HOW to

Recognize Hazardous Defects in Trees

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How to

Recognize Hazardous Tree Defects

Contents Page

Introduction 1
Inspecting Trees 2
What to Look For 3
- Dead Wood 3
- Cracks 4
- Weak Branch Unions 5
- Decay 7
- Cankers 8
- Root Problems 9
- Poor Tree Architecture 11

Multiple Defects 12
Corrective Actions 12
- Move the Target 13
- Prune the Tree 13
- Remove the Tree 14

Cabling and Bracing 14
Topping and Tipping--Poor Pruning Practices 15
Suggested Reading 16

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Introduction

Trees add to our enjoyment of outdoor experiences whether in forests, parks, or urban landscapes. Too often, we are unaware of the risks associated with defective trees, which can cause personal injury and property damage. Interest in hazard tree management has increased in recent years due to safety and liability concerns resulting from preventable accidents. Recognizing hazardous trees and taking proper corrective actions can protect property and save lives.

A “hazard tree” is a tree with structural defects likely to cause failure of all or part of the tree, which could strike a “target.” A target can be a vehicle, building, or a place where people gather such as a park bench, picnic table, street, or backyard.

This brochure was created to help home owners and land managers in recognizing hazardous defects in trees and to suggest possible corrective actions. We recommend that corrective actions be undertaken by professional arborists.

Because of the natural variability of trees, the severity of their defects, and the different sites upon which they grow, evaluating trees for hazardous defects can be a complex process. This publication presents guidelines, not absolute rules for recognizing and correcting hazardous defects. When in doubt, consult an arborist.

Inspecting Trees

Inspect trees under your responsibility every year. Tree inspections can be done at any time of year, leaf-on or leaf-off. To be thorough, inspect trees after leaf drop in fall, after leaf-out in spring, and routinely after severe storms.

Inspect trees carefully and systematically. Examine all parts of the tree, including the roots, root or trunk flare, main stem, branches, and branch unions. Be sure to examine all sides of the tree. Use a pair of binoculars to see branches high off the ground.

Consider the following factors when inspecting trees:

Tree Condition: Trees in poor condition may have many dead twigs, dead branches, or small, off-color leaves. Trees in good condition will have full crowns, vigorous branches, and healthy, full-sized leaves; however, green foliage in the crown does not ensure that a tree is safe. Tree trunks and branches can be quite defective and still support a lush green crown.

Tree Species: Certain tree species are prone to specific types of defects. For example, some species of maple and ash in the Northeast often form weak branch unions (page 5), and aspen is prone to breakage at a young age (50-70 years) due to a variety of factors, including decay (page 7) and cankers (page 8).

Tree Age and Size: Trees are living organisms subject to constant stress. Pay particular attention to older trees, which may have accumulated multiple defects and extensive decay.

What to Look For

Hazardous defects are visible signs that the tree is failing. We recognize seven main types of tree defects: dead wood, cracks, weak branch unions, decay, cankers, root problems, and poor tree architecture. A tree with defects is not hazardous, however, unless some portion of it is within striking distance of a target.

Dead wood

Dead wood is “not negotiable”-- dead trees and large dead branches must be removed immediately! Dead trees and branches are unpredictable and can break and fall at any time (Fig. 1). Dead wood is often dry and brittle and cannot bend in the wind like a living tree or branch. Dead branches and tree tops that are already broken off (“hangers” or “widow makers”) are especially dangerous!

Take immediate action if...

- A broken branch or top is lodged in a tree.
- A tree is dead.
- A branch is dead and of sufficient size to cause injury (this will vary with height and size of branch).

Figure 1. Dead branches can break and fall at any time.

Cracks

A crack is a deep split through the bark, extending into the wood of the tree. Cracks are extremely dangerous because they indicate that the tree is already failing (Fig. 2).

Take action if...

- A crack extends deeply into, or completely through the stem.
- Two or more cracks occur in the same general area of the stem.
- A crack is in contact with another defect.
- A branch of sufficient size to cause injury is cracked.

Figure 2. A serious crack like this one indicates that the tree is already failing!

Weak Branch Unions

Weak branch unions are places where branches are not strongly attached to the tree. A weak union occurs when two or more similarly-sized, usually upright branches grow so closely together that bark grows between the branches, inside the union. This ingrown bark does not have the structural strength of wood, and the union is much weaker than one that does not have included bark (Fig. 3). The included bark may also

Figure 3. This weak branch union has failed, creating a highly hazardous situation.

act as a wedge and force the branch union to split apart. Trees with a tendency to form upright branches, such as elm and maple, often produce weak branch unions.

Weak branch unions also form after a tree or branch is tipped or topped (page 15), i.e., when the main stem or a large branch is cut at a right angle to the direction of growth leaving a large branch stub. The stub inevitably decays, providing very poor support for new branches ("epicormic" branches) that usually develop along the cut branch.

