TREES & SHRUBS

Protecting Trees During Construction no. 7.420

by K.E. Bernard, C. Dennis and W.R. Jacobi [1]

Quick Facts...

Evaluate established, healthy trees to see if preservation is worthwhile and feasible.

Involve all parties in planning for tree preservation.

Establish specific guidelines to prevent tree injury.

Proper-sized barricades around trees can minimize injury.

Mechanized equipment can damage tree trunks, root systems and soil structure.

Soil compaction and grade changes limit root growth, causing dieback and death.

Tree Value, Health and Life Span

Shade trees add to the value of residential and commercial properties. During construction, established, healthy trees can be preserved with little effort or expense. Many trees are valuable enough to justify the extra concern.

Have a city forester, licensed arborist or certified tree appraiser evaluate every tree to see if preservation is worthwhile. Consider location, present size, future size, species, vigor, cost of preservation, and removal cost. Recognize that it is impossible to save every tree. Visualize the future landscape when evaluating trees for preservation. If plans call for preserving existing trees near buildings or in landscapes, the trees should be sufficiently healthy to justify preservation.

Some large, mature trees are not structurally sound or in good enough condition to warrant preservation. Older trees do not adapt to environmental changes as well as younger trees. It may be more practical to protect a 1- to 8-inch diameter tree than a larger, more mature tree. If necessary, move small trees with a tree spade or replace them. Certain species adapt better to environmental change than others (Table 1).

The Root System

Tree root systems contain large, perennial roots and small, short-lived absorbing roots. Large, woody roots grow horizontally and are mostly in the top 6 to 24 inches of the soil (Figure 1). Their main functions include water and mineral transport, food and water storage, and anchorage.

Figure 1: Roots lie in the upper 24 inches of soil and are easily damaged.

Smaller absorbing roots, averaging 1/16 inch in diameter, constitute the majority of the root system's surface area. These roots grow outward and upward from the large roots, near the soil surface where minerals, water and oxygen are abundant. Their major function is to absorb water and minerals.

The root zone extends horizontally from the tree for a distance at least equal to the tree's height. Preserve at least 50 percent of the root system to maintain a healthy tree. During summer construction, trees require adequate water, enough to saturate the soil, every one to two weeks.

The Planning Process

To avoid short- and long-term problems, early in the planning process consult all parties involved in the project: homeowner, contractor, architect, engineer, arborist, etc.

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Putting Knowledge to Work

Figure 2: Highly visible tree protection barriers.

Once trees are selected for preservation, include specific preservation methods in the project plans and contracts. All parties should be aware of and agree to the consequences for noncompliance. To ensure compliance, contractors should have tree preservation bonds to cover noncompliance fines. Fines are based on species, tree value, and the amount and type of damage done. These bonds create an additional incentive for compliance.

Before construction, conduct on-site meetings with all parties, with special emphasis on educating the project contractor. Give each worker or contractor handouts outlining the preservation activities. Post highly visible barricades and signs as a contant reminder of the protected areas (Figures 2 and 3). Preventing damage is less costly than correcting it.

