Community Trees

Community Tree Steward Program

Recognizing Living Hazard Trees

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Most tree managers realize dead trees should be removed as soon as they are detected. But living trees also can be a threat to life and property. A *living hazard tree* may have one or more defects that decrease its structural integrity and increase the probability it will fail. But trees with defects are not considered hazardous unless a *target* (park bench, garage, playground equipment, etc.) is present. Unfortunately, this potentially deadly combination of defective trees and places where people or their property stop and congregate are all too common in today's urban and residential landscape. Municipal tree managers must have the ability to identify and then correct hazardous situations created by defective trees.

Effect of Age and Growth Rate

A tree's structural support is most important during high winds, or when snow and ice accumulate on branches. For example, accumulation of ice can increase the weight of branches by 30 times or more. This additional weight may not pose a problem for relatively young trees, however, as trees grow older, they are less able to *compartmentalize* or wall-off injured portions of their framework and decay is more common. In addition, older trees have a greater tendency to shed branches due to unavoidable decline in wood quality. Besides age, growth rate and ability to respond to injury will influence a tree's functional life span. Fast-growing trees like silver maple, poplar, and willow allocate a relatively small portion of internal resources to building compartments that keep pests and decay from spreading. Instead, they rely upon a rapid rate of growth to outdistance decay-causing pathogens. But as they age, their rate of growth slows, and significant decay and structural failure become likely. On the other hand, trees like oak grow slowly and allocate a significant proportion of resources to defense. These trees effectively compartmentalize wounds and, in general, are long-lived and less likely to fail.

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Hazard Tree Detection

The best way to identify hazardous and potentially hazardous trees is through a systematic examination or inspection. Conducting a hazard tree inspection will enable municipal tree managers to detect defective trees in target areas, assess the severity of the defects, and implement corrective actions before tree failure occurs.

Inspections can be carried out at any time of the year, however, the best time to detect structural defects is during the dormant season when leaves are not present. Inspections also should be conducted following construction in the vicinity of trees or after severe storms.

Defects and Their Hazard Levels

Trees become hazardous when their woody structure is weakened by defects. Defects are signs of structural weakness and their origins can be traced to mechanical wounding, improper pruning, and/or the work of decay-causing fungi and bacteria that enter trees after they have been injured in severe storms. Defects indicate a tree has failed, is failing, or has the potential to fail, and their early detection is extremely important. The seven main categories of defects are:

- **internal decay**
- **cankers**
- **root failure**
- **poor branch attachment, codominant stems, and included bark**
- **cracks**
- **dead trees, tops or branches**
- **poor tree architecture**

Internal decay - Decay in living trees is the end result of many complex interactions between the tree and several groups of fungi and bacteria. Many of these microorganisms are opportunistic and enter through wounds. Healthy and vigorous trees have adequate defense systems that limit the spread of decay caused by these pathogens, however, older trees or those in poor health are at a disadvantage, and extensive columns of decay often result. It is important to remember that the health and vigor of a tree's crown is not a good indicator of the presence or absence of internal decay. Trees require only a thin layer of bark and sapwood to transport water and mineral elements to and from the crown, and therefore it is possible to find trees with visibly "healthy" crowns and extensive internal decay. Once decayed tissue takes over a large volume of the trunk, the tree will be unable to support its own weight and may fail at any time (even though failure is most likely to occur during periods of high wind). Warning signs of internal decay include:

- large, wide wounds or cavities
- presence of fungal fruiting bodies or conks
- bleeding (oozing sap) through the bark
- presence of carpenter ants, termites, nesting holes, and bee hives
- loose, cracked bark
- overall poor appearance, slow growth, or twig and branch die-back

Cankers - Cankers, localized dead areas on the bark caused by bark-inhabiting microorganisms, also can lead to structural instability in a tree. Cankers on the trunk and branches are inherently weak spots and trunk and branch failure may occur at old cankers. *Canker rots* occur when microorganisms attack and decompose the wood beneath the canker and adjacent bark tissues. Tree failure from canker-rots occurs because of the combined effect of dead bark around the circumference of the tree (from the canker) and loss of internal support

(from wood decay). Trees with canker-rot are very hazardous and should be removed as soon as possible.

