The Influence of Seasons on the Consistency and Accuracy of Professional Tree Risk Assessments

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Background:

Trees are a critical aspect of urban green infrastructure which provide many benefits to humans. To minimize tree-related risk and maximize tree benefits, tree care professionals use tree risk assessments (TRA's) to gauge the level of risk associated with a particular tree. However, previous research has shown that TRA's are inherently subjective, and that the assessor has just as much influence as the method on the overall risk rating. There is a need to outline specific criteria for conducting TRA's such that they become more reproducible and resilient to assessor bias. The Tree Risk Assessment Qualification (TRAQ) system uses three "levels" of applied TRA's: Limited visual (Level 1), basic (Level 2), and advanced (Level 3) assessments. All three levels address the likelihood of failure of the tree or tree part (LoF), likelihood of impact of a target (LoI), and the consequences of failure (CoF) associated with the tree and target. Limited visual (Level 1) assessments are the fastest but least thorough of the three, being conducted on-foot or from a slow-moving vehicle and noting outstanding defects, general characteristics, and potential targets on just the viewer's side of the tree. A concrete methodology for Level 1 assessments is not outlined in the literature, potentially opening this method to assessor bias. Basic (Level 2) assessments are 360-degree inspections conducted on foot that note tree characteristics and potential targets that could be impacted by failure. Most municipalities who conduct TRA's do so using a Level 1. This project investigates the efficacy of Level 1's when they are applied during different times of the year. We will conduct two re-assessments of a 2019 inventory of 17,846 trees in Sheboygan, WI, that was conducted using a Level 1 from a slow-moving vehicle. These re-assessments will take place in the dormant and growing seasons. Additionally, basic (Level 2) follow-up assessments will be conducted in our dormant season survey on a group of 96 trees that were identified by the previous assessors as high-risk or otherwise warranting further inspection. Using publicly available traffic data, we will compare the occupancy rates within the drop zone of these trees to both the previous the rating system of a different TRA method - Quantified Tree Risk Assessment (QTRA) - that quantifies the LoI as a numerical ratio. The likelihood that a target is impacted by tree failure is the crux of TRA's. However, the TRAQ method used to risk assess these 96 trees does not prescribe the use of occupancy measuring devices like traffic counters, and as such any application of LoI using this method may be subject to bias which could change the overall risk rating.

Methods:

- The original 2019 inventory was updated to only include trees in the landscape as of January 2022. Any trees which were removed by the City Department of Public Works to mitigate risk, or that otherwise failed due to environmental conditions, were removed from that list.
- Two re-assessments will be conducted on a sample of 4000 trees from the original inventory. In a leaf-off assessment in April 2022, we will observe 2000 trees, and in another leaf-on assessment in July 2022, we will assess a different set of 2000.
- Limited visual (Level 1) assessments from a slow-moving vehicle will be conducted on all trees included in the sample. We will observe the trees moving in both directions, though only the street-facing sides of the trees will be observed. We will stop the vehicle to conduct basic (Level 2) assessments on trees which appear to potentially have elevated risk (outstanding defects, multiple targets).
- Zones based on Sheboygan neighborhoods have been subdivided into zone segments that encompass City rights-of-way along streets. Each zone segment has a unique ID.
- Our pool of 4000 trees is sourced from a random sample of 114 zone segments.
- A census of 96 trees previously identified to have elevated risk will be conducted using Level 2 assessments only. This will be conducted during our leaf-off assessment in April 2022.
- Using QGIS software, maps featuring 187 Wisconsin Department of Transportation (WI DOT) traffic counters and the 96 elevated risk trees throughout Sheboygan have been created. The map identifies the two nearest counters to each tree, providing concrete occupancy data which can be compared to those trees' current likelihood of impact (LoI) ratings.
- LoI ratings using the QTRA system will be given for all 96 of these trees to compare two different methods for assessing LoI with quantified traffic data. QTRA uses mathematical quantities to rate LoI, while TRAQ uses a matrix system of nominal qualities.

Funding and Support:

This project is funded by the Florida Chapter of the International Society of Arboriculture. Additional support is provided by the Orlando Garden Club.

Zone Map:

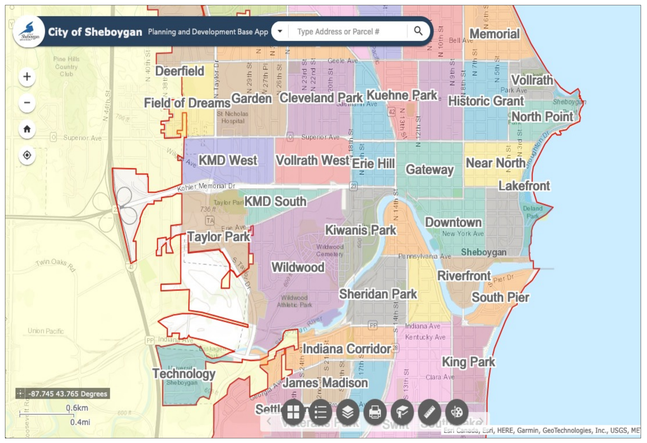

Figure 1: A portion of the neighborhood layer of the City of Sheboygan's Planning & Development base map, on which we based our system of zoning

Traffic Counters & High-Risk Trees:

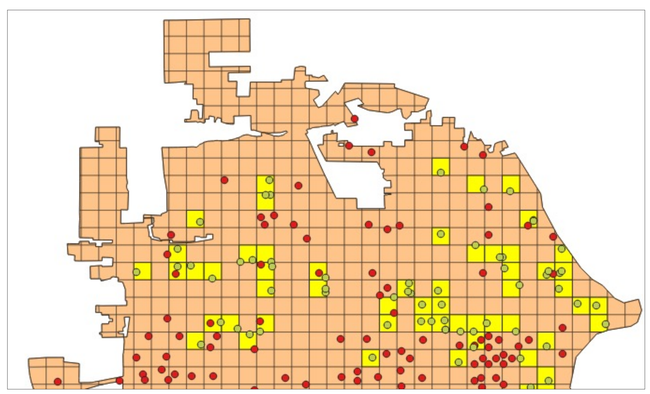

Figure 2: The city limits of Sheboygan featuring the locations of elevated risk trees and traffic counters which provide average annual daily traffic ratings. The trees are shown in green, and the traffic counters in red. A grid layer comprised of 200 m^2 cells is overlaid, with cells containing outstanding risk trees highlighted in yellow. Map by Thomas Ward.

Results from Initial Assessment:

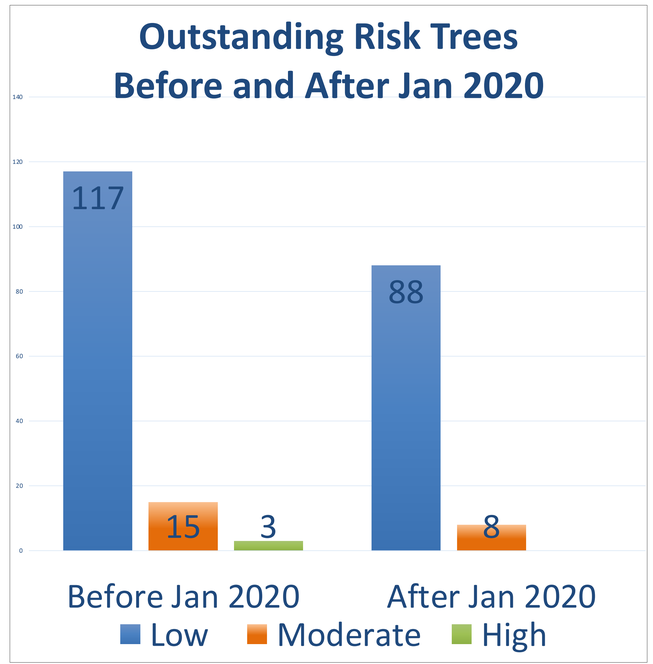

Figure 3: Elevated risk trees and risk ratings observed by the original assessors. After January 2020, several of these trees were either removed by the Sheboygan Dept of Public Works to mitigate risk or failed due to environmental conditions.

Tree Species	Low	Moderate	High
Ash	14	3	0
Maple	52	3	1
Linden	50	9	2
Oak	1	0	0
Removed since January 2020	29	7	3
Total remaining	88	8	0

Table 1: Species breakdown of elevated risk trees and quantities of respective risk ratings. Thirty-nine (39) trees have been removed since the assessment concluded. .