters.

The Sentinel crabapple pictured in Figure 4 is sufficiently upright to provide good clearance over the sidewalk and street.

In addition to crabapples, experiments with hedge maple (*Acer campestre*) planted under power lines proved successful. While in some locations hedge maple may become too large to fit comfortably under power lines, the 1983 planting in Downers Grove appears effective and has avoided necessity for line clearance pruning by the local utility. Figure 5 illustrates the form of the hedge maple after nearly 30 years and the high voltage power lines near the top of the pole. Attempts to "squeeze" trees with columnar or pyramidal form (i.e., *Tilia euchlora* 'Redmond') to the side of utility lines met with mixed results depending on how much distance was allowed to the side of the overhead lines.

Figure 4. August 2011 photo of *Malus* 'Sentinel' planted in the Village of Downers Grove in 1983. Note sidewalk and street clearance.

Figure 5. *Acer campestre* after nearly 30 years planted under power lines in Downers Grove, Illinois (August 2011 photo).

1988 Tree Removal and Replacement Program in Mt. Prospect, Illinois

In the spring of 1988, the Village of Mt. Prospect, Illinois, a Chicago suburb, participated with ComEd, the local electric utility, in a new tree removal and replacement program. Following the success in Mt. Prospect, ComEd brought the program to a number of other municipalities throughout northern Illinois. Trees targeted in Mt. Prospect were silver maples (*Acer saccharinum*) that were growing under power lines in a residential neighborhood (Figure 6).

Figure 6. *Silver maple trees prior to and during removal in 1988 as part of the tree removal and replacement program initiated between the Village of Mt. Prospect and ComEd.*

Prior to their removal, these trees required pruning every two years to keep them clear of the power lines. ComEd removed the trees and chipped the brush. The Village hauled away the larger logs, ground the stumps and contracted for the replacement plantings. At the time of this project the planting cost was $250 per tree, supplied, planted and guaranteed. ComEd reimbursed the Village for 50 percent of the cost, or $125.

The trees selected by the Mt. Prospect Village Forester and planted in 1988 were *Malus* 'Adams'. Subsequently some *Malus* 'Donald Wyman' were also planted (Figures 7 and 8).

Figure 7. Adams crabapples in 1988 (left) and same location in 2011 (right) in Mt. Prospect, Illinois.

Figure 8. A row of Adams crabapples in August 2011, planted as part of the 1988 tree removal and replacement program in Mt. Prospect.

Forty-two trees were removed and replaced as part of this pilot program in 1988. Figure 9 illustrates the estimated cumulative avoided cost of maintenance to the local utility. Figure 10 presents a more general summary of avoided cost per tree for two different scenarios. One example is of a site that requires line clearance pruning every two years and the other for sites that require pruning every four years.

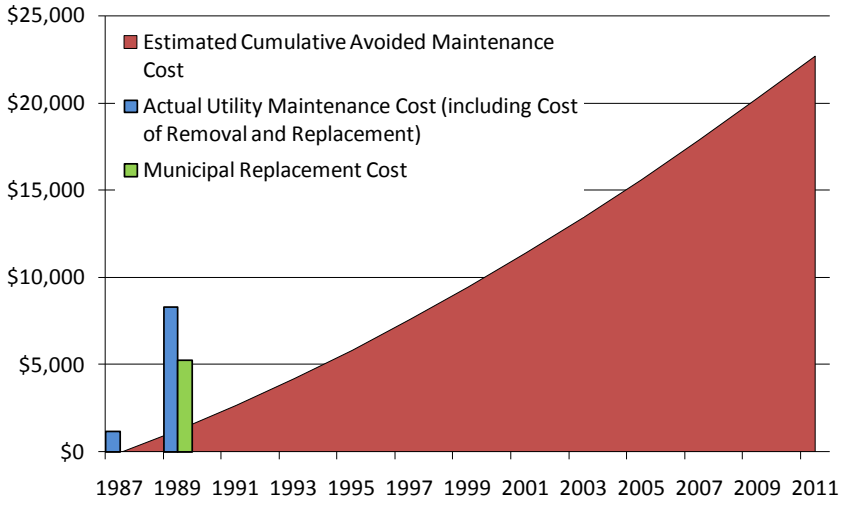

Figure 9. The estimated avoided maintenance cost for 42 trees in Mt. Prospect since 1988 and the respective initial costs to the Village and the utility.

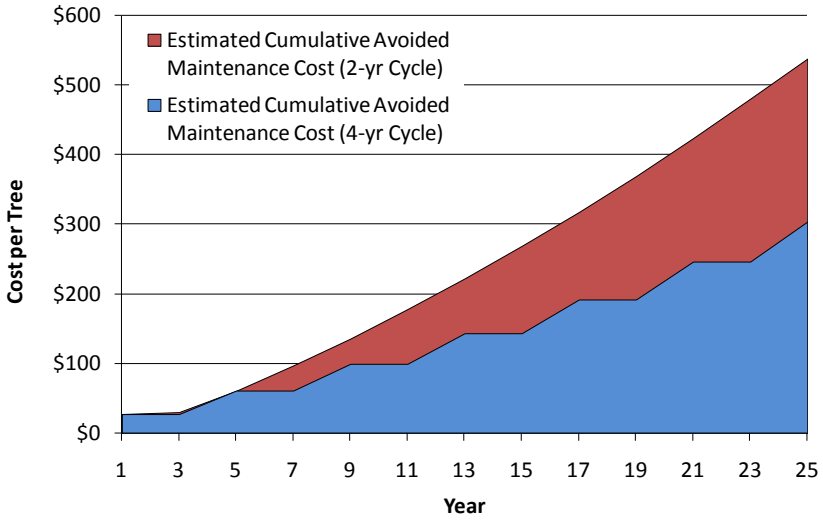

Figure 10. Appropriate species selection avoids between $300 and $500 per tree over 25 years depending on the maintenance frequency required (two years to four years) based on typical line clearance tree pruning costs. These estimated costs are expressed in nominal dollars beginning in 1987.

Based on the Mount Prospect project investment and estimated avoided maintenance costs over 25 years, a 14 percent internal rate of return was calculated[3]. The net present value of 25 years of avoided cost, with two percent escalation per year and a six percent interest rate, yields a 64 percent lower NPV for removal and replacement today than pruning every two years.

Other costs avoided by following the "right tree in the right place" advice includes improved customer relations, a reduction in outage restoration costs, reduced risk of interruptions for electric customers and improved streetscape aesthetics for residents.

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[3] Cost for initial removal was assumed to be two times the typical cost of pruning. Utility share of replacement cost was $125 and avoided costs on a two-year maintenance cycle were escalated at two percent per year.