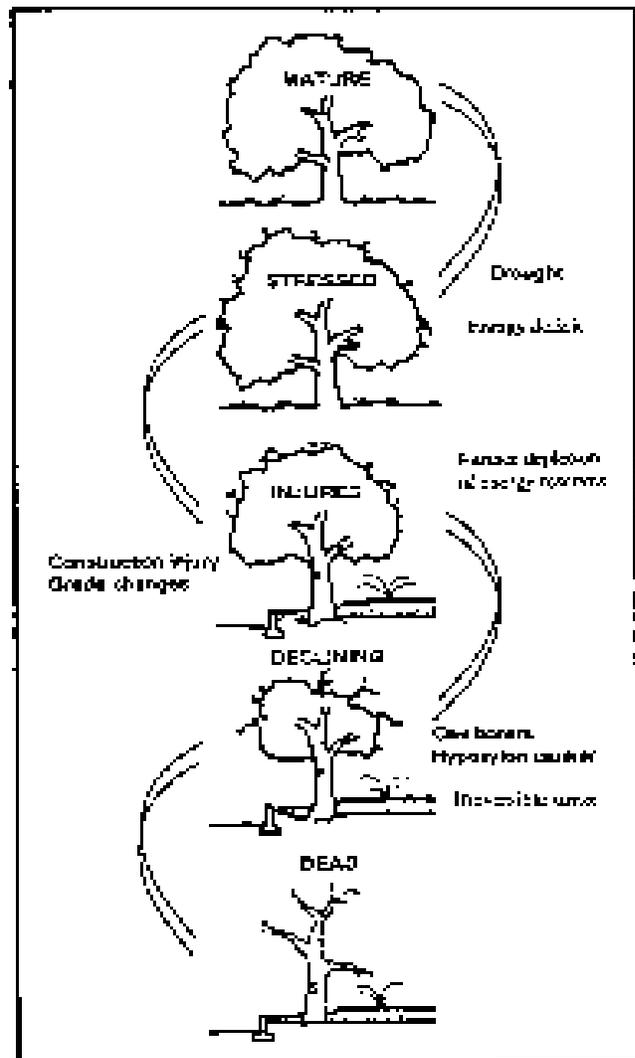


Plant Health Care Recommendations for Declining Trees

The decline of mature trees is typically caused by a combination of factors. The first is usually long term stress caused by drought, improper soil conditions, construction damage to the root system, or mechanical damage to the trunk. These types of problems force the tree to divert energy away from storage or growth toward overcoming the stress.

Then a shorter term, more acute problem develops. It may be a defoliating or boring insect, canker disease, root rot, severe root damage or an early frost. A healthy plant can usually overcome these acute problems without severe damage. However, for a plant that has been defending itself against a chronic problem, any of these factors can promote the decline syndrome. The tree, already low on reserves, must increase energy use to defend against the new problem. This takes energy away from the maintenance of chlorophyll in the leaves and the rejuvenation of the fine root system. With these two important systems impeded, the downward decline spiral accelerates.

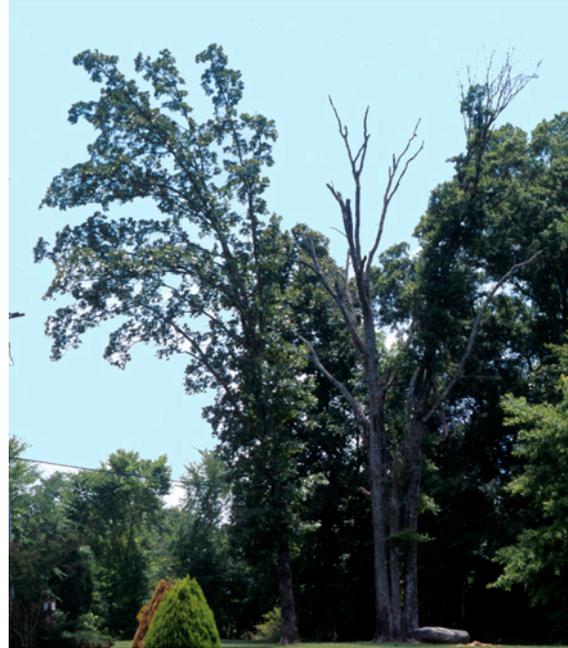
If conditions are not greatly improved at this point, the tree eventually dies. The



period of decline may be short or long depending on the tree species, location and factors involved with the decline. Generally, if a tree has more than 35% to 50% crown dieback from a decline syndrome, it cannot be saved.

