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Spotting and Mitigating Tree Hazards

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Disclaimer: The purpose of this article is to explain how to survey critical and visible tree hazards that may impact life, property, and activities. This article does not seek to turn participants into professional tree risk assessors. For more information on professional risk assessment and concepts, see https://www.isa-arbor.com and *Tree Risk and Hazard Assessment Concepts*[1].

INTRODUCTION

Georgia is fortunate to have a climate that provides sufficient sunlight and rain; and soils that provide necessary minerals and nutrients so our trees can grow and prosper. Some residents may wonder why we should worry about trees in the places we live. After all, they may think trees just sort of take care of themselves. But living with trees means dealing with tree hazards. Taking care of the community forest entails planting and caring for trees, as well as spotting and mitigating the potential for whole tree or tree part failure. This article presents a process by which homeowners can identify tree hazards and subsequently contact a Certified Arborist for additional assistance (Figure 1).

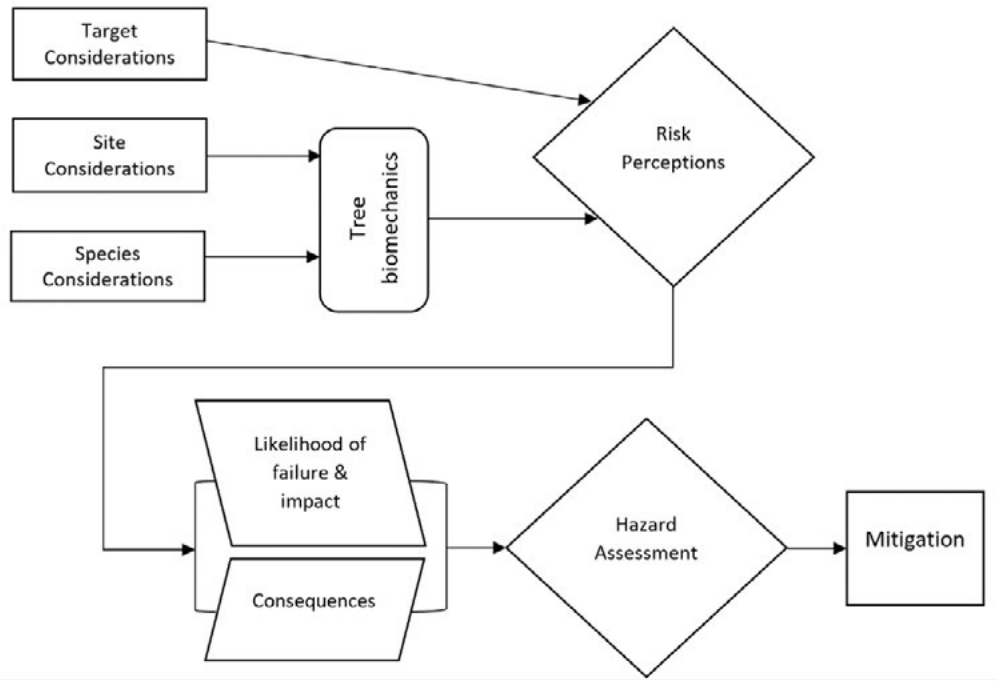

Figure 1: *A process approach to tree risk identification and mitigation*

[1]Coder, Kim D. 2018. Tree risk & hazard assessment concepts. Warnell School of Forestry & Natural Resources, University of Georgia, Outreach Publication WSFNR-18-12. Pp.24.

TARGET CONSIDERATIONS

A lone dead tree in the woods is not a hazard (to the human world). For a tree to be hazardous, it must have a target. A target consists of life (for example, people or pets), property (for example, a building or vehicle), or an activity (for example, walking or picnicking). Identifying the target is important to prioritize your decision to hire a professional risk assessor and/or remove the hazardous tree.

Targets have different values. A risk to life has higher consequences than a risk to property or activities. Damage to a home may have greater consequences for some people compared with damage to a vehicle. Identifying the target and the potential consequences is subjective and will vary by homeowner and even among professional risk assessors.

