

The Seven Deadly Defects

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No, not wrath, greed, sloth, pride, lust, envy or gluttony. Those may be deadly but have nothing to do with hazardous trees. Think decay, cracks, root problems, weak branch unions, trunk cankers, poor tree architecture and dead wood. THOSE are the seven deadly defects that every conscientious land manager holds to heart!

Tree *defects* are structural problems resulting from injury, disease, or poor architecture that makes it more likely the tree or branch will fail. Simply put, they are predictable, pre-existing weaknesses that when they fail usually cause significant damage or injury to targets. Knowing what these deadly defects look like will



This hackberry has extensive decay even though the cavity opening to the outside is small. The fungal fruiting structures indicate that decay is in the tree trunk and buttress roots.

Photo: Gary Johnson

help property managers avoid or minimize that damage or injury.

Deadly Defect #1...Decay. If you tend to be paranoid, this is something that warrants paranoia. Decay is the most common pre-existing condition that leads to tree failures during loading events. Whether the loading event is wind,



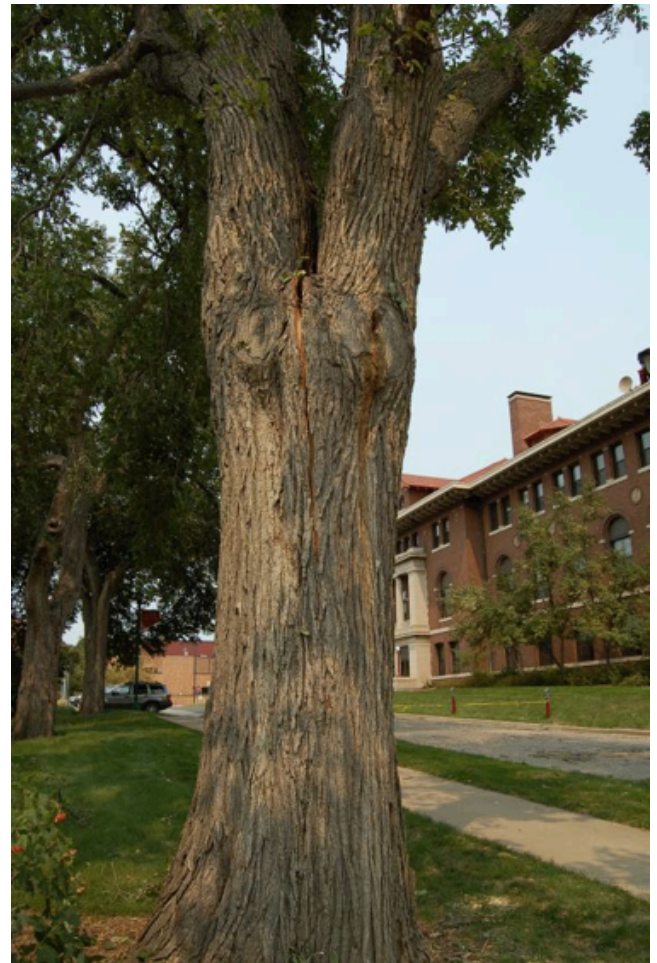
This basswood only had about 1.5 inches of solid wood in the trunk with the decay extending from the ground line up 20' into the tree trunk.

Photo: Gary Johnson

ice or snow, tree branches, trunks or roots with decay are the first places that trees fail. If you see decay, get nervous.

Deadly Defect #2...Cracks. Cracks in branches or tree trunks seem so minor and there are trees all over with cracks in them that seem just

fine. But cracks present two potential problems: 1. Weaknesses (“a chain is only as strong as its weakest link”), and 2. Internal decay. Cracks are outside indicators of damaged wood and the loss of the strength of a cylinder, in this case the tree trunk or major branch. Cracks can form when trees are twisted in severe winds and the wood fibers fail. They can also be the result of “frost cracks.” Either way, internally the wood has been wounded and most often decay is beginning...out of sight and out of mind.



Note the crack in the trunk between the two leaders of this American elm. The crack extended almost to the ground line.

Photo: Gary Johnson

Deadly Defect #3...Root Problems. The problems you don't even know you have.



A close-up view of the crack and the internal damage that resulted from it. Soon, the wounded wood would begin decaying.

