TREE CITY USA®
BULLETIN

Do Your Trees Pose a Risk?

January/February 2020 • Editor: Dr. James R. Fazio



It is the duty of municipalities and property owners to perform tree risk assessments that can help prevent accidents like this one.

The short answer to the question in the title is — quite possibly if your trees are over head high. But tree risk is not unlike the risk we take every day as soon as we get out of bed or when we cross a street. Tree risk is a combination of the probability of an event and the severity of its consequences. For tree owners, there are methods available to assess risk and make decisions accordingly.

We all know that trees provide tremendous benefits. We can also agree that no one wants trees to damage property or hurt people. Tree risk assessment provides a way to minimize the chances that community or privately owned trees will cause harm. There are now practices and guidelines available for use in making sound decisions about any tree. The result can help prevent accidents and the unnecessary removal of trees.

According to the American National Standards Institute, tree risk assessment is systematic risk identification, analysis, and evaluation. There are two ways to go about this. ***Quantitativ***e methods assign data-based numbers to derive probabilities for events and consequences, something that is often not yet possible with a great deal of certainty. The other, described in the following pages, is ***qualitative*** — the use of descriptive categories to help the tree inspector arrive at a risk rating.

There are various applications of these methods currently in use, but the one followed in this bulletin is based on the International Society of Arboriculture's *Best Management Practices, 2nd Edition* by E. Thomas Smiley, Nelda Metheny, and Sharon Lilly. For more details, please refer to this excellent booklet.

The intent in this issue of the Tree City USA Bulletin is to make readers aware of the concepts and one method of tree risk assessment. While this may help any tree owner improve tree safety, it should be emphasized that formal tree risk assessment should be done by certified arborists who have received advanced training in this important subject.

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Starting with Basic Decisions

From both a moral and legal standpoint, all trees should be assessed for risk. The real question is — to what degree?



The frequency and level of tree risk assessment depends on many factors, but not conducting regular assessments is a poor and dangerous decision.

NO ROOM FOR IGNORANCE

The old saying, "ignorance is bliss" is definitely not true when it comes to tree safety. In the past, some communities have taken this approach to tree risk assessment and have suffered the consequences after a tree or part of a tree falls. Regular inspections of trees, especially public trees, can prevent accidents, or be a defense against lawsuits if one does occur. The frequency of inspections depends largely on circumstances such as public exposure to trees, site conditions, and the age or general condition of the trees in question.

THREE LEVELS OF TREE RISK ASSESSMENT

Level 1: Limited Visual Assessment Methods at this level are the fastest but least thorough ways to inspect trees. They include walk-by, drive-by, or aerial observations. They are used mostly where the tree population and their locations are largely uniform. In this case, inspectors are looking primarily for trees that have an imminent and/or probable likelihood of failure.

Level 2: Basic Assessment This method is the more thorough inspection of a tree and its surroundings. The person examining the tree will walk completely around the tree and use tools such as binoculars to study top conditions, mallets or probes to determine soundness or the extent of decay, and trowels and shovels to look at suspected root problems. An analysis of findings is then made to determine the likelihood and consequences of failure during a specified time period and, ultimately, to evaluate risk.

Level 3: Advanced Assessment Specialized equipment, data collection, and/or expertise are usually required for this level of assessment. Examples include climbing or other means to exam the tree crown, decay testing, storm/wind analysis, load testing, and other sophisticated techniques. Sometimes this is requested after a Level 2 assessment, especially if the preliminary results are borderline, and it is often used for high-value trees or those in prominent locations.

At all levels of assessment, data should be recorded and stored for every tree examined (even those with low risk). Results and recommendations are provided to the owner or manager of the tree(s), who then has a basis for decision making.

Categorizing Tree Risk

The bottom line of tree risk assessment is a rating of risk. This rating can then be compared with a level of risk that is acceptable to the owner or controller of the assessed tree, and decisions can be made accordingly. Arriving at the rating requires the determination of three important factors.

1. A TARGET — AND LIKELIHOOD OF IMPACT

This is a relatively easy but essential part of tree assessment. A target, also called risk target, is people, property, or activities that could be injured, damaged, or disrupted by a tree failure. If there is a target present, what is the likelihood that it would be impacted? For example, a tree could fall in a wilderness area or in a natural area not near a trail and not be expected to do harm. The likelihood of impact is very low. On the other hand, in the case of a large tree that stands over a house, it would receive a high rating of potential impact.