Root failure - Root problems are difficult to detect and assess since tree roots are underground and out of sight, however, anything that alters or compromises the structural support provided by any part of the root system decreases tree stability. Two major culprits that jeopardize the integrity of roots are (1) root-rotting pathogens that attack weakened trees or enter through wounds and cause root decay, and (2) actions that sever or cut any portion of the root system. In addition, soil erosion, drought, gas leaks, grade changes around trees, flooding, soil compaction, or paving around trees can kill roots.

Building, road, and sidewalk construction, or installation of utilities can damage the roots of nearby trees. Large, heavy equipment used around trees often severs or injures a large portion of the roots. Without the support of the entire root system the tree is structurally weakened and the probability of failure increases as the amount of injured roots increases. Trees that have lost 50 percent or more of their root systems during construction should be removed.

Poor branch attachment, codominant stems, and included bark - To have strong attachment, a branch must be smaller (40 to 50 percent smaller) than the trunk or limb from which it arises. If the branch and trunk are close to the same size, their attachment may be weak and breakage may occur. Codominant stems or competing leaders and upright-growing branches with acute angles of attachment also are areas of potential weakness, particularly when there is *included* (ingrown or embedded) bark. Included bark forms when bark of the branch and trunk squeeze together, limiting the amount of supporting wood that can form. In fact, presence of included bark between two branches or between a branch and main stem is a better indicator of weakness than the acuteness of the angle that separates them. Some tree species such as horsechestnut, silver maple, linden, tuliptree, and willow are more likely to break because of their inherent poor branching habits. These species should be examined carefully when they are young to identify and correct structural flaws.

Cracks - Many arborists consider cracks to be the number one hazard defect because they indicate the tree is already failing. Cracks do not automatically indicate a hazardous condition, however, those most frequently associated with tree failure include:

- cracks that go completely through the stem or branch.
- cracks in contact with another defect (canker, cavity, decay, weak branch union, leaning tree, etc.).
- Branches 4 inches or larger with a crack (remove only the cracked branch).
- Conifer stem with a crack, in-rolled bark, and extensive decay.

Dead trees, tops or branches - Because dead trees could fail at any time, they should be removed as soon as they are detected. Dead tops or branches may remain attached to living trees for several years or they may break out of the tree suddenly. Trees with dead branches or tops should be pruned to reduce the hazard potential. Loose branches lodged in the tree crown also should be removed.

Poor tree architecture - Trees with growth patterns that result in weak structure or imbalances are said to have poor architecture. A surprising number of tree architecture problems can be traced to the lack of pruning or improper pruning at the production nursery. Flush cuts, acute branch angles, too many branches arising from a single location on the stem, codominant stems, and included bark will cause problems for trees later in life. In other cases, poor tree architecture is the tree's response to past changes or events. Leaning trees result when clearings are made in a wooded area. "Topped" trees will send out vigorous shoots that are poorly attached to the stem and frequently break off. Trees combining poor architecture with other defects have a very high failure potential.

Managing Tree Hazards

Early detection of tree defects can prevent tree failures and potential damage to property and injury to people and pets. Reducing the risk associated with living hazard trees might take one of the following forms:

- Remove the target - While homes or power lines cannot be moved, sometimes picnic tables, cars, landscape features, play areas, etc. can be relocated to prevent them from being crushed by a falling tree.

- Remove the tree - Some hazardous trees are best removed from the landscape. Remember, "When in doubt, take it out!"

- Prune the tree - Removing defective branches might alleviate a hazardous situation.

- Cable and brace the tree - Providing physical support to weak branch unions to increase their strength and stability may lengthen the functional life of a tree, however, **the hardware installed should be checked periodically, and it should not be installed with the expectation that it will make every tree 100 percent safe again**.

It would be virtually impossible to detect, correct, or eliminate every hazard tree. But frequent and thorough tree inspections (preferably walking inspections) will minimize the risk of injury or damage to citizens and their property. To disregard hazardous trees in your community is to invite disaster.