



LEFT
A bare-root tree is ready to be dipped in hydrogel prior to planting.

IMAGE CREDIT
Delaware Center for Horticulture

THE BARE-ROOT CAUSE

BARE-ROOT PLANTING IS A BETTER CHOICE FOR TREE HEALTH.

BY JAMES R. URBAN, FASLA

Tree planting may be the essence of sustainable landscape architecture, but the methods of harvesting and installation are not always specified in the most sustainable ways. Each of the most common options for tree planting—balled and burlapped, tree-spade planting, and container-grown trees—has environmental costs that reduce or even eliminate the trees' contributions to the sustainability equation.

Before World War II, bare-root planting was the most common method to move trees both large and small. Projects did not typically move at a fast pace, and people were more patient to wait until the right time to plant. After the war, increasingly larger trees were specified to meet both designer and client needs for instant gratification, and projects began to move more rapidly, with plantings often required at almost all times of the year. The current reliance on balled and spade-dug trees and particularly container trees developed to fill these project requirements.

Field-grown balled-and-burlapped and spade-dug trees remove large amounts of topsoil from the nursery, which reduces farmland productivity and expends large amounts of energy to dig, move, and plant the trees. These impacts increase with tree size. Container-grown trees and field-grown trees often have significant root problems, such as trunk-girdling roots and buried trunk flares, which keep the tree from ever becoming a mature specimen. These root problems are so widespread within the container nursery industry and so damaging to the long-term success of trees that planting container-grown trees may not be advisable until production practices are changed. A movement toward bare-root tree planting, including newly planted trees and the transplanting of quite large trees, is developing as a solution to each of these issues. Changes in technology and methods for planting bare-root trees offer the opportunity to harvest and plant a wide range of tree species, and

in larger sizes over a broad window of planting times, as bare-root specimens.

In 2000, research work by Nina Basuk, the program leader at the Urban Horticulture Institute at Cornell University, introduced the use of hydrogel dips to improve the ability to store trees longer and extend slightly the planting season and number of species that could be reasonably moved with bare roots. Hydrogel is a water-holding polymer that coats the roots after digging and protects them from drying out. Trees are harvested from the field and stored in a cool, moist, and dark storage building. For short periods of time the trees may be covered in moist mulch outside until it is time for shipment. At the time of shipment the grower should dip the tree roots into a vat of hydrogel slurry and wrap the roots in a plastic bag. The trees are shipped in enclosed refrigerated trucks. The dip and bag process allows the storage time after delivery to be up to one week in a cool, moist, and dark storage space. In warmer weather the trees may need to be stored in a refrigerated space. This method allows a longer harvesting and planting window, and the gel protection allows a larger number of species to be considered for bare-root planting.

Work by the Urban Horticulture Institute produced a list of trees that would be suitable for bare-root planting. In 2009 the institute published an excellent protocol for the bare-root process that is available at www.hort.cornell.edu/uhi/outreach/pdfs/bareroot.pdf. The protocol includes descriptions



LEFT
Volunteers dip bare-root trees into a hydrogel slurry and then bag the root system to protect it from drying out.

BOTTOM
Bare-root trees that have been dipped and bagged are ready to be shipped to the planting site.

IMAGE CREDITS
Delaware Center for Horticulture



of the process and a list of suitable trees. This protocol does not expand the transplanting season into the period where the tree is in leaf, limiting its use to early spring and late fall planting.

The most successful bare-root plantings have been in areas with cooler and wetter climates. However, many state forestry extensions are promoting bare-root tree planting in areas as dry and hot as Montana and Nevada.

Despite the improvements to early spring and fall plantings, to make bare-root planting compete with the conventional harvesting method it has to move toward allowing planting periods throughout the growing season. Chris Starbuck, a horticulture professor at the University of Missouri-Columbia, has developed the Missouri Gravel Bed (MGB) to allow bare-root trees to be planted throughout the plant growing season. Trees are dug in the early spring, immediately replanted into a matrix of pea gravel and sand, and watered by drip irrigation. The trees quickly regrow large amounts of roots in the gravel. When planting time arrives, the tree is easily removed from the gravel with a much larger

root system than it had when it was dug. This technique allows a wider range of tree species to be held until planting, as well as the use of larger trees up to five inches in caliper. These trees can be transplanted in full leaf in midsummer with similar success rates to balled-and-burlapped trees. This method offers the hope that we might one day see a much larger portion of our trees planted as bare-root plants. A good summary of the MGB concept can be found at www.plantsci.missouri.edu/PS2210/mgb/mgb_home.htm.

Another innovation is the use of an air spade combined with hydrogel application to dig trees. Pioneered by Mark Hoenigman, an arborist at Busy Bee Services in Cleveland, air spades have been used to move very large trees, and there are now many arborists who offer this service. With an air spade, almost

the entire root system of the tree can be unearthed, and large trees can be moved and shipped with small-sized equipment. For larger trees, hydrogel is sprayed onto the roots as the tree is dug. (See "Roots First," *LAM*, March 2009, for a review of this technique.) Air-spade digging is most often used to relocate larger trees at development sites. Digging nursery-grown trees with an air spade is more expensive than conventional methods of bare-root harvesting, but will likely improve the success rate of larger nursery-grown trees. This method can be specified as the required harvesting method for nursery-grown trees if budgets are adequate.

