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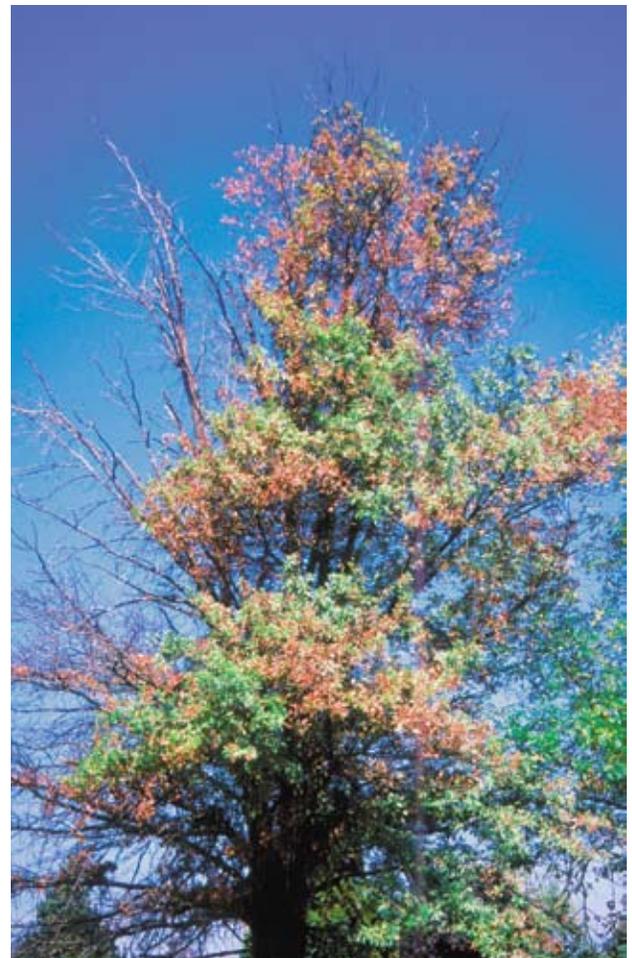
Tree decline is a general loss of vitality throughout the entire tree caused by a systemic disease or by a sequence of stressing events that causes the tree to deplete its energy reserves. Twig and branch dieback is initiated in the tree as a response to poor growing conditions, physical injury to the tree and/or pest attack. Usually a combination of physical, climatic and pest problems lead to decline and dieback of trees. The factors that contribute to this decline are the subject of this publication, as well as management practices to prevent decline.

Drought

Drought is a primary contributing factor to tree decline. Extended drought can influence the health of shade trees by the loss of absorbing roots. Most of the absorbing roots occur in the top 6 to 12 inches of the soil. Once the upper soil becomes dry, many absorbing roots dry out and die. Leaves and stems can also be damaged by drought conditions, especially when there is little water available for evaporative cooling and for photosynthesis and food production.

Trees that occur on thin soils or convex surfaces (ridges and ridge crests) where soil does not have much water-holding capacity are more susceptible to drought than others. Some species of trees are more drought-tolerant than others (Clatterbuck 2000). Trees may not readily show initial drought symptoms (curling of leaves, gradual loss of leaves, thinning of the crown) because of stored food reserves that reside in the woody tissues. However, as these stored foods are depleted, drought symptoms become more prevalent. Drought symptoms can be delayed two or more years as food reserves are slowly depleted and imbalances between the aboveground and belowground tissues occur, making it difficult for many to believe that drought was actually the problem.

Although irrigating trees during periods of drought stress is recommended, frequent and shallow watering contributes to shallow root development. This increases the chances of drought injury. Water once every week during



Crown dieback of an oak tree

Photo Credit: Wayne Clatterbuck



Photo Credit: Wayne Clatterbuck

A declining maple tree with a sparse crown and small leaves adjacent to a healthy maple tree.

periods of severe drought, making sure that moisture reaches a depth of 5 to 7 inches. Watering every day may contribute to the decline of the tree from root rots that thrive in overly moist conditions. The amount of water depends on the soil texture and the size of the rooting area. Clay soils are often over-watered.

Mechanical Injury

Physical or mechanical damage to the tree is another cause of tree decline in urban areas. In subdivisions and commercial developments, shade trees are often abused. Roots are severed, soil is compacted or disturbed and bark is bruised or scraped. Losses from such damage can be avoided if trees are properly protected during construction activities.

