TREE NOTES

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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Keeping Native California Oaks Healthy

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Oak trees in the residential landscape are often seriously damaged or killed during the construction and/or landscaping phase of development. Decline and early death may also stem from inappropriate landscaping and irrigation practices. Damage often takes years to become evident, and by the time the tree shows signs of decline it is usually too late to help.

Oaks and Summer Water

Once established, native oaks require little or no supplemental irrigation. In fact, they do best in non-irrigated soils. This is because oak roots, particularly those originating at the base of the trunk (root crown), are susceptible to root-disease fungi when exposed to prolonged moisture during the summer (Figure 1). These fungi are normally inactive in dry soil, but proliferate under the warm, moist conditions created when frequent summer water is applied. (Other species of trees are less susceptible to these fungi because they have evolved where summer soil moisture is high.) Oaks weakened by the loss of roots or root function are particularly susceptible to root pathogens and other pests. Frequent summer irrigation, particularly near the root crown, is likely to cause root decay which, over time, may destroy the roots, killing the tree or causing a hazardous situation. Therefore, irrigation for lawns, ground covers or other ornamental vegetation should be avoided or, at the very least, kept well away from the trunk. The common notion that younger oaks can adapt to frequent irrigation is incorrect. Young or newly planted oaks in irrigated situations often show signs of decline after 15 to 20 years.

Oak Roots

The roots of mature oaks grow predominantly within the upper three feet of soil. Most of the roots responsible for the uptake of water and minerals are concentrated within 18 inches of the surface. Few roots grow deeper than three feet. Although the roots typically radiate well beyond the periphery of foliage (drip line), much of the active root system is within the drip line (Figure 1). Roots are sensitive to environmental change (soil compaction, grade change, increased moisture, paving). Oak roots like those of most trees, are associated with beneficial fungi that resist pathogens in the soil and aid in the absorption of water and minerals. These fungi are easily killed by changes in soil conditions.

Common Problems That Occur During Construction and Landscaping

Life-supporting roots are frequently severed during construction or damaged by other construction practices that change the existing soil environment. The frequent irrigation of lawns and ornamental vegetation commonly planted under oaks after construction, leads to decay and progressive root loss. The net effect is reduced water and mineral uptake. This typically causes die-back and decline over one to many years. Few people associate this decline with construction or landscaping because the symptoms often develop gradually. Most of these trees will die or fall prematurely unless prompt remedial action is taken.

Activities That Damage Roots and Disturb the Soil Environment

Grade change. This involves either the addition or removal of soil within the drip line. Excavation can sever roots, while the addition of fill soil may suffocate them. Fill soils can also impede water infiltration and soil drainage, leading to drought conditions or waterlogging.

Trenching. Trenches dug for utility or irrigation lines within or across the drip line cut essential roots. This impairs the tree's ability to obtain water and essential elements, which may cause death, die-back, or gradual decline. It can also impede drainage and root development.

Pavement. Impermeable soil coverings such as asphalt or concrete restrict the amount of air, water, and minerals available to the roots. This impairs root growth and function, and can ultimately lead to their death.

Soil compaction. Frequent traffic, both human and livestock, and the operation and parking of heavy vehicles within the drip line, squeeze soil particles together, thus eliminating much of the natural air space. This reduces the infiltration and storage of water and air, inhibiting root growth and the uptake of water and minerals.

Drainage changes. Grade changes that cause water to collect around a tree, especially near the trunk, are harmful. Likewise, a grade change that diverts a source of water that the tree depends on may cause drought stress.

Soil contamination. Avoid storing and discarding harmful chemicals or materials such as, herbicides, petroleum products, building materials, or waste water near oaks.

Herbicides. It is best to avoid using systemic or soil active herbicides under landscape trees. If herbicides are to be used within the root zone follow label recommendations.

Root Loss. The degree to which oaks tolerate root loss depends on species, age, health, climate, soil depth, soil structure, and soil moisture. In general, the damage caused by a 15 to 30 percent loss of roots is negligible to moderate, respectively. A root loss in excess of 50% is considered to be harmful. A single three foot deep trench at the drip line along one side of a tree will remove approximately 15 percent of the roots. A similar trench made midway between the drip-line and the trunk will sever approximately 30 percent of the roots. Trenches made within 10' of large oaks are usually very damaging.