Photo: Gary Johnson

Root problems generally fall into two categories: roots that are dying because of root rots or structural roots that have been cut. Either way, tree stability is compromised and the entire tree can collapse during a wind loading event. One-sided root damage is bad but most

trees eventually recover from that. Two to four-sided root damage leaves trees so unstable that they often fail long before the root systems can recover and stabilize the tree again.

Another root problem is called Stem Girdling Roots, or SGRs. SGRs grow around or against tree trunks, usually below ground on trees that have their stems buried. As the roots enlarge and the tree trunks enlarge, the trunk is “girdled,” or compressed. This is the most common, pre-existing condition that leads to complete tree failure in Minnesota, based on research at the University of Minnesota from 1995-2000.

Deadly Defect #4...Weak Branch Unions. The old adage is that narrow-angled branch attachments are weak, while wide attachments are strong. This is only a partial truth. A more accurate assessment of a strong vs. weak branch attachment is the presence of a

branch bark ridge (strong) or included bark in the branch attachment (weak). Branch attachments with included bark do not have complete branch wood to trunk wood unions and as the trees get larger and heavier, the weak attachments become more of a hazard.

Deadly Defect #5...Trunk Cankers. Cankers are areas



A close-up view of the buried tree trunk and the compressed, weakened portion below ground.

Photo: Dave Hanson



This little leaf linden failed suddenly in a wind storm, breaking off at the weak point of the tree trunk. The weakness was caused by stem compression from stem girdling roots. This tree was planted with the stem buried by more than 12" of soil.

Photo: Dave Hanson

of trunk and/or branch tissues that have been killed by either diseases, insects or non-living agents such as fire. A canker is a larger, diffused dead area in the (previously) living bark that poses the same danger as a bark or wood crack. The canker weakens the tree trunk or branch because the solid cylinder of sapwood strength has been broken and quite often, decay is associated with cankers. As opposed to the previous defects, cankers cause failures more commonly with younger tree trunks. Younger tree trunks are more supple and flexible

which allows them to bend and flex in wind storms. If there is a weak spot due to a canker, the tree trunk or branch is most likely to break at that point.

*Deadly Defect #6...
Poor Tree Architecture.*
There can be a lot of architectural problems with unmaintained or



A good example of a branch union with included bark, literally, bark included in the attachment. This is weak.

Photo: Gary Johnson



These branch attachments are strong. Note the prominent branch bark ridges, indicating strong branch unions.

Photo: Gary Johnson

poorly-maintained trees, but multiple leaders is the most dangerous, especially if the tree is large or will become large. Medium to large trees (30 feet and taller) that have multiple leaders (the vertical branches a.k.a. leaders) bear too much weight as the tree matures, especially if the leaders begin close to the ground (less than 10 feet from the ground). The tremendous amount of weight in each leader combined with the movement of the tree in a



This young tree failed at a canker in the stem. The cause of the canker could have been a mechanical wound when it was younger. Regardless of the cause, the ending is usually the same with young trees.

Photo: Gary Johnson

wind storm is frequently the cause of failures in wind and ice storms. Combine the multiple leaders (co-dominant leaders) with included bark in the unions and maybe a little decay and you have the number one pre-existing condition for failures in the canopy of trees.

Deadly Defect #7...Deadwood.

Oddly, for many trees deadwood remains safely attached for many years before finally failing. Deadwood has less wind-resistance and therefore can sometimes be more stable than living branches with a lot of foliage and a poor branch attachment and/or decay.

However, when it does fail and especially if the deadwood is high up in the tree canopy, the damage or injury can be severe or fatal. Some trees can hold securely on to deadwood for many years, such as red elms. Others, such as green ash, begin dropping dead branches within a year of death. It's not worth the risk of leaving large branches (branch diameter of 2 inches or more) 50 feet off the ground of a large tree hanging over a trail, parking lot or building.

*The poster child
for a tree with
poor architecture:
multiple leaders,
all with included
bark in their at-
tachments and
all occurring far
too close to the
ground for a tree
that will grow to
50+ feet tall.
Photo: Gary
Johnson*



Thank you Dr. Johnson for your continuing series on tree management and risks associated with maintaining these beautiful plants while limiting liabilities. In the third and last installment of managing tree risks in public spaces, the focus will be on managing risks at an acceptable level through regular monitoring, predicting, preventing and planning ahead.