Several important questions should be considered when identifying a target:

- **Does the target move?** Consider how much time the target occupies a space. For example, if the target is a parked vehicle, determine if the vehicle is located in the space constantly, only after work hours, or only during work hours (Figure 2).
- **Can the target be relocated or access restricted?** Determine if access to the target can be restricted or if it mobile and can be moved from the space of concern to avoid possible damage from part or whole tree failure (Figure 3).
- **Is there protection?** Determine if a roof or other form of protection covers the target. For instance, a roof might cover people eating, the target (Figure 4).
- **What is the value of the target?** Think about the importance of the target in terms of both economic and non-economic value. Consider if the consequence of impact are minor, negligible, significant, or severe (Figure 5).
- **What is your risk threshold?** Consider whether you tend to be more accepting of taking risks (of tree failure in this case) or whether you tend to be risk averse. Another way to think about risk threshold is how willing you are to take a chance with the likelihood that damages will occur.
- **What is your risk time frame?** This is similar to risk threshold in that each person has a different perspective. The time frame is the period during which you think tree failure might occur under normal environmental conditions. You may want to consider one year or three years. A professional risk assessor will discuss the threshold with you as the owner, but typically a threshold is around three years.

Figure 2: *These cars are present during business hours.*

Figure 3: *This picnic table can be relocated.*

Figure 4: *The picnic tables are protected by the roof.*

Figure 5: *The consequences of impact are severe if children are playing on this playground during a tree failure.*

SITE CONSIDERATIONS

The environmental and human-influenced characteristics of the tree's location has a significant impact on the likelihood of tree failure. Some sites create harsher conditions for the tree compared to other sites. Some sites have a history of tree failure thereby increasing the chances of future problems.

The following questions should be addressed when considering the site of the tree:

- **Were there previous tree failures?** If unknown, talk with neighbors or look at insurance records.
- **What are the wind patterns?** A tree is more likely to fall based on the prevailing wind direction. Also, it is important to characterize tendencies in winds during storm conditions. Wind acts like a lever of force on the tree crown and stem. Wind stresses tree tissues that provide structure to support the tree during windy conditions (Figure 6). The potential breakage point is a function of the amount of wind energy hitting a specific location on the stem at a certain distance from the ground (Figure 7).
- **What is the tree's wind exposure?** Determine if the tree closely surrounded by other trees creating a buffer or if the tree is mostly exposed to wind energy. Recent changes to wind exposure where a tree is suddenly in the open is a red flag.
- **What are the soil characteristics?** Different soils anchor the tree differently. Identify the dominant soil type where the tree is growing: clay, loamy, or sandy soils. Very loamy and sandy soils tend to be loose soils associated with failure (in some cases, species adaptation has mitigated this effect). Water-saturated soils also lead to failure, especially where there is inadequate rooting space.
- **Has there been site disturbance?** Trenching and construction that has damaged roots and limited rooting space highly influence the likelihood of failure. The negative impacts of site disturbance are not limited to recent (in the past year) events.
- **Have there been hydrological changes?** Tree stability is influenced by the way water runs through the soil in the rooting space. Hydrological changes, such as rate or direction of flow, caused by disturbance or climate change can increase likelihood of failure.

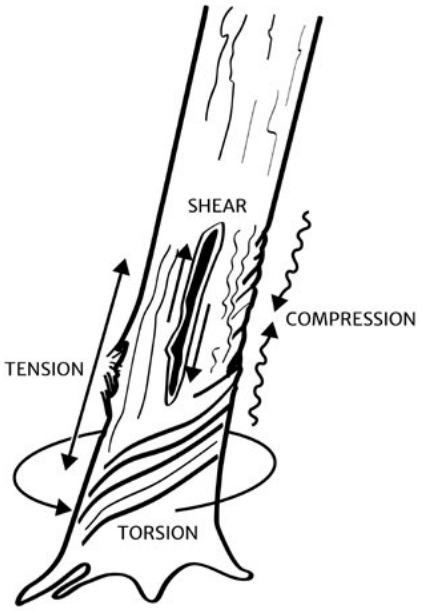

Figure 6: *Wind stresses on tree. Tension twists the tissue, compression squeezes the tissue towards a central point, shear slides the tissue in opposite directions along a plane, and tension stretches the tissue in opposite directions.*

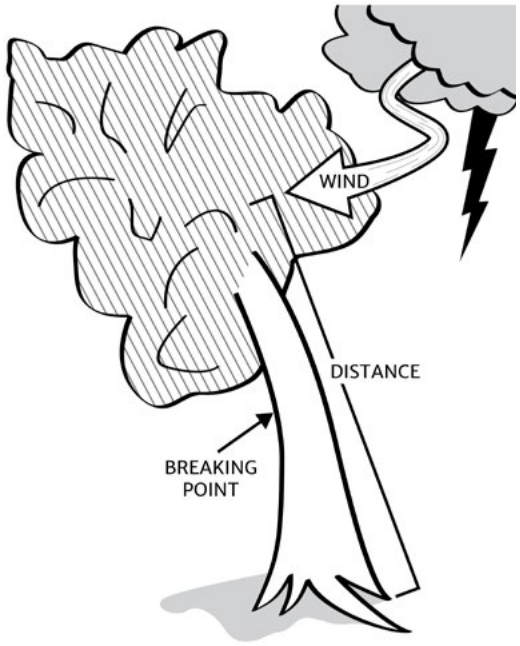

Figure 7: *Wind forces on tree. Wind pushes against the crown, which acts as a lever. The breaking point is determined by the distance between the ground and the central wind contact point.*

