Northumberland County Forest

Tree Risk Management Plan

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Contents

Purpose

The purpose of the Tree Risk Management Plan is to provide County staff with the operational guidelines needed to manage tree risk in the Northumberland County Forest. This plan provides direction for evaluating, recording, prioritizing and ultimately mitigating risk from tree failure in the Northumberland County Forest. Furthermore, this plan can be adapted to manage the risk posed by trees in similar natural areas and along trails owned by the County or its member municipalities.

Background

Trees provide us with immense benefits. Trees produce the oxygen and remove pollution from the air we breathe, filter the water we drink, help moderate climate change through temperature regulation and carbon sequestration and possess remarkable aesthetic value. Trees are public infrastructure investments that increase in value over time.

The experience of being on trails among trees is a reason people visit the Northumberland County Forest. Trees also have finite lifespans, thus there are risks to public health and safety as a result of falling branches or whole tree failure. While the risks such as the likelihood of a person being struck by a tree or running into a downed tree during wheeled recreation (e.g., cycling, ATVing, dirtbiking, snowmobiling) is low, Northumberland County is committed to the highest level of public safety possible in the County Forest. The aim of this plan is to develop a management strategy that balances the benefits and hazards of trees.

Duty of Care

Under the Occupier's Liability Act (R.S.O. 1990), the occupier is required to "take such care as, in all the circumstances of the case, is reasonable to see that persons entering the premises, and the property brought on the premises by those person are reasonably safe while on the premises". When entry "is for the purpose of recreational activity and no fee is paid for the entry or activity", a modified duty for the occupier is applied. The person entering the property is considered to have willingly assumed the risks and therefore occupier must not "create a danger with the deliberate intent of doing harm...and not to act with reckless disregard..."

To reduce danger and to not act with reckless disregard, the County will assess trees along forest roads and trails annually. Where danger from trees is identified, action will be taken to mitigate the hazard.

Standard of Care

Northumberland County Forest will take a proactive and preventative approach to tree risk management. Staff will conduct annual inspections of all trees within striking distance of publicly-accessible designated trails and forest roads as well as non-public recreational infrastructure. Identified hazard trees will be pruned or removed to mitigate and/or eliminate the risk. The County intends to meet or exceed all arboricultural industry standards including *American National Standards Institute A-300 (Part) 9 Draft 1 Version 1 Tree Risk Assessment a. Tree Structural Assessment.*

This management plan is rooted in the International Society of Arboriculture's (ISA) Tree Risk Assessment Qualification (TRAQ). The TRAQ approach involves tree biology and mechanics, tree

inspection and assessment, data analysis and risk categorization, and risk reporting to provide a standardized and systematic process for assessing tree risk.

Risk Tolerance

There is an inherent risk with participating in outdoor recreational activities, especially in a forest setting. To ensure safe and enjoyable experiences for trail users, Northumberland County is committed to performing annual, systematic inspections of all trees along forest roads and trails. Priority will be given to: forest roads that are necessary for emergency access, trails with high occupancy rates and gathering areas such as trailheads and parking areas. Forest users going off-trail for activities such as hunting, orienteering, berry and mushroom picking and nature photography are willingly assuming a much greater risk as they are leaving maintained infrastructure. It is financially and ecologically unreasonable to consider attempting to mitigate the risk to off-trail users.

Scope of Work

- Collect geodata (GPS locations) and map hazard trees or that require more detailed inspection.
- Annually inspect all trees along forest roads and trails.
- Identify and remove trees or portions thereof that have a high likelihood of failure and are within striking distance of forest infrastructure such as roads, trails, rest areas, trailheads and parking lots.
- Identify mitigation options that reduce or eliminate the overall risk of a hazardous tree.
- Combine geodata and tree inspection results to prioritize and plan mitigation work and assess
- Evaluate the County Forest Service's capacity to manage risk posed by hazard trees.

Level of Assessment

Staff will use a 3-staged approach to performing tree risk assessments. The first stage is a Limited Visual Assessment that is used to identify the existent of defective trees with imminent or probable likelihood of failure. Trees that are not at risk of imminent failure, but have defects that suggest possible failure may require a more detailed Basic Assessment to evaluate characteristics such as tree health, structure and load. The third stage, an Advanced Assessment, is used when an extensive assessment is necessary to evaluate tree risk but will rarely be used due to time, equipment and financial constraints.

Limited Visual Assessment (LVA)

The LVA involves looking for obvious defects such as dead trees, large cavity openings, large dead or broken branches, fungal fruiting structures, large cracks and severe leans. LVAs are the fastest but least thorough assessment and are typically used to efficiently assess a large number of trees. LVAs will be performed from a slow moving vehicle, when possible, or on foot. When a tree of concern is identified the location, species name, defect, remedial action and work priority will be recorded with a GPS.

A constraint of this assessment is that only one side of the tree, the side facing the trail, is inspected and defects on the other side are not visible to the inspector.

Basic Assessment

The Basic Assessment is a detailed visual inspection of a tree and requires walking around the entire tree. From different vantage points, the inspector will look at the buttress roots, truck, and branches. Simple tools including a clinometer, magnify glass, mallet, probe, compass, camera, trowel or shovel may be used. The assessment is recorded on a Basic Tree Risk Assessment Form (Appendix 2).

A constraint of this assessment is that it is only a ground-based and rapid assessment. Internal, belowground, and upper-crown factors may not be visible to the inspector.