Symptoms

Early symptoms of decline depend on the exact factors involved. Often, the initial symptoms are virtually impossible to see since they involve the root system. There is an overall loss in the number and health of fine roots. These are the smallest roots (< 2-mm diameter) that handle the majority of the water and nutrient uptake. Beneficial fungi, mycorrhizae, associated with these fine roots can also degenerate. These fungi colonize the root system, protecting roots from disease and increasing the efficiency of water and nutrient uptake. When the roots and mycorrhizae are weakened, root-rotting fungi may successfully attack.



Above ground early symptoms include the reduction in twig elongation and trunk diameter growth, and a lighter green color (chlorosis) in the leaves during the summer. Early fall coloration when compared to other trees of the same species, a later-than-normal flushing of new leaves in the spring, and a heavier than normal production of seed are also common in stressed trees.

As the decline syndrome progresses, symptoms become more noticeable. Often twigs die during the winter and do not leaf out in the spring. This results in an accumulation of dead twigs.

Since there are fewer leaves to produce energy to keep the larger lower branches healthy, the branches begin to die. If the tree has a good year, it may produce sprouts at the edge of the healthy portion of the branch. Sprouts and tufted growth are indicators of a history of decline.

The amount of energy stored in the tree can be estimated using a starch stain. Starch, the primary energy storing material in trees, colors black with application of iodine. A root or branch can be

HEALTHY



DARK STAIN

UNHEALTHY



NO STAIN

pruned and stained in the field. If there is no color change, starch reserves are depleted (see Starch Analysis Technical Report for details).

Treatment

An accurate diagnosis of factors involved in the decline is the first step toward treatment. If the initial causes of decline are well known, such as root cutting during construction, the diagnosis should concentrate on the other factors involved such as secondary borer or cankers.

For trees where neither the initial cause nor secondary factors are known, a more broad-spectrum diagnostic procedure should be followed. The first step should be a soil analysis for nutrients, pH, drainage and compaction. These soil factors are leading causes of decline.

A root analysis provides information on root pathogens such as *Armillaria*, *Phytophthora* and nematodes. Drilling into the buttress roots may be required to determine if decay is present and if the tree is structurally sound. Above ground problems such as insects and diseases should be identified in the field or sampled for laboratory diagnosis. Accurate diagnosis is essential for proper treatment.

When the specific problem is identified, it should be targeted for treatment. If trunk borers are found, the trunk should be protected; if insect defoliators are present, they should be managed; if *Phytophthora* root rot is present, the soil should be drenched. If severe soil compaction is identified a program of trenching and mulching will provide a non-compacted area for root growth.

For the predisposing factors, the soil can be treated to improve conditions for root growth. This includes mulching with two to four inches of wood chips from near the trunk to near the dripline to moderate soil conditions, conserve moisture and prevent further compaction. The tree should be fertilized in accordance with the soil analysis. Slow release nitrogen fertilizer will increase root density. If phosphorus is deficient, addition of phosphorus will also increase root growth. Mycorrhizae can be inoculated into the root area. These beneficial fungi will colonize the roots, making them more efficient at water and nutrient uptake and protecting them from some root rots. The combination of fertilizer and mycorrhizae has been shown to double or triple fine root density.

Soil moisture content should be monitored with a tensiometer or other device. If a permanent irrigation system is not present, soaker hoses can be installed within the mulch layer to provide water during droughts. Another strategy that can be employed on declining trees is to redirect the energy usage within the tree using a tree growth regulator, a chemical that inhibits elongation of the new twigs. It has been found that root growth increases after these treatments, indicating that energy was redirected from twigs to other parts of the tree.

Pruning declining trees must be done judiciously. Severe pruning reduces leaf surface area and produces numerous wounds that creates an energy deficit. Pruning should focus on removing dead, dying, diseased and broken branches.

In summary, tree decline is caused by a combination of factors. It is important to identify these factors and treat them as soon as possible. Programs that increase root growth are usually very beneficial for declining trees. Root growth promotion is done with mulching, fertilization, irrigation, mycorrhizal inoculation and treatment with a tree growth regulator. However, even with the best care, trees that have greater than 35% to 50% dieback may not respond to treatment.