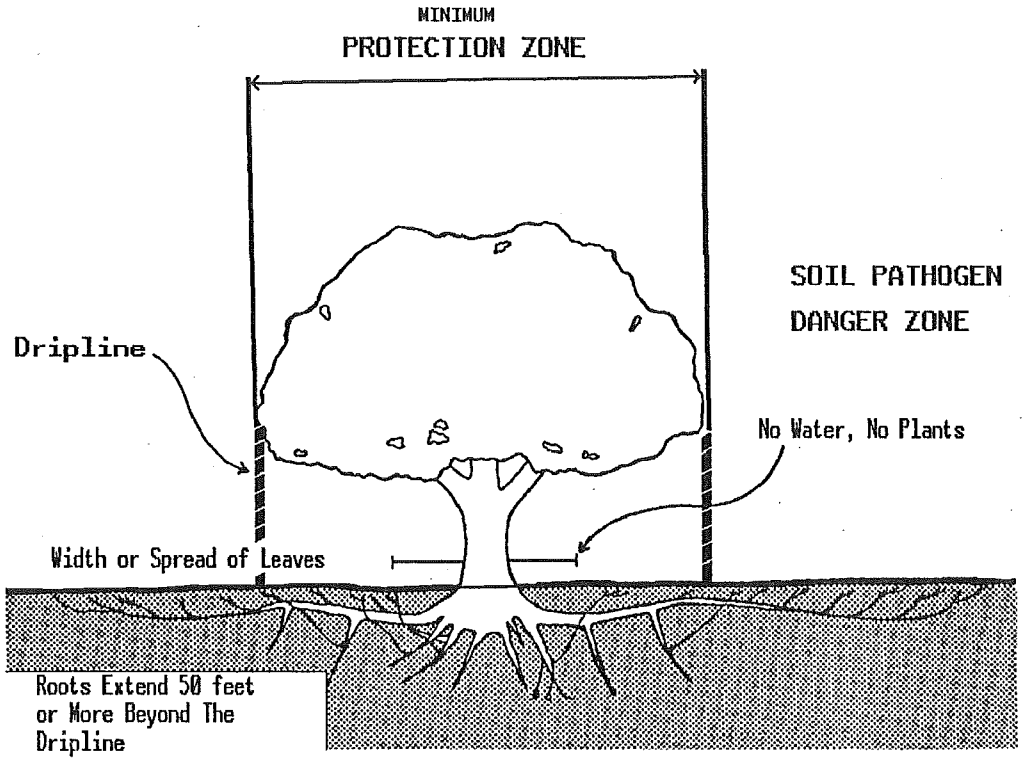

FIGURE 1.

Preventing Problems

Avoid injuring the roots or altering the soil where they grow, particularly within the drip line. Keep this area undisturbed and free of water-demanding ornamental vegetation such as lawns, ground covers, and shrubs like rhododendrons, azaleas, and camellias. Do not remove the leaf mulch unless there is a fire hazard. This organic material conserves water, provides nutrients as it decays, improves soil structure, decreases soil pH, and reduces soil temperature extremes. If turf is present beneath oaks, discontinue watering within the drip zone. If this is impractical, plug, alter or redirect sprinklers to prevent water from hitting the trunk or wetting the soil within 10 feet of the tree's trunk. Although not necessary, you may wish to remove the dying turf. In either case, cover the exposed soil surface or turf with 2 to 4 inches of organic mulch.

Appropriate Landscaping. If ornamental vegetation must be planted under old, established oaks, minimize its use. Keep the area within the drip zone relatively open. Use plants as accents rather than as ground covers. Extensive landscaping will disturb much of the root system and compete for available water and minerals. Select plants that tolerate shade and drought, and plant no closer than 10 feet to the trunk (Figure 1). Avoid all planting under declining oaks. Trees that have sustained construction damage will require several years to recover before landscaping.

Watering. As a general rule, native oaks should not be irrigated. One exception, however, is during drought years. If the winter is unusually dry, supplemental watering in the spring can complement natural rainfall. Water the soil from halfway between the trunk and the drip line to 10-15 feet beyond, allowing water to penetrate the soil to a depth of 18 to 24 inches. It may be necessary to water for 4 to 6 hours to get water to this depth. Keep water at least 10' away from the trunk. The length of time will vary based on the rate of water flow, method of irrigation (soaker hose, sprinkler, etc.), area covered, rate of water penetration, and topography. You

may have to experiment a little to get good water penetration. To check the depth of penetration, dig a small hole in the irrigated area several hours after watering. If the soil is moist at the desired level, the watering time is adequate. Insufficient watering is marked by dry soil, while excessive watering is indicated by standing water. Additional watering can be applied 1-2 times during especially dry summers. Another exception for the occasional watering of oaks is where extensive use of pavement causes natural precipitation to run off rather than penetrate the soil around the trees, causing drought stress. One further reason to irrigate native oaks, is to reduce water stress following moderate to severe root loss.

Plant drought tolerant landscape plants in the fall and winter to ensure their survival. If rain is lacking, water these plants twice a week for several weeks. Use a drip system or slow running hose to wet the root ball and 4-6 inches of surrounding soil. Thereafter, water twice a month until the rain starts. The following season, water 2-3 times during the summer. Wetting the soil to a depth and radius of 12 incles around the plant. By the third season, most of the plants should be well established, requiring no further watering. If turf is to be maintained under an oak, apply the least amount of water which will keep it reasonably green.

Mulching. Keep the soil surface beneath oaks mulched with 2-4 inches of natural leaf litter, wood chips, or gravel. Be careful not to place the mulch directly against the trunk. Organic mulch will improve soil structure and provide minerals upon decay. Avoid the use of impervious plastic tarping which reduces the availability of air and water to the roots.