Frequency and duration that the target is present must also be considered. The likelihood of impacting a target is obviously higher for a permanent structure than in a day-only parking lot or the lightly used portion of a park.

Likelihood of impacting a target is rated as high, medium, low, or very low. Definitions for these and other qualitative categories can be found in the International Society of Arboriculture's *Tree Risk Assessment — Best Management Practices.*

2. THE TREE — AND ITS SITE — AND LIKELIHOOD OF FAILURE

An examination of a tree should include a close look at the growing site. Exposure to wind and past events such as a new sidewalk or change in grade can affect the tree. But, above all is the condition of the tree being assessed for potential problems. Examples of some of the more common conditions that will increase the likelihood of a failure are illustrated on pages 5–7.

How does one determine the *likelihood of failure?* This is a tough one! It is based on site conditions and the size and nature of any defects found as the tree is examined. The examiner's experience becomes especially important at this point, including knowledge of the species involved. His or her judgment then leads to a determination of whether failure resulting from the defect is (1) imminent, (2) probable, (3) possible, or (4) improbable.





A target rating in a tree assessment matrix is based on both the presence of a target and the likelihood the target would be hit if the tree or part of it fell. Although the tree in the top photo is in good condition, the prevailing wind is toward the building (a permanent structure), so this part of the assessment would be given a "high" rating. The golf course trees would probably be rated "low" because people are only occasionally in the area and features in the built environment are not likely to be greatly damaged, if at all.

Categorizing Tree Risk (continued ...)

3. CONSEQUENCES OF FAILURE

Arriving at a rating of consequences requires considering the size of the tree or tree part that could fall and, if it did fall, how it could impact an identified target. Categories for this part of an assessment are: (1) severe, (2) significant, (3) minor, and (4) negligible. Again, criteria for each are found in the *ISA Best Management Practices* publication.



MATRICES TO GUIDE DECISIONS

A tree risk assessor, using experience-based judgment and best management practice guidelines for each category, can then record the findings in two matrices. These are illustrated below as shown in *Tree Risk Assessment – Best Management Practices.* The first combines conclusions about (1) the likelihood of failure and (2) the likelihood of impacting a target. Matrix 2 takes the results of the first matrix, combines them with the consequences if the failure occurs, and designates a level of risk.

Likelihood of Failure	**Likelihood of Impact**			
	Very Low	**Low**	**Medium**	**High**
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Likelihood of Failure & Impact	**Consequences of Failure**			
	Negligible	**Minor**	**Significant**	**Severe**
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Searching for Problems

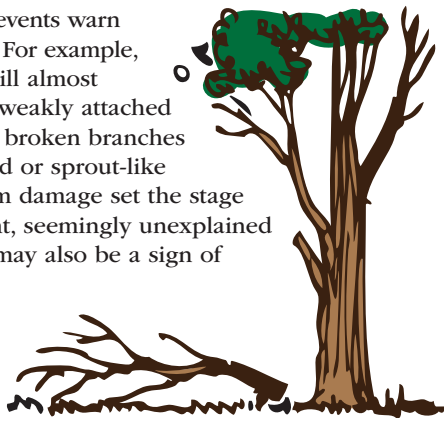
The key factor in tree risk assessment is a careful examination of the tree. On happy occasions, no issues are discovered — the tree is healthy and free of defects. In other cases, there are one or more danger signs. Here are some of those conditions that would influence the categories in the decision matrices. They are presented in order of a recommended inspection of any tree.

1 EXAMINE THE TOP (CROWN)

Some species are simply more brittle than others. This is one reason city ordinances sometimes prohibit or discourage trees such as willows, box elders, and silver maple. Plant these trees only in open areas. If they already exist on your property, a minimum precaution would be to avoid locating play areas or patios beneath these trees.

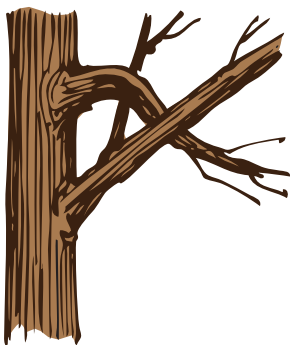
WHAT'S THE TREE'S HISTORY?

