



Planting Under Trees

Hostas and ferns thrive in the cool shade cast by the trees in this garden allée.

DURING MY career as an arborist, a client once asked me to examine the root system of a large tree in his backyard. He wanted to plant a perennial bed around the base of the tree, but was having trouble because the tree's roots were so close to the soil surface. He sought my opinion on whether he could clear away some of the surface roots with an ax.

My response was that if he did that, he might as well just cut down the tree. Damaging the root system that extensively, I explained, would make the tree—which was growing close to his house—dangerously unstable and could even kill it eventually.

Instead, we created an unobtrusive mulch bed around the tree. He was able to install a great new garden without significantly harming the tree's roots.

Understanding the physiology of tree roots before you launch into a planting

Protecting tree roots from damage is important when creating beds under trees.

BY DAVID OETTINGER

project like this will increase your chances of sustaining a tree's health. Because trees—especially mature ones—are a valuable investment, it is critical to carefully consider what you plant around your trees and how you plant it.

THE ROOT OF THE ISSUE

Gardeners naturally tend to focus on the health of the visible, above-ground struc-

ture of the tree. It's easy to forget about the roots, which serve several key functions: anchorage, absorption of water and mineral nutrients, storage of food, association with symbiotic fungi known as mycorrhizae, and synthesis of certain organic compounds, including those that regulate activities in the top of the plant.

Roots, unlike stems, do not have regular branching patterns. They grow wherever moisture and oxygen are available. Paul Cowie, a consulting arborist in Hiawatha, New Jersey, says there's a common misconception that roots do not grow beyond a tree's crown—the circumference of the branch spread. "Roots won't stop at the drip line unless a physical or environmental barrier prevents them from growing beyond it," says Cowie, adding that under ideal growing conditions, a tree's roots can extend up to two to three times the width of the crown.

However, the drip line does define the "critical root zone." This is the area, explains Scott Josiah, state forester and director of the Nebraska Forest Service in Lincoln, where damage to any roots will adversely affect the tree's long-term health and structural stability. The closer you garden to an existing tree trunk, the greater the potential for root damage that will cause lasting harm to the tree.

Because the roots of most ornamental trees grow in the first one or two feet of soil, even shallow digging may damage them. And most of the fine feeder roots—the ones that absorb water and nutrients—are located in the upper foot.

Of course, some trees do tend to send roots deeper than others. In some cases, root depth is as much soil dependent as species dependent. According to Cowie, even typically deep-rooted species may become surface-rooted when growing above a rock outcrop or in compacted soil.

Severely compacting the soil around a tree—which often happens when heavy equipment is used during construction or major landscaping—jeopardizes tree health because it removes air that roots need for healthy growth. If you are planning major construction for your home or garden, ask the contractors to make the root zones of

CHEMICAL DEFENSES

A few tree species are allelopathic—they produce chemicals that can kill or inhibit the growth of other plants growing underneath or nearby. The best known examples of this are walnuts (*Juglans* spp.), which produce juglone, a chemical toxic to a wide range of plants including azaleas, blueberries, and tomatoes. Other trees known to have allelopathic tendencies are sugar maple (*Acer saccharum*), black locust (*Robinia pseudoacacia*), some eucalyptus (*Eucalyptus* spp.), and sassafras (*Sassafras albidum*). Establishing new plants under these trees may be more difficult than under others.

—D.O.

trees off-limits to heavy equipment by roping them off or installing temporary fencing.

Root damage may not directly kill your tree. More often, in order to make up for the lack of nutrient uptake, the tree begins to divert resources from defense to growth. This leaves it vulnerable to secondary stresses such as disease and insects. It is this secondary attack that usually kills the tree—months or even years later.

CUT WITH CARE

The rule of thumb among arborists is that once 50 percent of a tree's root mass is lost, the eventual death of the tree is a foregone conclusion. Extensive root loss also makes a tree very unstable, which can create a hazardous situation.

According to the International Society of Arboriculture, severing even one major root can cause the loss of 15 to 25 percent of the root system. And root damage does not repair quickly. On average, it takes a tree one year for every inch in trunk diameter to recover from torn roots. If you must trim roots radically to accommodate landscape construction, you should consider root pruning well in advance of construction to lessen the impact.

The further away from the trunk the cut, the less likely you are to injure a large root that will have a profound impact on the entire root system. "Unfortunately, on most sites, space is limited and this rule must be bent," says Gary R. Johnson, an Extension professor in the department of forest resources at the University of Minnesota in Minneapolis. "Just how close an activity can come without seriously threatening the survival of a tree depends on the species, the extent of damage, and the plant's health."



