



# Guidelines for Assessing Failure Potential Associated with Tree Defects <sup>1</sup>

The following table provides general guidelines for assessing failure potential from tree defects. Many additional factors must be considered when assessing failure risk including site conditions, weather and climate conditions, species characteristics, crown size and presence of multiple defects.

	SEVERE DEFECTS	CRITICAL DEFECTS
<b>BRANCHES</b>	Dead branches with loose or missing bark	<b>Hangers</b>
	Trees with past history of branch failures	Branches with cracks
	Branches with abrupt bends	Branches with abrupt bends and cracks
<b>STEMS</b>	Co dominant stems with included bark	<b>Co dominant stems with cracks and/or decay at leader junction</b>
	Leaning stems-more than 45° from vertical	Leaning stems with cracks or decay that exceed 70% of stem diameter
	<ul style="list-style-type: none"> <li>• <b>Decayed stems - Decay column exceeds 70% of stem diameter</b></li> <li>• Decay column exceeds 50% of stem diameter plus other defects or conditions such as cavity openings, leaning trees or decay in stress points</li> </ul>	<ul style="list-style-type: none"> <li>• Decayed stems - decay exceeds 80% stem diameter</li> <li>• Decayed stems with cracks</li> <li>• Decay column that exceeds 70% of stem diameter associated with other defects such as cavity openings, and decay in leaning trees or at other stress points</li> </ul>
<b>ROOTS</b>	Root loss or decay in more than 33% of the buttress roots	<ul style="list-style-type: none"> <li>• Root decay or root loss affecting more than 50% of buttress roots</li> <li>• Root loss or decay in flare roots opposite a lean</li> </ul>
		Leaning tree with soil mound opposite lean
	Excavations within 3 times stem diameter	Excavations within 3 times stem diameter on 2 or more portions of the root system or on the side opposite a lean.

**Severe Defects:** Trees or tree parts with high-risk defects are likely to fail during periods of high stress such as wind and ice storms.

**Critical Risk Defects:** Trees or tree parts with critical defects are in the process of failing or prone to failure at any time. Tree with these defects should be given priority for remedial treatments

<sup>1</sup>Adapted from *Tree Risk Management*, Bartlett Tree Research Laboratories

## **DRAFT - Failure Profiles of Common Trees in Kansas - DRAFT**

The following list summarizes the known defects and common failure profiles for many tree species native or introduced to Kansas. Many species are not included in this profile summary as there are few commonly occurring defects or failure profiles. This list is not intended to be a comprehensive listing of all defects by species. The purpose of this listing is not to discourage the planting and use of the species listed, rather it out intention for this to be used as an educational tool for arborists, tree board members and other managers in the proper selection and placement of tree species relative to their use in the community landscape.

<b>Species</b>	<b>Failure Profile</b>
Ailanthus	<ul style="list-style-type: none"> <li>• Branch and stem failures due to susceptibility to wood decay and heavy branch ends</li> <li>• High failure rate with large trees</li> </ul>
Ash	<ul style="list-style-type: none"> <li>• Leader/branch failures, splits/cracks with codominant stems codominant stems and upright branching habits causing included bark</li> <li>• Branch failures-heavy branch ends</li> <li>• Dead Branches from Ash Yellows/Ash decline</li> </ul>
Beech	<ul style="list-style-type: none"> <li>• Susceptible to root decay in old age</li> <li>• Leader failure in old age due to weight and decay</li> </ul>
Birch	<ul style="list-style-type: none"> <li>• Branch failures-dense branch ends</li> <li>• Stem and Branch failures due to wood decay and weak wood</li> <li>• Dead branches due to borers, sensitivity to root problems</li> <li>• Leader failure due to multiple stems</li> <li>• Sensitive to storm damage from snow, ice, wind</li> </ul>
Black Locust	<ul style="list-style-type: none"> <li>• Stem and branch failure from wood decay and borers</li> <li>• Prone to soil failures</li> </ul>
Catalpa	<ul style="list-style-type: none"> <li>• Trunk failure due to internal decay</li> </ul>
Cherry	<ul style="list-style-type: none"> <li>• Stem breakage due to poor architecture</li> <li>• Stem Branch Failures due to susceptible to wood decay</li> <li>• Branch failures due to heavy branch ends</li> </ul>
Cottonwood (Poplar)	<ul style="list-style-type: none"> <li>• Branch and Stem failures due to brash, weak wood, susceptibility to decay and heavy branch ends.</li> </ul>
Elm	<ul style="list-style-type: none"> <li>• Branch shedding will occur within on year of death from Dutch elm disease</li> <li>• Branch leader failure (Co-dominant leaders, included bark/splits) due to upright branching habit and dense branch ends.</li> </ul>
Hickory	<ul style="list-style-type: none"> <li>• Branch/leader failure in old trees due heavy branch ends and upright branching habit that results in included bark</li> </ul>
Horse chestnut	<ul style="list-style-type: none"> <li>• Branch, leader and stem failures due to co-dominant stems, included bark, cracks and susceptibility to wood decay</li> </ul>
Juniper (Redcedar)	<ul style="list-style-type: none"> <li>• Branch breakage due to snow/ice accumulation</li> <li>• Soil /root failures due to dense crown and susceptibility to root decay</li> </ul>
Linden	<ul style="list-style-type: none"> <li>• Branch stem failures due to decay</li> <li>• Branch/leader failures due to included bark, cracks due to upright branching habit</li> </ul>