Many utilities and municipalities are also guilty of tree abuse. Underground water, gas or cable lines often disrupt root systems. Root loss contributes to the weakening and decline of a tree's crown. As with drought, the appearance of decline symptoms can often be delayed for a year or two.

The leveling of the ground on a building site by either adding soil or excavating soil will also cause root problems. Root tissues need oxygen. By adding several inches of soil and by compacting the soil, oxygen becomes limited and roots decline or die. Exposing roots by removing soil can also alter water relations of the roots and soil. Each of these events leads to weaker trees that are prone to other stress factors or pests that can further injure the tree.

Damage from wind, frost and ice can also cause physical damage to trees.

Chemical Injury

Injury to trees from pollution as well as from direct chemical application is a common occurrence. Pollutants such as ozone, carbon dioxide, fluorides, nitrates, road salts and particulate matter all affect the life processes of trees. Some pollutants will be concentrated near roads or factories, while others, such as ozone, can disrupt tree growth from hundreds of miles away. Pollution acts as one factor in a tree decline problem.

Most chemical injuries are the result of mistakes from not following label instructions or incorrect application procedures. Often, chemical is absorbed by a non-target tree or plant from an application to a targeted plant. Foliar chemicals have a tendency to drift to non-target vegetation when applied incorrectly. Root grafts between plants can also be a cause of chemical spread to non-target vegetation. Many chemicals are now being used in the management of turfgrass. Make sure that chemicals used for turfgrass do not have detrimental effects on trees in the area. Commercially available chemicals (pesticides and herbicides) have been tested thoroughly and are safe if the label and application instructions are followed completely.

Chemical injury can be much more severe when trees are already weakened by other factors.

Pests

Physical, chemical and climatic stress mechanisms weaken trees and make them more susceptible to pest organisms. Insects and disease both take advantage of a weak tree. The initial stress predisposes the tree to attacks by insects and disease. Once trees have been stressed and attacked by these secondary organisms, they rarely recover.

A few of the more common insects and disease mechanisms that affect weakened trees include Hypoxylon, Fusarium, Nectria and Fusicoccum cankers, Armillaria root rots, boring insects such as two-lined chestnut borer and red oak borer, pine beetles (southern pine beetle, Ips beetle and black turpentine beetle), Verticillium wilts, and many leaf-feeding insects or defoliators including scales, aphids and adelgids.

Leaves often become disfigured and discolored late in the growing season (August and September) and trees sometimes suffer premature foliage loss when there is hot weather and limited moisture. Growth of most trees has diminished by late summer, as the trees prepare for the dormant season. Although trees often look sick, with leaves shriveling or falling prematurely due to fungi and leaf-sucking or defoliating insects, the impact of these fungi and insects do little permanent damage to the tree. These diseases and insects occur annually and actually go unnoticed most of the time. During periods of stress, excessive defoliation often occurs late in the growing season when trees are in a weakened condition. Usually, trees recover unless defoliation occurs several years in succession.

Decline Management

The key to good tree health is to keep the trees vigorous and in a thrifty condition. Sometimes that is easier said than done, especially during excessive droughts. Watering the trees (if a source of water is available) before water stress occurs is the best prevention. Tree care and maintenance are equally important to ensure that physical and chemical damage does not occur.

A few guidelines to maintain healthy trees are:

1. Provide a site that is suitable for the tree species involved. Plant the right tree in the right place.
2. Provide protection for roots and trunks of trees during construction to reduce accidental injury and soil compaction.
3. When branch dieback occurs, proper pruning will reduce pest susceptibility and improve the tree's appearance. Remove dead and dying branches promptly.
4. When roots are damaged or soil is compacted, continue to water the tree to maintain a more favorable rooting environment.
5. Water, fertilize and care for your trees when needed during stress periods

Tree decline is becoming more prevalent, especially in older, mature trees that do not have the inherent capacity to recover from various stresses. Taking actions early to address tree stress will increase the probability of tree recovery. Older trees nearing the end of their life cycles may not recover from stress and secondary insect attacks. Plans to replace these trees in the landscape should be initiated.

References

- Clatterbuck, W.K. 2001. Drought-tolerant trees. Publication No. SP 570. Knoxville, TN: University of Tennessee Extension.
- Brown, E.A. and K.D. Coder. 1995. Shade tree decline. Leaflet 366. Athens, GA: University of Georgia Cooperative Extension Service.



Photo Credit: Wayne Clatterback

Physical examples of tree stress: (a) wood frass from boring insects, (b) mushrooms at the base of the tree, (c) fungi on the trunk and (d) bird pecks.

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