Sometimes past events warn of potential trouble. For example, previous topping will almost invariably result in weakly attached regrowth. Similarly, broken branches with stubs unpruned or sprout-like regrowth after storm damage set the stage for breakage. Recent, seemingly unexplained loss of large limbs may also be a sign of internal problems.



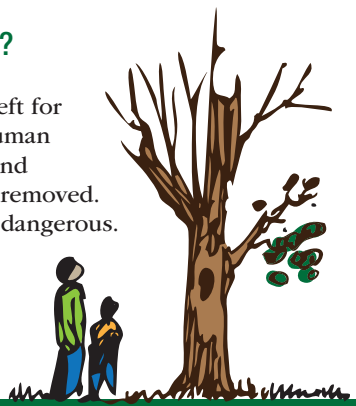
DO SOME BRANCHES CROSS OR RUB?

Branches that cross or rub invariably lead to weak spots. These should be pruned off as soon as they are spotted, and the smaller the better.



IS THE TREE DEAD OR DYING?

With the exception of trees left for wildlife where structures and human traffic are absent or rare, dead and dying trees should be promptly removed. Felling a large tree is extremely dangerous. Call an expert to do the job.



ARE THERE DEAD LIMBS?



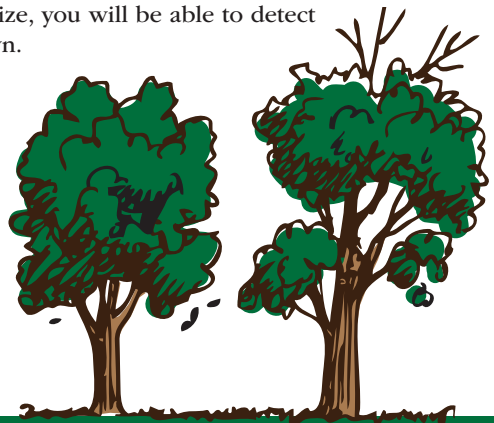
Loggers call these "widow makers" and treat them with great respect. Homeowners and arborists should should do likewise. Dead limbs are an accident waiting to happen. They can fall in the slightest breeze, when a mower bumps the tree, or when a child climbs in it. They sometimes give way even on a calm day. Dead limbs larger than 1" in diameter are clearly a red flag for prompt action.

Risk assessment and hazard tree correction or removal in public places should be one of the first steps toward improved community forestry.

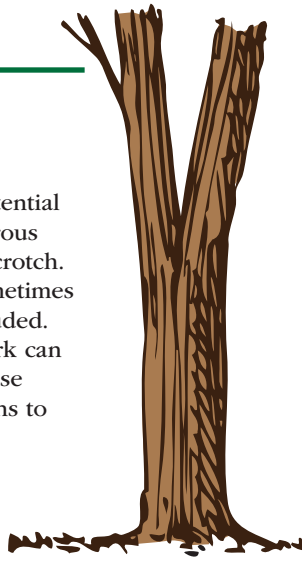


HOW VIGOROUS IS THE TREE?

Evaluating a tree's vigor is somewhat subjective. However, experts say it is the surest early warning that there is a serious health problem in a tree. Vigor is reflected in the amount of leaf cover, size, color, and condition. By comparing your tree with others of like size, you will be able to detect a less vigorous crown.



2 CHECK THE TRUNK

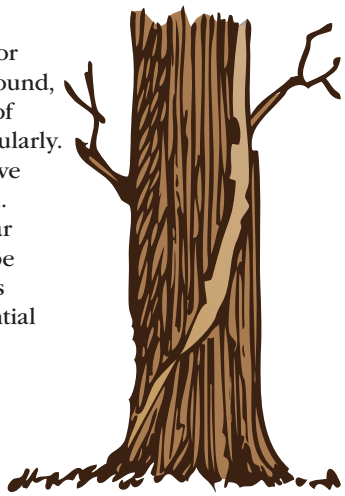


WATCH FOR FORKED TRUNKS

Forked trunks are signals of potential weakness. This is especially dangerous when bark grows into the narrow crotch. This can also encourage decay, sometimes indicated by sap or pitch being exuded. Early pruning of one side of the fork can prevent these problems; arborists use cables or braces as corrective actions to strengthen the fork in large trees.

EXAMINE WOUNDS AND CRACKS

Any trunk wound is an opening for decay. Wounds extending into the ground, including lightning scars, should be of particular concern and examined regularly. Some cracks, such as frost cracks, have little effect on the strength of a trunk. However, if two vertical cracks appear on opposite sides of the tree, it can be a sign of root injury or breakage. It is usually associated with a circumferential separation of wood internally and is extremely dangerous.



WHAT ABOUT BALANCE?

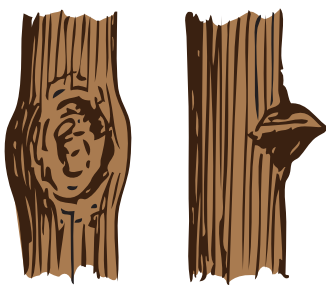
Leaning or lopsided trees present more of a risk than those growing vertically, but if a tree has always grown off-center, it generally is not an undue risk. However, any sudden lean indicates breakage or weakening of support roots and should be cause for alarm and immediate action.



LOOK FOR SIGNS OF DECAY

Clues to internal decay of the trunk or large branches are cavities, disfiguration (cankers), and the fruiting bodies of decay fungi (conks). Sometimes there are no outward indications. Arborists then use one of the methods shown in the box at right to check for decay.

According to the U.S. Forest Service, internal decay does not automatically render a tree unsafe. Working with pines, it determined that if the amount of sound wood surrounding internal rot is sufficient, the tree can be considered relatively safe from failure.



Canker Conk

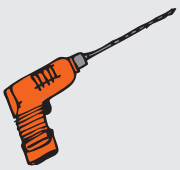
TOOLS USED BY ARBORISTS TO CHECK FOR INTERNAL DECAY



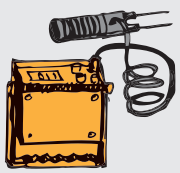
MALLET: This method is harmless to the tree and relies on differences in sound as the tree is struck.



INCREMENT BORER: A small core of the tree about ¼" thick is removed and examined. This causes some wounding.



DECAY-DETECTING DRILLS: Drills with very small bit diameters can be used to detect changes in resistance as the bit moves through the wood. In a Resistograph™, the bit is coupled with a graph that visually portrays the changes between sound wood and decaying wood or hollow parts.



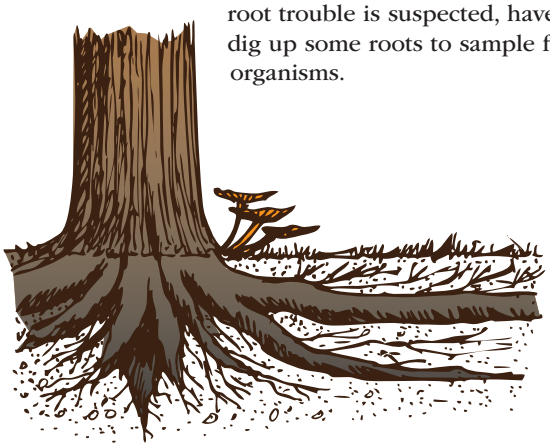
DECAY SENSORS: Instruments are commercially available that measure ultrasonic or other sound signals or electric currents passed through the tree's trunk. Some methods are non-invasive, but all require a degree of interpretation that is sometimes difficult.

3 DON'T FORGET THE ROOTS

Diseased or damaged roots are an important cause of trees assessed at high risk. Pascal Pirone, tree scientist, reported that in his 30 years of examining tree problems, more than half were traced to root disease or injuries.

ANY SIGNS OF ROOT DECAY?

Root decay is often insidious and difficult to detect. The late Dr. Alex L. Shigo, noted tree expert, called the organisms that cause root problems "the sneaky fungi." Sometimes their work in weakening support roots goes completely unnoticed because the smaller feeder roots may go right on absorbing water and lawn fertilizer. Then suddenly, one day the tree falls over. To detect root decay, look carefully for "mushrooms" on or near the base of the tree. If found, or if root trouble is suspected, have an arborist dig up some roots to sample for decay organisms.



ARE ANY ROOTS SEVERED?

Trenching or construction within the root zone is another cause of higher tree risk. The main problem is that severed roots may lose their ability to support the trunk and crown, especially if located on the windward side of the tree.



NOTE: When the cutting of roots is unavoidable, severed ends should be kept moist while exposed and then watered well after the trench is filled.

A CHECKLIST FOR REDUCING TREE RISK

- ☑ Establish a regular system of inspecting your trees, ideally using a certified arborist.
- ☑ Avoid planting brittle species where falling limbs could injure people or property. Some examples:
  - Silver Maple
  - Box Elder
  - Lombardy Poplar
  - Willows
- ☑ Prune trees when they are young and regularly thereafter.
- ☑ Use correct pruning methods, making the pruning cut outside the branch collar when possible.
- ☑ Don't allow trees to be topped.
- ☑ Always plant the right tree in the right place. For example, avoid planting large-growing trees under power lines or too close to a house, and make sure the species selected matches the soil and other site characteristics.
- ☑ Water deeply during dry periods.
- ☑ Erect barriers around or slightly beyond the drip line of trees during construction. Insist that these root protection zones be honored by construction workers.
- ☑ Consider cabling or bracing weak forks or branches in larger trees of high value. This is work for a professional arborist.
- ☑ Do not plant trees with narrow-forked stems.
- ☑ Where a high-value tree may be suspected of developing into the high-risk category, use landscaping to keep people at a safe distance. This may require techniques such as re-routing walks, moving patio furniture, or planting shrubs and hedges as barriers to foot traffic.

REMEMBER: *A healthy, vigorous tree that receives regular care is less likely to become a high-risk than one that is ignored. Under certain conditions when a risk exists, consider mitigation methods.*

Hazard Tree Removal — Not so Fast!

Action is needed when a tree is assessed in a high-risk category. It is also advisable when a rating indicates that failure and impact are even somewhat likely. It is important to act promptly after such an assessment to prevent an accident and costly litigation. Unfortunately, removal is often the only option. But thousands of community trees could be saved if risk mitigation actions were taken instead of removal. Here are a few practices that should be considered.

CHANGING THE TARGET

Either temporarily or permanently, remove picnic tables or other portable facilities to a safer location. With high-value trees, paths or walkways might be closed or re-routed and camping sites closed or moved.

MAKING THE TREE SAFER

Prune following best management practices. Pruning cycles are a good way to spot problems early and reduce the need for later corrective pruning.

Install structural support systems such as cables, brace rods, guy wires, and/or support props. Of course, installation should be done by a certified arborist and only in cases where the tree's value warrants.

Add lightning protection on high-value trees in areas with potential for significant or severe consequences if the tree were struck.

Improve growing conditions to maintain or improve tree health and vitality.

Monitor trees frequently that are in the lower risk categories. Take prompt action on any trees rated as high risk and monitor all trees at affordable intervals.

After a storm, promptly inspect affected trees and render tree first aid to remove imminent dangers.

For more information, see "Tree Recovery for Homeowners", and other helpful websites at **arborday.org/treerecovery.**



SOME HAZARDS TO AVOID

Defective and brittle trees are not the only high risks presented by vegetation in urban settings. Common sense combined with a little planning to plant the right tree in the right place can avoid these problems:

HEAVY FRUIT

Most trees will yield fruit of some kind, often creating an annoyance during some time of the year. Even a favorite street tree, such as red oak, can literally rain down acorns in a year of heavy production (usually coming in two- to three-year cycles). However, trees with large fruit can create more serious problems in parking lots and pedestrian areas and even be dangerous. Osage orange trees and Coulter or digger pine trees are obvious examples. Such trees are better suited for hillside stabilization or other more natural sites.

THORNS

Trees like hawthorns, honeylocusts, and some other species have large thorns that can be dangerous, especially to children. Although thorny species can be used strategically as hedges for privacy or to direct pedestrian traffic, under most circumstances it is best to use thornless cultivars or restrict such trees to natural areas.

LINE OF SIGHT OBSTRUCTION

Tree limbs that block stop signs or other traffic signs can create dangerous situations. Similarly, conifers near street or driveway intersections can block views and are difficult to remedy through pruning without compromising the appearance of the tree.

UTILITY LINES

Trees that reach into power lines when they mature are hazardous in at least three ways. They endanger the reliable delivery of electricity to buildings, they potentially bring children or other tree climbers into contact with deadly power lines, and they may pose a fire risk.

ADDITIONAL INFORMATION

For some excellent sources of additional information, please visit **arborday.org/bulletins.**

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