Take action if...

- A weak branch union occurs on the main stem.
- A weak branch union is cracked.
- A weak branch union is associated with a crack, cavity, or other defect.

Decay

Decaying trees can be prone to failure, but the presence of decay, by itself, does not indicate that the tree is hazardous. Advanced decay, i.e., wood that is soft, punky, or crumbly, or a cavity where the wood is missing can create a serious hazard (cover photo). Evidence of fungal activity including mushrooms, conks, and brackets growing on root flares, stems, or branches are indicators of advanced decay.

A tree usually decays from the inside out, eventually forming a cavity, but sound wood is also added to the outside of the tree as it grows. Trees with sound outer wood shells may be relatively safe, but this depends upon the ratio of sound to decayed wood, and other defects that might be present. Evaluating the safety of a decaying tree is usually best left to trained arborists (Fig. 4).

Take action if...

- Advanced decay is associated with cracks, weak branch unions, or other defects.
- A branch of sufficient size to cause injury is decayed.

Figure 4. This seriously decayed tree should have been evaluated and removed before it failed.

- The thickness of sound wood is less than 1" for every 6" of diameter at any point on the stem.

Cankers

A canker is a localized area on the stem or branch of a tree, where the bark is sunken or missing. Cankers are caused by wounding or disease. The presence of a canker increases the chance of the stem breaking near the canker (Fig. 5). A tree with a canker that encompasses more than half of the tree's circumference may be hazardous even if exposed wood appears sound.

Take action if...

- A canker or multiple cankers affect more than half of the tree's circumference.

Figure 5. The large canker on this tree has seriously weakened the stem.

- A canker is physically connected to a crack, weak branch union, a cavity, or other defect.

Root Problems

Trees with root problems may blow over in wind storms. They may even fall without warning in summer when burdened with the weight of the tree's leaves. There are many kinds of root problems to consider, e.g., severing or paving-over roots (Fig. 6); raising or lowering the soil grade near the tree; parking or driving vehicles over the roots; or extensive root decay.

Soil mounding (Fig. 7), twig dieback, dead wood in the crown, and off-color or smaller

Figure 6. Severing roots decreases support and increases the chance of failure or death of the tree.

than normal leaves are symptoms often associated with root problems. Because most defective roots are underground and out of sight, aboveground symptoms may serve as the best warning.

Take action if...

- A tree is leaning with recent root exposure, soil movement, or soil mounding near the base of the tree.

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- More than half of the roots under the tree's crown have been cut or crushed. These trees are dangerous because they do not have adequate structural support from the root system.

Figure 7. The mound (arrow) at the base of this tree indicates that the tree has recently begun to lean, and may soon fail.

- Advanced decay is present in the root flares or “buttress” roots.

Poor Tree Architecture

Poor architecture is a growth pattern that indicates weakness or structural imbalance. Trees with strange shapes are interesting to look at, but may be structurally defective. Poor architecture often arises after many years of damage from storms, unusual growing conditions, improper pruning, topping, and other damage (Fig. 8).

A leaning tree may be a hazard. Because not all leaning trees are dangerous, any leaning tree of concern should be examined by a professional arborist.

Take action if...

- A tree leans excessively.
- A large branch is out of proportion with the rest of the crown.

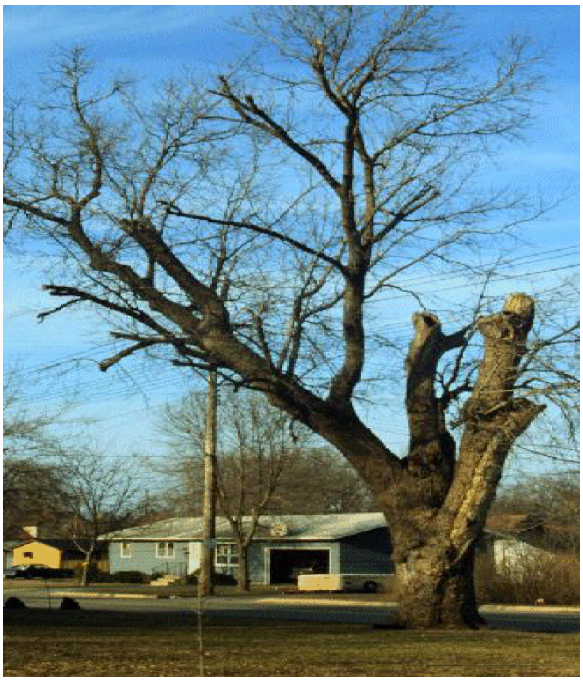

Figure 8. This tree is decayed and badly out of balance because of poor maintenance. It is dangerous, and extremely unattractive!