TREE CONSIDERATIONS

Tree considerations include species characteristics and environmental influences on tree anatomy and physiology. Such considerations are important because each tree (species) responds to stress differently with some trees becoming more hazardous due to stresses than others. In addition, tree considerations influence the success of hazard mitigation measures that reduce likelihood of failure and impact as well as consequences of impact.

Tree owners should note these tree considerations:

- **Species:** Species like water oak (*Quercus nigra*, Leyland cypress *(xCupressocyparis leylandii)*, sweetgum *(Liquidambar styraciflua)*, and maples (*Acer* spp.) have fairly high frequency of failure (Figure 8). Likelihood of failure is influenced by, for example, species tendencies for codominant leaders, included bark, poor branch attachment, decay and compartmentalization of decay, and susceptibility to pathogens and insects.
- **Size:** Large trees and branches are heavier than their counterparts. Weight and size can increase likelihood of failure and cause greater consequences of impact.
- **Growth habit:** Depending on the species, decurrent (spreading branches) trees such as oaks are more susceptible to wind and ice damage than excurrent (pyramidal) trees such as conifers (Figure 9).
- **Roots:** Damaged and decayed roots, particularly a damaged root plate close to the tree base, can lead to whole tree failure.
- **Tree age and history:** Mature and senescing trees may be more prone to failure due to their age compared with young trees. A history of poor pruning or damage to the tree can suggest internal decay or other defects that lead to failure (Figure 10).
- **Defects:** Defects, as listed below, can be sings of potential tree failure. Many defects are indicators that the tree is in decline and can be an probable or possible failure (Figure 11).

Figure 8: *Trees have different species failure profiles. Sweetgum (Liquidambar styraciflua) and Leyland cypress (xCupressocyparis leylandii) have high rates of failure.*

Figure 9: *Growth habit influences risk of failure. The tree on the left has an excurrent (cone-shaped) habit while the tree on the right is decurrent (spreading).*

Figure 10: *Tree age, such as this old oak tree, and history of poor pruning can influence likelihood of failure.*

DEFECTS

The following list illustrates common defects to look for in a potentially hazardous tree.

Codominant stems/branches and included bark

Codominant means two or more stems or branches are about the same size and emerge from the same location so that no single stem or branch is dominant (Figure 12). Codominance is highly susceptible to wind and ice stresses. Many codominant stems and branches are also characterized by included bark, which is bark that has turned into itself. Included bark creates a weak attachment between stems or branches.

Cavity/decay in stem or branches

Cavities in the stem or branches are a sign of decay and may be indicative of a high risk of failure (Figure 13). The stem is a hazard if it has an opening greater than or equal to thirty percent of the stem circumference with a shell thickness of less than two inches of sound wood for each six inches of stem diameter. Often, the cavity is not visible from the outside and an advanced risk assessment must be performed using specialized tools.

Rot at base or roots

Rot at the root base or in the roots is often characterized by the protrusion of mushrooms or woody conks out of the wood or soil (Figure 14). This is a serious problem that suggests loss of structural support in the root system. Wood-decay fungi cause brown rot, soft rot, and white rot. White-rot fungi break down the lignin in wood, leaving the lighter-colored cellulose behind, and causing rotted wood to feel moist and spongy, and white in appearance. Brown rot breaks down cellulose and leaves brown discoloration.

Lean

A leaning tree may indicate imminent failure or it may not fail for many years. An indication of hazard is if the lean increases over time. A tree with greater than forty percent lean is of concern. Sometimes leans can be corrected with the tree growing back so that its center of gravity is above the stem base. An uncorrected lean (Figure 15) has the top of the tree significantly away from the stem base.

Root plate lifting

Root plate lifting is noticeable when cracks appear in the soil near the base of the tree. Lifting often occurs when the soil is saturated. It also occurs when the root system is rotten and can no longer support the tree.