Fertilizing. Healthy, mature oaks growing under natural conditions do not normally require added fertilizer. However, oaks in landscaped areas where the leaf litter is regularly removed, will benefit from nitrogen fertilization. Young oaks can be fertilized to encourage rapid growth. The ideal time to fertilize is in the spring. Fertilizer is best applied by broadcasting over the tree's root zone. If rain is lacking, lightly water the minerals into the soil, avoiding the area within 10' of the trunk. Use fertilizers high in nitrogen (N) such as calcium nitrate, ammonia sulfate, ammonia nitrate or urea. Complete fertilizers containing nitrogen (N), phosphorous (P) and potassium (K) are more expensive and generally unwarranted.

Pruning. NEVER TOP OAKS. DO NOT LEAVE STUBS. DO NOT MAKE FLUSH CUTS. PROTECT THE BRANCH COLLAR. Try to retain natural shape. Avoid excessive pruning, remove no more than 10-20% of the foliage in any one year. Except for the removal of weak, hazardous, diseased, damaged or dead branches, mature oaks normally require little pruning. Some trees can benefit from light thinning to open the foliage canopy to more sunlight or to lighten heavy branches. Avoid pruning in the spring and early fall. Pruning large trees is dangerous and difficult; it is best left to professionals. Consult an arborist, preferably someone certified by the Western Chapter of the International Society of Arboriculture.

Correcting Soil Problems

Fills - The flared bases (root crowns) and trunks of trees buried during construction should be exposed by careful excavation down to the original soil grade and out to several feet. Moist soil in contact with the bark of the trunk usually leads to decay. Slope the soil away from the tree so that water does not collect near the trunk and try to provide some drainage. A retaining wall may be needed to keep soil away from the root crown and trunk. You can tell that the soil level around your oak has been raised if the trunk does not flare out as it enters the soil.

Compaction - Soil compaction displaces much of the natural air space in the soil, reducing the amount of air (oxygen) available to the roots. Oxygen is critical for the uptake of the water and minerals necessary for tree growth and survival. Oaks growing in compacted soil may benefit from increasing the availability of oxygen to the roots. The best way to do this is to eliminate or curtail activities around the tree which cause compaction, followed by the addition of several inches of organic mulch to the drip zone. This will gradually improve soil structure and aeration, while helping to prevent further compaction. Avoid placing mulch directly against the trunk.

Several methods may be used to temporarily improve soil aeration. One method involves drilling holes 1-3 inches wide, 12 inches deep, and 1-3 feet apart around the tree out to the drip line. Holes may be filled with coarse sand or pea gravel or left open. It may be necessary to repeat every two to three years. Another method involves the injection of air under pressure into holes to fracture and lift the hardened soil, allowing air penetration. Holes can also be made by injecting water under high pressure via a hollow tube into the soil. The water jet loosens and expels soil particles as it is inserted into the ground.

Pavement - Where practical, remove asphalt and concrete pavement within the drip line and replace with permeable materials like organic mulch, gravel, brick, or stone set in sand.

Inspecting Your Tree for Health and Hazard Potential

Signs of Advanced Decline or Decay

- **Thin, sparse foliage**
- **Poor growth**
- **Yellow, undersized leaves**
- **Dead branches and limbs in the upper canopy**
- **Wilted, brown leaves during spring and summer**
- **Many short shoots growing on trunk and branches**
- **Mushrooms at tree base or on the roots in the fall or early winter**
- **Conks - shelf-like mushrooms on trunk**
- **Cavities in trunk**

- **White, fan shaped mats of fungus under the bark at the soil line.**
- **Soft, punky wood**
- **Wet, oozing areas on the bark**

Proper health and hazard inspection is difficult to do. It requires training, experience, and sometimes elaborate procedures to be reliable. A thorough tree inspection may involve exposing the large, supporting roots originating at the base of the trunk (root crown). This requires the careful removal of soil from a distance of 2 - 3 feet around the root crown to a depth of 12-18 inches or to the original grade if fill soil has been placed around the tree. Soil excavation and root-crown inspection are best done by a consulting arborist.

Oaks with extensively decayed roots should be removed for safety; those in the early stages of decay can be treated. Carefully expose infected roots and remove diseased portions. Cut the bark back until healthy wood is found. Dispose of all diseased roots and bark. Allow the exposed roots to dry for several months. You may wish to construct a retaining wall around the perimeter of the excavation to keep the soil away from the exposed roots. Try to provide drainage to keep rainwater from collecting in the well. The soil can be replaced before winter. Otherwise, the roots can be left exposed. Although this is not a cure, it will slow the progress of the disease-producing organisms, prolonging the life of the tree. For this treatment to be helpful, all further watering near the trunk must be stopped.

Successful Development Around Oaks

Successful development around oaks depends on careful planning and construction. For this to happen, everyone involved in the development process must recognize that tree health suffers when roots are destroyed or soil conditions are altered.

When oaks die, property values drop and removal costs are incurred. Prudent development can ensure a more attractive and more valuable setting.

Further Reading

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Other Resources:

Western Chapter International Society America, Certification Committee, P. O. Box 424, St. Helena, CA 94574. (707) 963-7578, for lists of Certified Arborists.

University of California Cooperative Extension, Natural Resources Program, 163 Mulford Hall, Berkeley, California, 94720. (415) 642-2360.

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