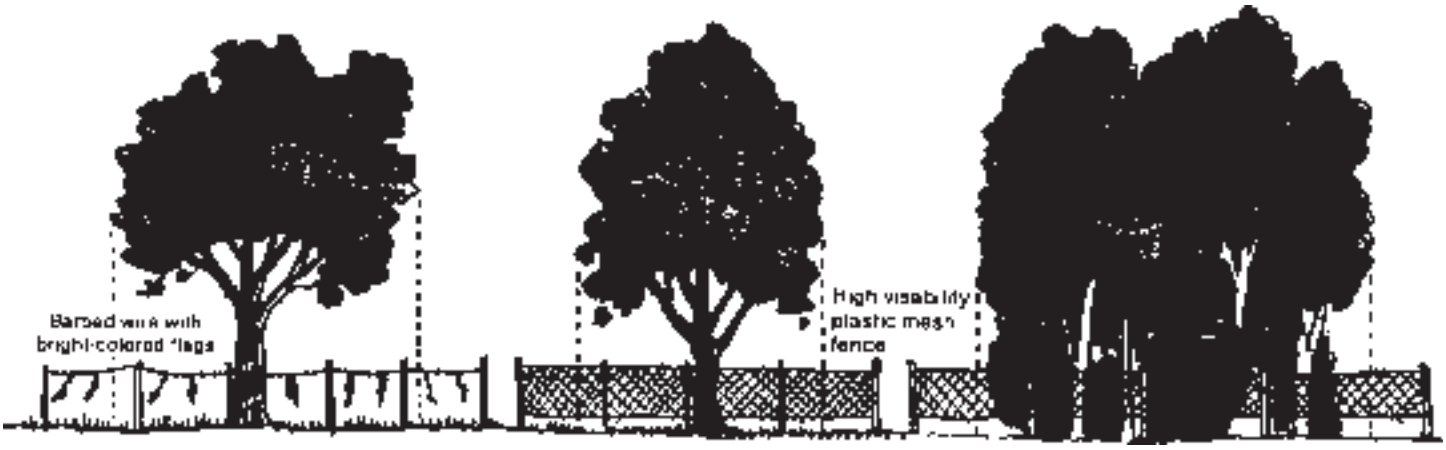

Figure 3: Ideally, the protection barrier should extend beyond the dripline. Reprinted with permission from *Tree City USA* Bulletin No. 7, National Arbor Day Foundation.

Preventing Injury

Set contractor guidelines for tree protection within contracts. Such guidelines include: prominently mark protected areas; erect barricades around designated trees; avoid vehicular traffic or parking in restricted areas; and prohibit material storage, grading, and dumping of chemicals and other materials in restricted areas.

The optimal size of barricaded areas varies by tree size, species and construction project. For recently planted trees (one to four years), the area under the branches (dripline) should be adequate. For minimal protection of trees older than four years, barricades should have a 1-foot radius per inch of diameter, with a wood chip mulch 4 to 6 inches deep extending to the dripline. If low branches will be kept, place the fence outside the dripline. Examine trees and barricades at least once a week during construction.

Figure 4: Construction vehicles can damage the existing soil structure by compressing soil particles.

Soil Compaction Problems

After a tree is established, any activity that changes the soil condition is extremely detrimental to its health. Construction traffic compacts soil most severely near the surface, the area where the majority of tree roots lie. This compaction decreases soil permeability, increases soil strength and reduces soil oxygen. These factors limit root growth, reduce tree vigor and can cause tree death. When root growth is restricted by compacted soils, less nutrients and water are available for plant growth. Soil compaction also limits other processes such as gas exchange and surface and subsurface drainage. Decline and dieback may gradually appear over a period of years.

It is easier to avoid soil compaction than to correct it. Keep construction traffic and material storage away from tree root areas. Mulch with 4 to 6 inches of wood chips around all protected trees to help reduce compaction from vehicles that inadvertently cross the barricades.

Figure 5: Surface grading severs many roots.

Direct Tree Injury by Equipment

There are four general forms of direct tree injury caused by mechanized equipment: bark removal, branch breakage, surface grading and trenching injury (Figures 5 and 6).

Bark removal or “skinning” of the trunk can be caused by any type of equipment. This can easily kill the tree, because it cannot survive without bark. Breakage of lower branches may make the tree unsightly or remove too many leaves, causing stress. Surface grading removes surface vegetation and topsoil that contains many absorbing roots. Also, injury often occurs to the tree base.

Trenching for utilities can also cause substantial root damage and should be done far away from existing trees. In new developments, this can be done easily. Where the trench must pass under or near a tree, avoid substantial injury by using a power auger to bore a tunnel under the roots. If trenching is unavoidable, place the trench as far from the trunk as possible (minimum 8 feet), cutting as few roots as possible. Cleanly prune cut roots and refill trenches as soon as possible to prevent excessive moisture loss.

Figure 6: Trenching near trees can severely damage root systems.

Wounds make the tree highly susceptible to root pathogens and decay fungi. Decline and death can result if more than 40 percent of the stem or roots are damaged or killed. Stressed trees are also more susceptible to insects such as bark beetles and borers.