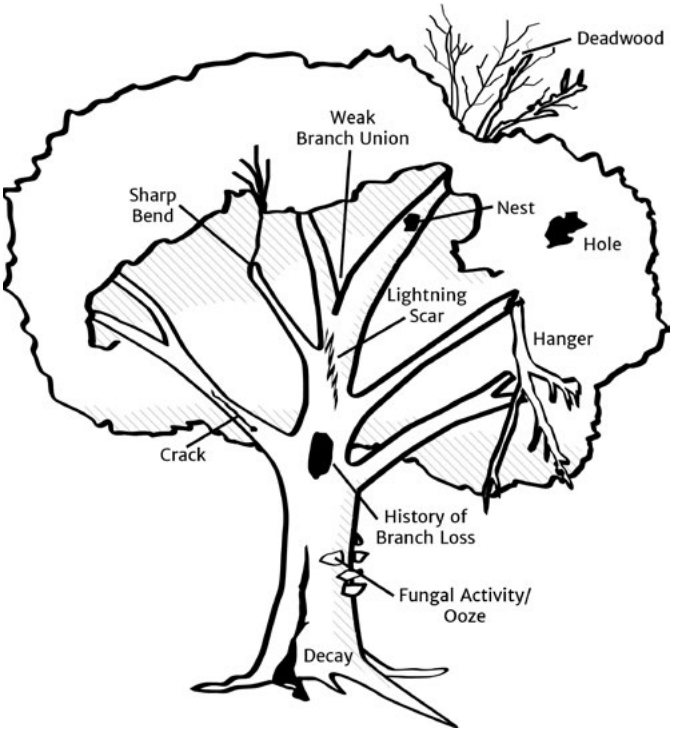

Figure 11: *Trees must be assessed for defects.*

Figure 12: *Codominant stems with included bark.*

Cankers, galls, burls, conks

Cankers, galls, burls, and conks can all indicate stress and decay (Figure 16). The extent of each defect determines the extent of hazard. Just because the tree has a few conks does not mean it is an imminent threat of failure; however, it does indicate decay because as a fungus, conks feed off wood.

Site disturbance

Site disturbance includes trenching, construction, and soil compaction around the roots (Figure 17). The amount of disturbance that negatively impacts the tree, and leads to a hazard, is determined by the size of the tree as measured by diameter at breast height (dbh) and the critical root zone (CRZ) needed to maintain healthy roots. A rule of thumb for determining the CRZ is to multiply the dbh by 1.5 to get the critical root radius (CRR). The CRZ is then the CRR squared times pi, or 3.14 (the formula for a circle). If disturbance cuts into the CRZ, the potential for failure increases.

MITIGATION THROUGH MANAGEMENT

Depending on the hazard and level of risk, a Certified Arborist may suggest various mitigation prescriptions to decrease risk. Some of these could include, for example:

- Prune the tree (treat the specific hazard in the tree)
- Cable or brace the tree
- Aeration, fertilization, mulching
- Remove the tree (last resort)
- Regular inspections

Ultimately the decision to mitigate risk is the homeowner's responsibility. There are some activities the homeowner can accomplish without the help of a professional. For example, the homeowner can ensure the tree has favorable growth conditions with the appropriate application of mulch and irrigation. In addition, the homeowner could potentially move the target. One of the most important activities a homeowner can undertake is to continuously and regularly monitor the condition of the trees. Tree are living organisms that should not be taken for granted!

Figure 13: *Decay in stem.*

Figure 14: *Fungus at base of tree indicates decay in root plate.*

Figure 15: *Uncorrected lean.*

Figure 16: *Conks indicate decay.*

LIABILITY

The tree owner must maintain trees so as not to cause injury to property or person. This is known as exercising reasonable care) and the court decides if defendant acted reasonably. The owner is liable for an obvious visible condition and act reasonably to address that condition. By contrast, the owner is typically not liable for damages caused by Act of God, which is not an obvious defect, and is determined by the Court.

In the case of a boundary tree, both owners are tenets in common and are liable. If a tree located solely on one property is treated as common property, it is considered a boundary line tree. A neighbor has absolute right to treat limbs and roots of a neighbor's tree extending into property. However, the neighbor must not trespass onto the adjacent property while treating the tree. Further, the owner of boundary line tree must obtain consent of the other owner before treatment. Treatment must not cause undue damage to tree. The best thing to do is to communicate with the neighbor!

CONCLUSION

A Certified Arborist has the knowledge, skills, and experience needed to accurately assess tree risk. However, homeowners may not immediately have access to a Certified Arborist. The tree owner is the ultimate arbitrator of tree risk and is therefore responsible for assessing the level of hazard of a tree worthy of following-up with a professional. This article provides basic considerations when assessing a tree for hazards and requesting a professional confirmation.

Figure 17: *Site disturbance. The construction interfered with the critical root zone as determined by the diameter of the tree (dbh) and the critical root radius (CRR).*