

# Cost-Benefit Analysis of Planting Stock – A Three Year Study



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The myriad benefits of urban forests – ranging from social to economic to environmental – continue to be studied and recorded as our understanding of them is ever expanding. As we gain more insight into how maintaining a vigorous urban forest serves our communities, more and more municipalities and counties are putting forth a concerted effort to grow and enhance their urban greenspaces. These communities often face limited budgets though, so the question of cost effectiveness emerges. How can communities ensure that the investments they are making in the development of their urban forest are going to reward them the most benefits possible? This question requires a complex and multi-faceted answer, informed by many locally unique factors, as well as it includes a consideration of what planting stock options are best suited for their planting events. The three-year Cost Benefit Analysis of Planting Stock intends help communities decide which planting stock types they might prefer to use under a variety different circumstances.



*Figure 1: A serviceberry tree included in the study in St. Paul sporting its identifying tag*

## **Planting Stock Types and Associated Costs**

Many avid tree planters are at least familiar with the different types of planting stock, some may even have experience working with and planting a variety of them, but for many the transitional period between the tree nursery and boulevard or park may be a grey area, or a complete unknown besides the traditional nursery container. The four planting stock types included in this study are containerized trees, ball and burlapped (B&B) trees, spring planted bare root trees, and gravel bed bare root trees. Each of these stock types have varying costs when not only purchasing price, but labor, transportation, machinery, and storage requirements are taken into consideration.

Containerized trees are the most well-known planting stock. They are ubiquitous in nurseries and garden centers, and many species are grown as containerized trees. While there is some variety in container types, all of the containerized trees included in the study were planted out of traditional black containers with fully sealed sides. Containerized trees have a wide range of purchase prices, but generally, pot-size (#5, #10, #15, etc.) is the major factor contributing to the price. Containerized tree prices for can run from around \$40-\$250 per tree depending on species and size. Handling these trees may also require a fair amount of labor and transportation costs, particularly when trees are in larger pot sizes as they can be very heavy and require a fair amount of knowledge regarding best planting practices.



Figure 2: B&B tree before planting

Ball and burlapped trees, otherwise known as B&B trees, are generally the largest size planting stock available. B&B trees have been field grown, and then are dug out with a large soil ball and are tightly wrapped in burlap, wire, and twine, hence the name. B&B trees are the easiest way to plant a tree that is already large, and has an appearance closest to that of an already mature tree. These trees tend to be the most expensive planting stock available because they are costly to produce, large, very heavy, and difficult to handle without adequate training and equipment. Individual B&B tree prices range from about \$200-\$390, depending on caliper size, soil ball size, and species.

Spring planted bare root trees ship directly from the nursery bare root, they have generally been field grown and dug up, with the soil completely removed from the root system. They are stored in a damp cooler over the winter, and must be planted either immediately or following a period of “sweating,” during which the trees are covered until the buds begin to break. Bare root trees usually represent the widest variety of species compared to other stock types as well.

Gravel bed bare root trees are those which have at some point during the same season of their planting been held in a community gravel bed of whatever form, a technique which is utilized to not only store bare root trees until the time of planting, but also to stimulate additional fine root development in the trees. Both forms of bare root trees are easy to handle as they are relatively



Figure 3: Community gravel bed in Robbinsdale, Minnesota

lightweight, one person can easily handle multiple small bare root trees or one to two large bare root trees alone. So long as the root system remains well hydrated during storage and transportation, bare root trees are well suited for different planting scenarios, particularly for volunteer events. Purchasing prices for bare root trees range with species and size, but average prices are from \$10.00-45.00. Transportation costs are often reduced because of how lightweight bare root trees are compared to stock

types with soil, and because the trees are much lighter and easier to handle labor costs and time commitments may be reduced as well. Costs associated with building and maintaining a community gravel bed are something communities also must consider, see link to Community Gravel Beds information at the end of this report for more information on the construction and use of gravel beds.

## What about Performance between Stock Types?

Each of these four stock types present their own set of advantages and disadvantages in terms of transplant success, making some types more suitable depending on the planting circumstances. Success in the establishment and survival by stock type can vary a great deal between species, sizes of trees, and environmental conditions, making comparisons between the stock types themselves difficult. The intention of this cost benefit analysis is to look specifically at whether there are measurable differences between different stock types planted out in Southeastern Minnesota cities, and what other factors may be contributing to any differences. Analyzing any differences in growth and survival between stock types in the first three years following transplant (general length of establishment period) alongside the costs associated with each planting will help determine which stock may be more appropriate for different planting situations.