The advantages of bare-root planting include lower energy use and the associated lesser costs in harvesting, moving, and planting trees. Soil remains in the field to support future

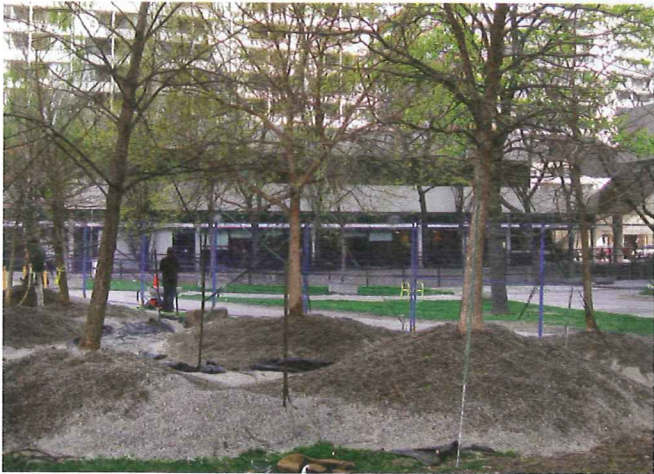
tree production. The root system can be inspected at the time of planting to assure that girdling roots are removed and that the depth of the flare is located at the ground line. More roots are put in direct contact with the soil, and the planting hole can be shallower than is the norm with other methods. Water is absorbed quickly into the soil around the roots when compared to watering a standard root ball, which makes watering easier and more effective. Tree loss is normally the same as with conventional methods.

There are disadvantages to bare-root planting, and they are primarily related to the sensitivity to planting time and the nature of individual species. Both of these problems can be resolved with the improvements in technology, including the use of hydrogels to reduce stress on the tree, air-spade digging to harvest more of the root system, and the inclusion of the MGB for storage to allow summer planting. But overcoming two other problems requires an industry commitment to use bare-root stock.

First, there are only limited numbers of nurseries that will dig bare-root trees.

RIGHT

This large-caliper tree's root system was dug bare root with an air spade.



ABOVE

Bare-root trees will be stored with others at the construction site for more than a year in a temporary Missouri Gravel Bed.

IMAGE CREDITS

James R. Urban, FASLA, top right; Vanessa Eickhoff, above

One problem is a lack of demand; another is that it is difficult to dig bare-root trees in the heavier soils of many existing nurseries. Trees grown for balled-and-burlapped harvesting are better grown in soils with higher clay content. It is less common to find nurseries in areas of sandy loam soil, which is ideal for bare-root harvesting. Demand is growing and suppliers can respond to a gradual increase in the number of bare-root trees specified by landscape architects. Heavier soils respond well to air-spade digging but at an added cost per tree.

The second problem is that change is required in most of the current harvesting, transporting, storage, and planting procedures. Change at this scale is hard for any industry. The nursery industry, particularly the container tree growers, has been very slow to adopt fairly simple changes in production practices to reduce the incidence of girdling roots, and girdling roots can actually kill the tree. It will be harder for nurseries and contractors to adopt more complex changes for the altruistic motivation of promoting sustainability.

Here is where landscape architects must take a leadership position, as they did in the promotion of native species or in the adoption of pervious pavers and green root technology, each of which were fringe movements just a decade ago. To move this concept into the commercial landscape, landscape architects, during the design process, must identify nurseries that will dig bare-root trees and then specify the types of trees these nurseries produce. They must start working with contractors before the bidding procedure to be sure the contractors are aware of the bare-root storage, shipping, and planting requirements. For example, using the MGB concept will require adding it to the specifications. The MGB is best constructed at the installing contractor's yard, and is simple to construct and maintain. As an example, at the Toronto City Hall, the landscape architects Hoerr Schaudt of Chicago and PLANT Architect of Toronto specified a temporary MGB to be constructed at the site to hold large bare-root trees removed for the renovation of the plaza. These trees, which are sized up to 10 inches in caliper, will be reinstalled after more than a year in storage.

Change is already occurring. At the Delaware Center for Horticulture, Gary Schwetz plants hundreds of bare-

root trees in the center's community tree planting programs. The lighter trees lend themselves to the volunteer labor that plants their trees. They find the bare-root trees' success similar to other planting methods. Andy Hillman, the city forester in Ithaca, New York, also uses large numbers of bare-root trees in his planting program. Major bare-root growers, including Brotzman Nursery in Madison, Ohio, and Schichtels Nursery in Springville, New York, report that they are seeing an increase in bare-root sales.

As energy costs rise, bare-root planting, both for newly planted trees and transplanted trees, is going to become increasingly important, as it requires less energy to harvest, ship, and plant. As we develop a better understanding of what makes one particular product more sustainable than another, the use of bare-root trees will undoubtedly score higher than conventional harvesting and planting methods. For these reasons, landscape architects need to become proficient in specifying bare-root plants and including them on their plans. ●

JAMES R. URBAN, FASLA, SPECIALIZES IN URBAN TREES AND SOILS AND IS A CONSULTANT TO OTHER LANDSCAPE ARCHITECTS.