Above: Trees with shallow or surface roots, like this one, can be easily damaged by plantings. Right: The health of many urban trees is often compromised during major construction when heavy equipment severely compacts or removes the soil around their roots.



TOUGH TREES

The following common landscape trees have shown some tolerance of root disturbance or soil compaction.

Acer rubrum (red maple)
Carya glabra (pignut hickory)
Cercis canadensis (eastern redbud)
Crataegus phaenopyrum
 (Washington hawthorn)
Fraxinus pennsylvanica (green ash)
Gleditsia triacanthos (honey locust)
Gymnocladus dioica
 (Kentucky coffee tree)
Ilex opaca (American holly)
Magnolia grandiflora
 (southern magnolia)
Picea abies (Norway spruce)
Picea pungens (blue spruce)
Pinus banksiana (Jack pine)
Pinus virginiana (Virginia pine)
Quercus prinus (chestnut oak)
Quercus rubra (red oak)



Top right: Red maple (*Acer rubrum*).
 Right: Lilyturf (*Liriope* sp.).

PLANTS FOR DRY SHADE

The plants below tolerate the shade cast by a tree's canopy and the dry conditions caused by the tree roots' great intake of soil moisture.

Asarum canadense (wild ginger)
Carex pensylvanica
 (Pennsylvania sedge)
Chrysogonum virginianum
 (green and gold)
Convallaria majalis (lily of the valley)
Dennstaedtia punctilobula
 (hay-scented fern)
Epimedium spp. (barrenworts)
Eurybia divaricata, syn.
Aster divaricatus (white wood aster)
Hakonechloa macra (Hakone grass)
Helleborus foetidus (stinking hellebore)
Liriope spp. (lilyturfs)
Ophiopogon spp. (Mondo grasses)
Polypodium virginianum (rock fern)
Polystichum acrostichoides
 (Christmas fern)
Sanguinaria canadensis (bloodroot)
Symphytichum cordifolium, syn.
Aster cordifolius (blue wood aster)

To minimize root damage, Johnson recommends that for each inch of tree trunk diameter at breast height (dbh), allow for one and a half feet of critical root zone for sensitive trees; one foot for trees regarded as more tolerant of root disturbance. So, for a tree with a dbh of 10 inches, cutting roots no less than 15 feet away from the trunk would reduce the risk of major damage.

Arboriculture and forestry professionals use a specially graduated tape to determine trunk diameter, but anyone can make this calculation by measuring the circumference of a tree with a household measuring tape and then dividing that number by three (3.14, or pi, if you want to be precise).

Some tree species are more tolerant than others of root disturbance (see the list above). Older trees are generally less tolerant of disturbance than are younger trees, so if you have a choice, consider creating a new bed under a younger tree.

RAISING THE GRADE

Aside from the impact on a tree's health, the biggest dilemma in trying to plant under one is the same problem my client encountered—finding space to in-



Bulbs and shallow-rooted plants like Johnny jump-ups (*Viola tricolor*) are good choices for sites like this, where a couple of inches of soil have been added around a cluster of trees.



Barrenworts (*Epimedium* spp.), foamflowers (*Tiarella* spp.), and Siberian bugloss (*Brunnera* spp.) form a dense groundcover around a birch tree.

sert new plants among the existing roots. This, too, varies by tree.

"Some tree species produce a denser root mass that is more difficult to work around," notes Cowie. "Maples, for example, produce a thick, dense mat of fibrous roots while oaks tend to have larger, more distinct primary horizontal roots that can be located and worked around."

For small-scale landscaping renovations, adding soil around the base of a tree to provide a planting area is probably a better option. This approach has its own potential problems. Adding too thick a layer of soil can starve the root zone of oxygen. Raising the grade around the tree can potentially divert water and nutrients away from roots, too.

It has been my experience, however, that adding some soil around a tree will cause less harm than indiscriminately cutting roots. Experts recommend adding no more than two to four inches of planting medium to the base of any tree at one time.

Make sure to use a light blend of soil—or, better yet, compost—and organic mulch such as wood chips, shredded bark, or pine needles. As it slowly decomposes, this organic matter will condition the

soil, moderate soil temperatures, maintain moisture, and reduce competition from weeds and grass. Never let the planting medium come into direct contact with the trunk because it can facilitate fungal and bacterial infections.

Rex Bastian, an arborist with Davey Tree Expert Co./The Care of Trees in Wheeling, Illinois, advises amending the soil around trees several months in advance of planting. "Mulching first and installing later provides a couple of advantages," he says. "First, the soil and mulch mix will have had some time to break down, providing some organic matter to the soil. Second, the organic layer will help loosen the soil beneath it, making it easier to open holes to receive the plants. This allows a greater depth over the existing root system with which to work."