## Methods

Nine communities in Southeastern Minnesota are included in this study: Arlington, Fridley, New Ulm, North Saint Paul, Robbinsdale, Rochester, Shakopee, Saint James, and Saint Paul. Location, species, stock type, size, planting date, and who planted the tree (volunteer, contractor, city employee, etc.) was recorded by the cities for each tree, as was the price of trees, labor hours, and machine hours for every planting as well. Of all trees planted in these nine communities, 1,362 are included in the study. For some communities every tree planted was included, and for others where the number of trees far exceeded what was realistic to collect data from and monitor, study trees were randomly selected. The 1,362 trees included were measured for diameter at six inches above the ground (caliper), or above their graft union if above six inches if they are broadleaf deciduous, and measured for height if conifers. Each tree was

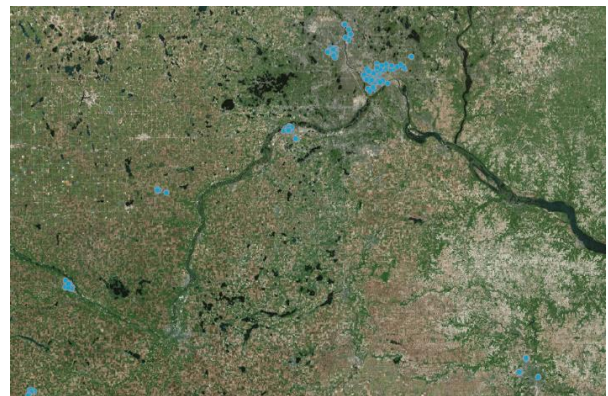


Figure 5: All study trees in Southeastern Minnesota represented by blue dots

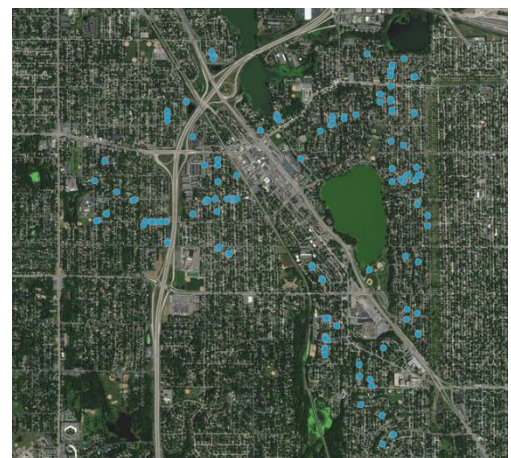


Figure 4: Study trees in the city of Robbinsdale represented by blue dots



measured once following their transplant in 2016, and then again at the end of their first full growing season in the ground since transplant in the fall of 2017. Every tree included in the study is to be monitored and measured for the first three years following transplant in order to obtain data throughout the establishment period.

This first year of data collection has been completed, and the growth rates between stock type, genus, and city are currently being analyzed through the Statistical Consulting Center at the University of Minnesota. Study trees are also monitored throughout the growing season to record survival, and every study tree has been mapped using the Collector app for ArcGIS, which is available to view online. Trees planted in 2017 will also be included in the study, and measured for the first three years following transplant. Using the growth rate and survival data collected after three years, the future benefits of the tree can be estimated and compared to the cost information compiled by the cities, so that each individual tree can be analyzed by stock type.

## **Preliminary Results**

While analysis of the growth rates have not yet been completed, some preliminary survival results are visible through the data collected from 2016 planted trees. Eighty-seven trees from the study have died in 2017, and are distributed through the stock types as follows: 12.44% of spring planted bare root trees, 7.72% of gravel bed bare root trees, 3.56% of containerized trees, and 2.91% of B&B trees. These percentages have not been adjusted to account for the differences in sample size by stock type, which are extreme (193 spring planted bare root, 647 gravel bed bare root trees, 421 containerized trees, and 103 B&B trees) due to the varying planting capacities and available resources within each city.

What these percentages indicate are slight advantages in stock types, though they have not yet been analyzed to include local precipitation data or distribution across the 32 different genera included in the study. As the study grows to include 2017 planted tree data any differences (or lack of) between stock types will hopefully become more visible, and can help to inform planting decisions.

## **More Information**

Link to the online map of study trees here: <http://arcg.is/9WGW5>

Community Gravel Beds:

[http://www.mntresource.com/uploads/2/0/7/0/20706756/all\\_you\\_need\\_to\\_know\\_about\\_community\\_gravel\\_beds\\_2013\\_edition.pdf](http://www.mntresource.com/uploads/2/0/7/0/20706756/all_you_need_to_know_about_community_gravel_beds_2013_edition.pdf)

Sweating:

[http://www.mntca.umn.edu/sites/g/files/pua2161/f/media/long\\_term\\_planting\\_success\\_often\\_begins\\_with\\_a\\_good\\_sweat.pdf](http://www.mntca.umn.edu/sites/g/files/pua2161/f/media/long_term_planting_success_often_begins_with_a_good_sweat.pdf)