Figure 7: Within two years of adding 12 inches of soil, this tree died.

Soil Fills

When fill is added around a tree base, it acts as a blanket and prevents normal air and moisture circulation to the roots (Figure 7). It subjects roots to improper gas exchange and can lead to carbon dioxide or toxic gas buildup. Minor fills (less than 3 inches) will not harm most trees. The topsoil should be high in organic matter and have good drainage properties — it should not be clay. Major changes in grading require an air supply to the roots. This can be accomplished with a drywell.

A drywell is a system of drain tiles covered with small stones and soil fill. It is designed to allow air to circulate within the upper root area. These systems can be effective but they are expensive to install.

Early symptoms of decline from excessive fill are small leaf size and premature fall coloration. Dieback of twigs and progressive dying of larger stems in the upper crown also occurs. This dieback may not be noticed for several years, depending on tree species and initial tree health.

Figure 8: Lowering the grade severs roots and kills trees.

Soil Cuts

Lowering the grade usually is less complicated than fills but can be equally harmful. Where the grade has been changed near a tree, the most common damage is the complete severing of major roots in that area (Figure 8). This can cause decline, death or decreased stability to high winds.

To protect the tree, terrace the grade (Figure 9) or build a retaining wall between the tree and the lower grade. Walls should encompass an area extending at least to the drip line.

References

For more information on protecting trees during construction, call your Colorado State University Cooperative Extension county office, Colorado State Forest Service, city forester, local arborist, or forestry consultant.

The following fact sheets and publications are also available through "The Other Bookstore" (Cooperative Extension Resource Center), 115 General Services Building, Colorado State University, Fort Collins, CO 80523-4061, (970) 491-6198

2.926, Healthy Roots and Healthy Trees
5.530, Shade Tree Borers
5.566, Peach Tree Borer
6.302, Creating Wildfire-Defensible Zones
7.833, The Science of Planting Trees
7.41 9, Large Deciduous Trees
HG83, Pruning Shade Trees and Repairing Their Injuries

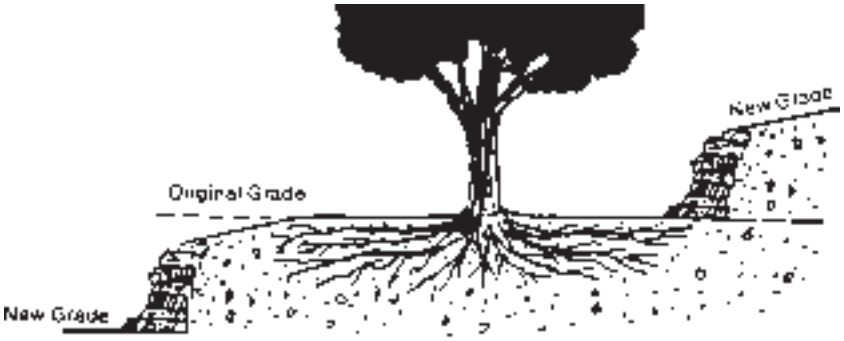

Figure 9: Terracing can substantially limit root injury. Reprinted with permission from *Tree City USA* Bulletin No. 7, National Arbor Day Foundation.

Pruning Injured Trees

Trees with injured roots may show branch dieback quickly or within a few months. Prune dying branches to reduce insect and disease damage to the rest of the tree. Also prune to reduce any hazardous conditions on preserved trees. It is better to wait until the tree dies back to see how much to prune than to arbitrarily remove parts of the crown because you assume the root system was damaged.

Wildfire regulations may require pruning to a height of 10 feet all trees around your home and outbuildings.

Table 1: Adaptability to environmental change.

Degree of Adaptability		
High	**Moderate**	**Low**
American elm	Aspen	Bolleana white poplar
Common hackberry	Black walnut	Black locust
Cottonwood (spp)	Boxelder	Colorado blue spruce
Ginkgo	Bur oak	English oak
Green ash	Linden	Lombardy poplar
Honeylocust	Norway maple	Northern red oak
London planetree	Pine (spp)	Norway spruce
Siberian elm	White oak	
Silver maple		
White ash		
Willow (spp)		

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