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

By David Oettinger

Planting Under Trees

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

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 sure to keep the root zones of 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.

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.

Cut with Care

The rule of thumb among arborists is that once 10 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.

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—whose roots were 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.
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 dioicus (Kentucky coffee tree)
- hex 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 (white oak)
- Quercus rubra (white oak)
- Quercus rubra (jack oak)
- Quercus rubra (norway spruce)
- Quercus rubra (red oak)
- Quercus rubra (southern beech)

RAISING THE GRADE
Aside from the impact on a tree’s health, the following common landscape trees have shown some tolerance of root disturbance or soil compaction.

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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)
- Convolvulus majalis (lily of the valley)
- Dendrobaena punctilobula (hairy-scented fern)
- Epimedium spp. (barrerworts)
- Eurybia divaricata, syn. Aster divaricatus (white wood aster)
- Hakonechloa macra (Hakone grass)
- Helianthus annuus (tithonia)
- Liriope spp. (lilyturfs)
- Ophiopogon spp. (Mondo grasses)
- Polypodium virginianum (rock fern)
- Polytrichum acrostichoides (Christmas fern)
- Sanguinaria canadensis (bloodroot)

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.

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 within one and a half feet of critical root zone for that tree would reduce the risk of major damage.

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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*), foamflowers (*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.

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*. 

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**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.