Multiple Defects

The recognition of multiple defects in a tree is critical when evaluating the tree's potential to fail. Multiple defects that are touching or are close to one another should be carefully examined. If more than one defect occurs on the tree's main stem, you should assume that the tree is extremely hazardous.

Corrective Actions

Corrective actions begin with a thorough evaluation. If a hazardous situation exists,

there are three recommended options for correcting the problem: move the target, prune the tree, or remove the tree.

Move the Target

Removing the target is often an inexpensive and effective treatment for correcting a hazard tree. Easily moved items like play sets and swings, RV's, and picnic tables can be placed out of the reach of the hazardous tree with little effort and expense.

If the target cannot be moved and a serious hazard exists, consider blocking access to the target area until the hazard can be properly eliminated.

Prune the Tree

A hazardous situation may be caused by a defective branch or branches, even though the rest of the tree is sound. In this case, pruning the branch solves the problem.

Prune when

- A branch is dead.
- A branch of sufficient size to cause injury is cracked or decayed.
- A weak branch union exists and one of the branches can be removed.
- Branches form a sharp angle, twist, or bend.
- A branch is lopsided or unbalanced with respect to the rest of the tree.
- A broken branch is lodged in the crown. Remove the branch and prune the stub.

Pruning a tree properly early in its life is a good way to effectively avoid many potential problems when the tree is older and larger. When done correctly, routine pruning of trees does not promote future defects. If done improperly, immediate problems may be removed, but cracks, decay, cankers, or poor architecture will be the ultimate result, creating future hazards.

We recommend that the "natural target" pruning method be used. This pruning method is fully described in How to Prune Trees (Bedker, O'Brien & Mielke, 1995).

Remove the Tree

Before cutting a tree down, carefully consider the alternatives. The effects of removing a tree are often pronounced in landscape situations and may result in reduced property values. Tree removal should be considered as the final option and used only when the other two corrective actions will not work. Tree removal is inherently dangerous and is even more serious when homes and other targets are involved. Removal of hazardous trees is usually a job for a professional arborist.

Cabling and Bracing

Cabling and bracing does not repair a hazard tree, but when done correctly by a trained arborist, it can extend the time a tree or its parts are safe. Done incorrectly, it creates a more serious hazard. We do **not** recommend cabling or bracing as treatment for a hazard tree unless the tree has significant historic or landscape value.

Topping and Tipping--Poor Pruning Practices

Topping is the practice of pruning large upright branches at right angles to the direction of growth, sometimes used to reduce the height of the crown. Tipping is the cutting of lateral branches at right angles to the direction of growth to reduce crown width. Both of these practices are harmful and should **never** be used. The inevitable result of such pruning wounds is decay in the remaining stub, which then serves as a very poor support to any branches that subsequently form. Trees that are pruned in this manner are also misshapen and esthetically unappealing (see Fig. 8).

Conclusions

Evaluating and treating hazard trees is complicated, requiring a certain knowledge and expertise. This publication outlines some of the basic problems that may alert you to a hazardous situation. Never hesitate if you think a tree might be hazardous. If you are not sure, have it evaluated by a professional. Consult your phone book under "Arborists" or "Tree Service."

Remember that trees do not live forever. Design and follow a landscape plan that includes a cycle of maintenance and replacement. This is the best way to preserve the health of our trees and ensure a safe and enjoyable outdoor experience.

Suggested Reading

Albers, J.; Hayes, E. 1993. How to detect, assess and correct hazard trees in recreational areas, revised edition. St. Paul, MN: Minnesota DNR. 63 p.

Bedker, P.J.; O'Brien, J.G.; Mielke, M.E. 1995. How to Prune Trees. NA-FR-01-95. Radnor, PA: USDA Forest Service, Northeastern Area State and Private Forestry. 30 pp. Also available on the Internet via FTP or the World Wide Web at: http://willow.ncfes.umn.edu.

Fazio, J. 1989. How to Hire an Arborist. Tree City USA Bulletin No. 6. Nebraska City, NE: National Arbor Day Foundation; 8 p.

Fazio, J. 1989. How to Recognize and Prevent Hazard Trees. Tree City USA Bulletin No. 15. Nebraska City, NE: National Arbor Day Foundation; 8 pp.

Robbins, K. 1986. How to Recognize and Reduce Tree Hazards in Recreation Sites. NA-FR-31. Radnor, PA: USDA Forest Service, Northeastern Area;. 28 p.

Shigo, A. L. 1986. A New Tree Biology. Durham, NH: Shigo and Trees, Associates; 595 p.

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Notes

How to Recognize Hazardous Defects in Trees was written to help people identify potential problems with trees. Trees with serious defects can pose an extreme hazard and should be treated with caution. The best way to correct a hazardous tree is to hire a professional arborist. Information in this publication can help to identify trees that require attention.

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For further information, contact: