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Basic Tree Risk Assessment

By Guy Meilleur

LEARNING OBJECTIVES

The arborist will be able to

- review and apply the basic concepts of liability and tree risk.
- understand the process of basic tree risk assessment and some of the business management factors to be considered.
- explain a system for thoroughly and consistently assessing tree and site conditions.
- know the difference between some lower risk conditions and some higher risk conditions.

"Can you tell me if this tree is safe?"

We've all heard variations of this question, and it's a tough one to answer. Hurricane season is almost over in many areas of the United States, and tree owners have seen enough storm devastation, live and on television, to have some real concerns about their trees. The winter storm season lies ahead in other areas. Trees everywhere are exposed to gravity 24/7/365, and Nature's more explosive forces can strike at any time. Tree owners decide how much tree risk they will accept, depending on how much they value the tree, what condition the tree is in, and how much they value the nearby people and property—the "targets."

Your assignment, should you choose to accept it, is to calculate and clearly communicate to the owners the risk associated with their tree, and what they can do about it.

"Risk" means danger, the possibility of suffering loss. The reality is, everything carries risk. A "defect" has been defined as a visible sign that a tree has the potential to fail. However, because every tree has the potential to fail, the questions of how visible, and how much potential, remain. Any harmless feature of a tree that looks unfamiliar to the inexperienced observer can be called a defect that creates a "hazard tree," defined as a tree with an unacceptable level of risk to a target. The question is, what can be done about it? All risks can be lowered (abated, mitigated, lessened), but when arboricultural options are not carefully considered and clearly communicated, the owners cannot make an informed decision. Quickly labeling "defects" and "hazards" can lead to the needless removal of valuable trees, when more conservative actions may have been more reasonable.

Basic tree risk assessment involves an objective, systematic review of the tree's condition (good and bad), the site, and the exposure of targets. By listening to the owners' history of the trees and the site, you can gain vital information on the trees' condition, the use of the site, and associated risk. Both parties benefit from the insights and intelligence working in the other. As a professional arborist, you demonstrate competence and trustworthiness by looking at the trees' strengths as well as their weaknesses. It is important to learn all you can about past maintenance practices, previous symptoms noted, and changes in nearby plants. Recent disturbance, such as construction, grade changes, and trenching, can impair the stability of trees on the site and increase their risk of failure.

Risk is a fact of life—it's only a matter of degree. One attempt to numerically measure the degree of risk is the Quantified Tree Risk Assessment system (QTRA), which was devised in the context of law in the United Kingdom. Using this system, the risk of harm presented by a tree with dead branches over a road is 1 in 8,200. Removing the dead branches reduces that risk to 1 in 45,000, far safer than the 1 in 10,000 that is considered by medical groups to be an acceptable level of risk to the public.

You may or may not want to put a hard number on risk, using the QTRA or another system. It all depends on the job and the owners' needs and style of communication, but it is important to remember that there is no zero-risk scenario. An experienced arborist can inspect a tree, assess in relative terms the risk of failure and the risk of harm, and describe reasonable actions that can lower those risks.

LIABILITY

Some arborists choose not to accept the assignment of assessing risk, out of a generalized concern about getting sued. Liability is assumed according to four specific factors:

- duty, the responsibility for the tree's care
- breach, the failure to act reasonably
- harm, damage or injury
- cause, proof that the breach resulted in the injury

A certain level of liability is unavoidable no matter what we do or not do, but there are steps that can limit our own personal and professional liability when assessing tree risk. First, define your assignment so that you and the owner understand the level of detail that you will be going to, and what form the written report will take. Second, unless you have a big "S" on your chest, you cannot see inside the tree or under the tree. You cannot foresee what storms will be testing the tree's strength, so you cannot guarantee its safety for a week or even for a day. You must state the job's limitations in a written "disclaimer." Finally, make it clear that risk is always present, and it is the owners of the tree who are responsible for the decisions affecting the tree.

People may unreasonably expect that all arborists are experienced and knowledgeable enough to be experts in tree risk assessment, even if they are not. Knowledge gained from experience and from books will build your abilities, but that knowledge is a double-edged sword. As professionals we are expected to act reasonably and in the public interest if we see a very high-risk, life-threatening condition. Despite our disclaimers, and even if we were hired for other reasons and they are not part of our assignment, we may still be wrongly considered responsible for nearby trees. In extreme cases, it may be a good idea to document critical conditions with words and pictures, deliver that information to the property owners, and make copies for your files. Once you have lowered your personal and professional liability to a level that is acceptable to you, you are ready to assess tree risk.

INSPECTION

A basic issue in basic tree risk assessment is the need to distinguish tree health from tree structure. Tree workers and tree owners may see that the leaves are a nice shade of green and conclude that the tree is safe. However, arborists understand that healthy foliage is not a reliable indicator of structural integrity. Judging a tree's strength by how it looks at first is like judging a book by its cover. Tree structure, not appearance, is the major focus of tree risk assessment. Visual tree assessment must be combined with hearing, smelling, touch, and judgment. When inspecting trees, use a checklist and stick to that system so you do not miss anything that should be included in the level of assessment that you have agreed to do. Basic inspection includes the site, the roots, the trunk flare, the trunk, and the branches.

✔**Site.** The tree's environment can lessen or increase risk of tree failure. If a tree is sheltered by other trees, it is more stable. Exposure to wind, snow, rain, and ice add to the loading that can cause tree failure. Saturated soil conditions and slope can also affect the risk of failure.

This sugar maple (*Acer saccharum*) had beautiful leaves, but root damage had resulted in decay. The arborist who cleaned dead branches the year before was not paid to assess risk.

✔**Species.** Identify the type of tree that you are asked to inspect. Different species have different strengths and susceptibilities. For instance, most oaks (*Quercus*) can carry greater loads on their limbs than willows (*Salix*) or poplars (*Populus*), but oaks may be more likely to uproot. By taking notes and pictures of trees that have failed, you can know what to expect from similar species in similar conditions under similar strains. By sending your observations to the International Tree Failure Database, you can gain access to observations from arborists around the world.

✔**Shape.** Look at the entire aboveground tree, checking for dead branches, sprawling branches that stick out from the rest of the crown, and overall branch structure. If the tree leans, determine whether the tree is adapting to that lean by growing branches in the opposite direction. If the top is curving back toward vertical, the lean is "self-correcting."

✔**Roots.** Check for obstructions to root growth, such as curbs and foundations and water. Look for signs of trenching, and check to see how water moves through the site. Use a soil probe to check the location and health of roots. You might tap on the roots with a mallet, listening for a hollow sound. If the sound is suspicious, you can either dig or angle a probe toward the bottom of the root. Because roots often rot from the bottom up, getting under them can give you valuable information.

✔**Trunk Flare.** A most vital area to inspect is the trunk flare, where the trunk expands, or "flares," into the structural roots. If you cannot find the flare, remove mulch and soil and any small girdling roots until it is visible. Roots that encircle all or part of the trunk are known as stem-girdling roots. These not only damage plant tissues and circulation, but they can also impair stability. They are commonly found on container-grown trees, but can occur on almost any tree. After the end of a root is cut off, new roots can branch off sideways. This growth in time may girdle the stem.

✔**Trunk.** If there is a hole in the trunk or root collar, you can gain information about that cavity by probing with a tool such as a screwdriver or a tile probe, a long, narrow fiberglass rod with a "T" handle. A ruler or yardstick will give you some idea how extensive the cavity is. If the trunk sounds very hollow but there is no soft spot or opening to probe and measure, then more advanced equipment may be used to determine how much sound wood is in the stem. Drilling and coring can measure the sound wood in one small area, so many holes must be made to get a picture of the whole tree. Drilling (including resistance measuring devices) and coring invade healthy tissue, potentially spreading decay and decreasing stability. Practicing on fallen trees can provide valuable experience in the use of these methods.

Devices using radar and sound waves are not as invasive, but they cost a lot more. Trunks can also be tested by pulling on the tree, using the Statics Integrated Method. All of these methods and devices require experience to interpret the results well enough to communicate the risk to the tree owner. Deciding how closely to inspect a tree is always a professional judgment, different for each assignment and each tree. Cavities greater than two-thirds of the diameter are sometimes considered "hazardous" and a reason for removal, but with close monitoring and care, trees with cavities greater than 80 percent of the diameter have been managed for many years.

✔**Scaffold Attachments and Branches.** Finally, examine the skeleton of the tree from below. Check the forks for branch bark ridges (good) and included bark (bad). Check the branches for holes, bulges, irregular bark growth, and cracks. Branches on "edge" trees that develop heavy ends can also develop cracks on the upper side. These branches often require reduction pruning to lower the risk of failure. A Certified Tree Worker/Climber Specialist or another qualified climber with a digital camera can provide essential information that cannot be gained from the ground, The lack of an aerial inspection is a limitation that may be significant enough to include on the written disclaimer.

It soon becomes clear that the kind of professional assessment that minimizes liability for all concerned takes a lot of valuable time. You should be paid for this time; if you are not, think carefully before offering an opinion. Getting paid for assessment affords the time needed to put together and write down a report that a tree owner can use. It also removes the appearance of bias, because assessors will not be compelled to sell maintenance or removal to justify their assessment time. Risk assessment is a distinct service, best done independently from the sale of tree care services.

Lower-Risk Conditions

Some conditions do not significantly increase risk of failure.

- Narrow-angled forks between stems and branches do not always indicate poor structure. Usually the bark is pushed outward into a ridge between the stems or branch. These forks are not likely to split apart unless they are shaped like a V and not a U. The two sides are codominant if they are nearly the same diameter and lack a normal branch union. If there is no ridge and the bark is rolled inward, the bark is "included" in the fork. Forks with included bark are not only more likely to split apart, but, if they lack a branch collar, they also may lack a strong branch protection one. Removing one branch down to an included or codominant fork can create a wound that decays. Dwarfing one side with reduction cuts, even if they are made at small laterals, makes smaller wounds that can close much faster, resulting in a stronger branch. Old pruning wounds, at forks or on the stem from removing lower limbs, often need inspection for decay.
- Decay of living wood is caused by fungi, so the sight of a fungal reproductive structure, such as a conk or a mushroom, can be a sign of decay. However, some fungi are saprophytes, which grow only on wood that is already dead. Saprophytes are not pathogens, because they do not cause disease. Even if a fungus is pathogenic, it may be very weak, so if the tree is in good health it can live with the fungus indefinitely. Strong pathogens such as *Armillaria mellea* sometimes stop spreading after being walled off, or "compartmentalized," by the tree. A fungus is not necessarily a sign of structural weakness unless any decay is assessed. Identifying the fungus, and assessing overall tree vitality, can help forecast the spread of decay.

Saprophytic fungus has spread from mulch to trunk, but it has no affect on structure.

- Abnormal swelling of plant tissues—"galls"—in leaves and twigs are seldom a health concern, and never a structural concern. Galls in stems can be inspected for hollow sounds, holes, weeping, and "frass"—material produced by insects. If they are free of these aggravating factors, the galls may be a structural benefit.

Galls or burls on rot-resistant species such as post oak (*Quercus stellata*) do not often increase risk.

- Sour-smelling fluid oozing from a stem may attract insects and cause concern among tree owners, but it rarely indicates a safety issue. This slime flux may need treatment for the long-term health of the tree, but not because of immediate risk concerns. The bacteria that cause the sap to ferment and ooze down the trunk also inhibit the growth of decay fungi, so the ooze is not bad news for the structure of the tree. Bacterial infection is not a structural defect in and of itself, but it can open the tree to decay fungi.
- Trees respond to wounds by forming callus, or "scar" tissue, around them. In time, this tissue can become differentiated, or specialized, as it develops into woundwood. As the hardening substance called lignin is deposited, the lignified woundwood can be much stronger than normal wood. Therefore, even while decay is spreading on the inside of a tree, the development of woundwood can compensate, in part, for some of that loss of strength.

Wounds from grader gash, aka "bulldozer blight." When closure takes place before the wood decays, risk is low.

- Wood formed to counteract gravity is known as reaction wood, and it can take several forms. Compression wood, commonly found on gymnosperms, or "softwoods," is formed on the underside of the lean, pushing the tree upward. Tension wood, commonly found on angiosperms, or "hardwoods," is formed on top of the lean, pulling the tree upward. A leaning tree can in time correct itself with reaction wood and branch growth, so a gradual "sweep" in the trunk can indicate a relatively stable, self-corrected tree. These patterns of growth are words in *The Body Language of Trees*. With field experience and reference to texts, arborists should become fluent in this language over time.

Higher-Risk Conditions

- Rings around a wound may be a sign of a target canker. If the rings are dark, dry, and dead, they indicate that disease is preventing wound closure, increasing the risk of decay and risk of failure.

After a hurricane ten years ago, the home owner managed the split with rope and pruning paint. Now the rope is swallowed, creating a new risk of failure.

This codominant fork with a cracking wound is a high-risk condition.

- Soil mounding behind the lean of a tree is a sign that the roots are being pulled out of the earth. Short of extreme reduction or engineering major support systems such as propping, root failure cannot be prevented after it has begun.
- If there are "shear" cracks on opposite sides of the trunk, the trunk may be failing. Crown reduction and the installation of support systems might not adequately lower the risk of trunk failure from shear cracks.
- An abrupt bend in a branch or trunk is known as a crook. Risk of failure increases with aggravating factors such as cracks, disease, and insect activity.

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Wounds larger than one-third the circumference in plan of lean over a busy road create a high-risk condition.

Woundwood is strong, but a rapidly closing wound can form "ram's horns," which can cause splitting in the future.

- Leaning trees are at a higher risk of failure if most of the branches are growing in the direction of the lean. Other aggravating factors include full exposure to wind, and poor soil drainage.

TREE RISK MANAGEMENT

After the risk of tree failure and the risk of that failure to people and property are assessed, ways of managing the risk must be discussed. You should describe for the owner all the reasonable ways of lowering that risk to a level that the owner is willing to accept. At this point, tree risk assessment transitions into tree risk management. The answer may be as simple as removing a dead branch or reducing a sprawling limb. It is essential to consider the long-range effects of the complete removal of living limbs and trees. Pruning, cabling, and other arboricultural treatments are not perfect or zero-maintenance solutions, but neither is removal. Without the support provided by the missing tree or limb, adjacent trees and limbs will be on the "edge," newly exposed to the forces of nature. Some of these forces are as subtle as sunshine, which can kill bark by scalding. The balance of the tree or grove will be altered, and they will react to stresses in new and possibly unanticipated ways. Removing large limbs also can result in the decay and failure of the parent branch or stem. Arborists sometimes automatically recommend removal in the hopes of protecting themselves from liability, but, in fact, removal of trees and limbs can lead to an unanticipated increase in risk and liability.

Because some decay can be compartmentalized by a tree with adequate resources, the risk from decay may be lowered over time by managing the soil to increase those resources. Mulching, fertilizing, inoculating with microorganisms, and irrigating can encourage new root growth and increase the tree's vitality and resources to resist decay. After reviewing the options, the owners decide which corrective actions to take and prioritize when to take those actions. If other abatement or mitigation does not meet the owners' needs, then they may decide that removal and replacement is the best answer for some trees. The ultimate goals of tree risk assessment include maintaining a secure environment, maximizing the benefits delivered by the landscape, keeping maintenance affordable, and demonstrating the value of arboriculture.

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Photos courtesy of the author.

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CEU TEST QUESTIONS

To receive continuing education unit (CEU) credit (1.0 CEU) for home study of this article, after you have read it, darken the appropriate circles on the answer form of the insert card in this issue of *Arborist News*. (A photocopy of the answer form is ***not*** acceptable.) A passing score for this test is 12 correct answers.

Next, complete the registration information, ***including your certification number***, on the answer form and send it to ISA, P.O. Box 3129, Champaign, IL 61826-3129. Answer forms for this test, **Basic Tree Risk Assessment**, may be sent for the next 12 months.

You will be notified only if you do not pass. If you do not pass, ISA gives you the option of re-taking the quiz until you do achieve a passing score.

1. Tree owners accept risk based on all the following **except**
   a. how much they value the tree
   b. how much they value the target that is near the tree
   c. how much money they make
   d. what condition the tree is in
2. Which of the following statements about stem-girdling roots is **not** true?
   a. they encircle all or part of the trunk
   b. they are a common problem in container-grown trees
   c. they are easy to find without digging
   d. they are damaging to plant tissues, circulation, and stability
3. A crook is
   a. a gradual curve in a branch or trunk
   b. a dishonest person
   c. a bend in a branch or trunk, with a crack
   d. an abrupt bend in a branch or trunk
4. Deciding whether a tree is safe enough to keep is the arborist's responsibility.
   a. true
   b. false
5. A conk is
   a. a reproductive structure made by a fungus
   b. always a conclusive sign of structural decay
   c. the result of sitting under a coconut tree
   d. the nut made by a horsechestnut tree
6. A tree's structural integrity is indicated by all **except**
   a. the condition of the trunk
   b. the condition of the foliage
   c. the condition of the branches
   d. the condition of the roots
7. Included bark is
   a. caused by the branch bark ridge
   b. an indication of poor structure
   c. caused by crown cleaning
   d. a sound in a small kennel
8. Which of the following statements about liability is **not** true?
   a. it is something that one is obligated to care for
   b. it is minimized by disclaimers and careful wording
   c. it is a legal responsibility
   d. it is possible to eliminate
9. A pathogen is
   a. a route followed by carpenter ants
   b. a casual agent of disease
   c. any microorganism
   d. a disorder inside of a tree
10. The trunk flare is
    a. where the trunk expands around a cavity
    b. where the trunk expands into the scaffold branches
    c. where the trunk expands into the structural roots
    d. all of the above
11. To limit liability, you should
    a. admit what you do not know
    b. make sure the owner decides what to do
    c. agree with the owner that trees are worth some risk
    d. all of the above
12. Removing defective trees and limbs always lowers risk.
    a. true
    b. false
13. Basic tree inspection relies which of the following?
    a. an understanding of tree anatomy and physiology
    b. familiarity with local pests and environment
    c. knowledge of the species' growth habits
    d. all of the above
14. Reaction wood is
    a. a sign of tree failure
    b. wood formed to counteract gravity
    c. wood formed around serious decay
    d. wood formed in reaction to insect attack
15. A saprophyte is
    a. a parasite
    b. an organism that grows on sapwood
    c. a threat to tree stability
    d. an organism that feeds on dead organic matter
16. Liability must include all these except
    a. duty, the responsibility to care for trees
    b. breach, the failure to act reasonably
    c. harm, damage or injury present
    d. cause, carrying out the duty caused by risk
17. A target canker is
    a. a structure or person that could be hit by a tree
    b. the area outside the collar where a pruning cut is made
    c. a perennial infection with annual rings
    d. a canker that a fungicide will control
18. Woundwood is
    a. a defect in the stem or branch
    b. weaker than normal wood
    c. lignified and differentiated
    d. a sign of structural instability
19. Goals of the risk assessment include all except
    a. maintaining a secure and safe environment
    b. minimizing the benefits delivered by the landscape
    c. keeping maintenance affordable
    d. demonstrating the value of arboriculture
20. When you see critically high-risk conditions, it is important to
    a. document the risk with words and pictures
    b. deposit copies into your files
    c deliver the information to the owner
    d. . all of the above