Maple - Silver - Red - Norway - Box elder	<ul style="list-style-type: none"> <li>• Branch/leader failure due to upright co-dominant stems, included bark.</li> <li>• Branch failures due to heavy branch ends and weak wood</li> <li>• Stem and branch failure due to susceptibility to root decay</li> <li>• Susceptible to wind-throw (soil failure) due to shallow root system especially on wet sites</li> </ul>
Maple - Sugar	<ul style="list-style-type: none"> <li>• Branch/leader failure due to upright co-dominant stems, included bark</li> <li>• Dead branches are common in older trees due to decline/root problems</li> <li>• Stem/branch failure due to wood decay in old trees</li> <li>• Susceptible to root failures due to decay and large crowns in old age</li> </ul>
Oak	<ul style="list-style-type: none"> <li>• Root decay is common in older and mature trees</li> <li>• Dead branches in old trees due to <i>Agrilus</i> borers</li> </ul>
Pear	<ul style="list-style-type: none"> <li>• Limb failure due to poor attachment</li> <li>• Splitting and trunk failure due to included bark, poor architecture</li> </ul>
Pine	<ul style="list-style-type: none"> <li>• Stem and root failures due to low live crown ratios</li> <li>• Branch failures due to snow, ice accumulation</li> <li>• Wind-throw on edge trees, new construction sites or high irrigation sites</li> </ul>
Redbud, Eastern	<ul style="list-style-type: none"> <li>• Decay with mature specimens</li> <li>• Branch failure due to included bark and poor branch angles</li> </ul>
Sweetgum	<ul style="list-style-type: none"> <li>• Trunk failure from internal decay</li> <li>• Branch loss with loading from ice/snow</li> <li>• Prone to sudden limb drop</li> </ul>
Tulip tree ( <i>Liriodendron</i> )	<ul style="list-style-type: none"> <li>• Highly susceptible to damage from lightning strikes</li> <li>• Susceptible to branch, leader and stem failure due to weak wood and susceptibility to decay.</li> </ul>
Walnut	<ul style="list-style-type: none"> <li>• Branch failure due to heavy branch ends</li> </ul>
Willow	<ul style="list-style-type: none"> <li>• Branch and stem failures due to decay</li> <li>• Branch failures due to weak wood and heavy branch ends</li> <li>• Soil failures due to shallow root system and heavy crowns</li> </ul>
Zelkova	<ul style="list-style-type: none"> <li>• Poor branch structure</li> <li>• Decay and large branch failure on mature trees common</li> </ul>
Old (“over mature” trees)	<ul style="list-style-type: none"> <li>• Old trees are generally prone to all types of failures due to wood and root decay that is common in older plants.</li> </ul>

*Adapted from Tree Risk Management, Bartlett Tree Research Laboratories*

Very Low	Low	Medium	High	Very High
<i>Alder, Mountain</i> <i>Golden Raintree</i> <i>Hawthorn Species</i> <i>Juniper Species</i> <i>Peach Species</i> <i>Pine</i> <i>Bristlecone</i> <i>Mugho</i> <i>Pinon</i> <i>Limber</i> <i>Plum Species</i>	<i>Apple Species</i> <i>Cherry Species</i> <i>Crabapple Species</i> <i>Mountain Ash</i> <i>Russian Olive</i> <i>Willow</i> <i>Corkscrew</i> <i>Globe</i> <i>Redbud Species</i> <i>Maple</i> <i>Amur</i> <i>Rocky Mountain</i> <i>Oak</i> <i>Shumard</i> <i>Swamp White</i> <i>Scarlet</i> <i>Red</i> <i>White</i> <i>Pin</i> <i>Bur</i>	<i>Buckeye, Ohio</i> <i>Catalpa</i> <i>Western</i> <i>Douglas-Fir</i> <i>Elm</i> <i>American</i> <i>Red</i> <i>Honeylocust</i> <i>Horsechestnut</i> <i>Linden</i> <i>American</i> <i>Redmond</i> <i>Maple</i> <i>Sugar</i> <i>Red</i> <i>Mulberry spp</i> <i>Oak</i> <i>Willow</i> <i>English</i> <i>Pear spp</i> <i>Pine</i> <i>Austrian</i> <i>Ponderosa</i> <i>Scotch</i> <i>Plane Tree</i> <i>Sweetgum</i> <i>Sycamore</i> <i>Tree of Heaven</i> <i>Walnut, Black</i> <i>Zelkova</i>	<i>Ash</i> <i>Green</i> <i>White</i> <i>Birch</i> <i>Paper</i> <i>Weeping</i> <i>White</i> <i>River</i> <i>Hickory</i> <i>K. Coffeetree</i> <i>Locust, Black</i> <i>Pecan</i> <i>Pine</i> <i>Eastern white</i> <i>Spruce</i> <i>Blue</i> <i>Engelmann</i> <i>Norway</i> <i>Walnut</i>	<i>Ailanthus</i> <i>Boxelder</i> <i>Cottonwood</i> <i>Eastern</i> <i>Lanceleaf</i> <i>Narrowleaf</i> <i>Plains</i> <i>Siouxland</i> <i>Elm, Siberian</i> <i>Hackberry</i> <i>Maple, Silver</i> <i>Pear, Bradford</i> <i>Poplar, all</i> <i>Willow</i> <i>Black</i> <i>Golden</i> <i>Peachleaf</i> <i>Weeping</i>

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