Resources

Arbor Day Foundation, Nebraska City, NE. (888) 448-7337.
www.arborday.org.

International Society of Arboriculture, Champaign, IL. (888) 472-8733.
www.isa-arbor.com.

A BALANCING ACT

Landscaping under or around existing trees involves balancing the health of the tree against the needs of the plants you want to grow under them. When deciding what to plant under your tree, try to match the moisture needs of the new plants with those of the tree or trees they are going to accent. This is important because as you try to get your new garden established, you might wind up overwatering an existing tree that does not like wet soils. Trees such as birches, alders, bald cypresses, sweetgums, and some maples will thrive in moist soils, but most others do not.

Thirsty trees tend to quickly absorb water in their root zone, leading to the dreaded gardening challenge known as dry shade (see the list of plants adapted to dry shade on opposite page). Soil moisture levels are also affected by the rain shadow cast by different trees; dense-canopied trees such as maples, beeches, pines, and spruces tend to divert water toward their drip lines.

Dense-canopied trees also cast heavier shade than open-canopied trees, which means you have a narrower choice of plants adapted to grow underneath them. To let through more light, your main op-



Good choices for planting under trees for spring color include snowdrops and crocuses, above left, and lily of the valley, above right.

tions are to limb the tree up (remove some of the lowest branches) or have its canopy thinned by a certified arborist.

PLANT SELECTION

In general, shallow-rooted herbaceous perennials, bulbs, and groundcovers are best suited to sharing soil space with existing tree roots because they need less growing medium and will not require the digging of large holes around the tree.

Small bulbs such as crocuses, snowdrops (*Galanthus* spp.), *Iris reticulata*, and hardy cyclamen (*Cyclamen* spp.) only need to be planted a couple of inches deep (or covered to that depth with new soil) and can be easily integrated between roots. Rhizomatous or shallow-rooted groundcovers like hardy gingers (*Asarum* spp.), Allegheny spurge (*Pachysandra procumbens*), crested iris (*Iris cristata*), foam-flowers (*Tiarella* spp.), and some ferns are

also ideal for such sites as long as the soil remains somewhat moist.

Because annuals need to be replaced frequently, they are not the best planting choice under shallow-rooted trees unless you grow them from seed.

Shrubs with larger root balls are also problematic. “There is no good way to incorporate a lot of large plants close under a tree without doing long-term damage to the tree,” says Nina Bassuk, a horticulture professor at Cornell University and program leader for its Urban Horticulture Institute. Your best bet is to select the smallest possible ones and plant them in phases over several growing seasons.

If you are planting a bed of mixed shrubs and perennials, consider placing perennials closest to the tree trunk, then gradually integrating shrubs as you get further away from the tree’s major roots.

Remember, arboriculture, like gardening, is both an art and science, so there’s no magic-bullet solution for every situation. But you’ll have better results with both your trees and garden plants if you take tree-root health into account before putting shovel to earth. When in doubt, consult a professional arborist rather than risking the loss of a treasured tree. 🌿

CARING FOR ESTABLISHED PLANTINGS

Once you’ve planted underneath trees, you will have multiple root systems competing for water and nutrients. Be sure to water your new planting regularly for a couple of months until the plants are well established. Then gradually reduce the frequency of waterings but soak the entire planting area thoroughly each time you water.

Deep watering encourages root systems to grow deeper, making plants more drought tolerant and reducing surface rooting that can interfere with your garden. Letting the soil dry between irrigations allows for natural shrinking and swelling that will help improve soil structure.

Watering the lower trunk near the root collar can lead to fungal problems so aim sprinklers or irrigation nozzles away. If you are installing an irrigation system in and around a new garden bed that encompasses trees, arborist Rex Bastian with the Davey Tree Expert Co./The Care of Trees also cautions against running irrigation lines across tree roots. “Many system installers will simply cut the roots of a tree when installing irrigation,” he says. “Require the contractor to run the main line outside the drip line, and run the branches toward the trunk of the tree like spokes on a wheel. Install a directional head that waters away from the tree trunk to avoid problems.”

Established trees generally don’t need much supplemental fertilizer, but with new roots to feed, you may want to add a balanced slow-release fertilizer (10-10-10 is fine) or compost tea at the time you install your new plants. Once the new plants get established, apply fertilizer a couple of times a growing season or amend the bed annually with compost or other organic matter. —D.O.

David Oettinger was a professional arborist and forester for over 25 years. This updated article was originally published in the January/February 2005 issue of The American Gardener.