Advanced Assessment

The Advanced Assessment is used when information beyond a Basic Assessment is needed. It is used to collect and evaluate detailed information about specific tree parts, defects, targets or site conditions. Advanced assessments could include aerial inspections, internal decay assessments, drilling, sonic assessments, root assessments and load tests.

Advanced Assessments require significant time, expense and skill to complete and will only be used in special circumstances for historically valuable trees, species of interest or species at risk. This assessment could require an outside company as it entails the use of specialized equipment.

Targets

A tree is only a hazard if there is a risk that it will impact a target. Targets in the County Forest include people, emergency access routes, vehicles and trailhead infrastructure. People are clearly the most important target and the consequence of being struck by a tree or striking a tree lying across the trail could be severe. People frequenting the Forest are considered mobile as they will be moving at different speeds and may stop in potential target zones for varying periods of time. Therefore, the occupancy rate of Forest users will be considered frequent to occasional (Appendix 3). The use of trail use counters would improve our understanding of occupancy rates, help to determine overall risk and help prioritize mitigation recommendations. Inspectors will refer to the definitions in Appendix 1 to estimate likelihood of impact.

Prioritization of Assessments and Mitigation

Table 1 outlines how Tree Risk Assessments will be prioritized for assessments and mitigation.

Table 1. Prioritization of Assessments and Mitigation

Location	High	Medium	Low
Emergency Access Routes	✓		
Trailheads and Gathering Areas (Benches, Picnic Tables, Interpretive Signs)	✓		
Forest Roads		✓	
Trails with High Occupancy Rates		✓	
Trails with Low Occupancy Rates			✓
Active Work Areas	✓		

Mitigation Options

Forest staff will employ a precautionary approach to ecological damage when preparing mitigation strategies. All relevant legislation including, but not limited to, the Endangered Species Act, Species at Risk Act, Migratory Birds Convention Act, and Fish and Wildlife Conservation Act will be strictly adhered to.

Mitigation Options

- Tree Removal – Standing dead trees within striking distance of a trail, road or parking lot will be removed.
- Pruning – Selected braches (dead, dying, diseased, damaged or deformed) of a tree will be removed if they pose a threat to Forest users.
- Trail Re-routing – Small trail re-routes may be used to retain valuable trees or when the cost to mitigate the hazard is greater than the cost to re-route the trail.
- Temporary Trail Closure – Staff would restrict access to a trail in the short term until it is safe for re-entry.

- Retain and Monitor – An inspected tree that has been deemed to not pose an imminent or probable risk of failure before the next scheduled assessment will be mapped and monitored annually.

Implementation Plan

The amount of hazard trees in the County Forest is unknown and as larger-scale efforts to manage them began in 2013, there is a large backlog that needs to be managed. In order to safely and efficiently evaluate and clear the backlog of hazardous trees to mitigate the County's overall risk exposure the following plan will be implemented.

Table 2. Hazard Tree Action Plan based on risk ranking.

Risk Rank	Possible Actions
Low	• Retain and monitor annually
Medium	• Monitor tree based on recommendations made in basic assessment.
High	• Perform mitigation technique recommended in basic assessment. • Identify tree as lower priority for removal. • Monitor tree at shortened interval.
Severe	• Perform mitigation as soon as possible (within safety, staffing and budget constraints). Expected time should not exceed 1 month after identification of a tree with a severe rating.

Time Frame for Reassessment

A forest completely free of risk is unrealistic; therefore annual hazard tree inspections are necessary. The frequency of inspections depends on the reasonable availability of staffing and financial resources as well as in response to significant weather events.

Summary

A strategy to reduce the risk posed by hazard trees in the Northumberland County Forest will benefit the safety of Forest users and reduce Northumberland County's risk. The objective of this risk management strategy is to promote the benefits of trees while reducing the overall inherent risk to public health and safety. This plan is based on the best scientific knowledge and information available and the latest recommendations of the International Society of Arboriculture. It provides staff an operational protocol for conducting annual inspections, evaluating response strategies and mitigating the hazards of trees along County Forest roads and trails.

Appendix 1 Risk Categorization

Likelihood of Failure

Improbable - the tree or branch is not likely to fail during normal weather conditions and may not fail in many severe weather conditions within the specified time frame.

Possible - failure could occur, but it is unlikely during normal weather conditions within the specified time frame.

Probable - failure may be expected under normal weather conditions within the specified time frame.

Imminent - failure has started or is most likely to occur in the near future, even if there is no significant wind or increased load. This is a rare occurrence for a risk assessor to encounter, and it may require immediate action to protect people from harm.

Likelihood of Impacting a Target

Very low- The chance of the failed tree or branch impacting the specified target is remote. This is the case in a rarely used site fully exposed to the assessed tree or an occasionally used site that is partially protected by trees or structures. Examples include a rarely used trail or trail head in a rural area, or an occasionally used area that has some protection against being struck by the tree failure due to the presence of other trees between the tree being assessed and the targets.

Low - It is not likely that the failed tree or branch will impact the target. This is the case in an occasionally used area that is fully exposed to the assessed tree, a frequently used area that is partially exposed to the assessed tree, or a constant target that is well protected from the assessed tree. Examples include a little-used service road next to the assessed tree or a frequently used public street that has a street tree between the street and the assessed tree.

Medium - The failed tree or branch may or may not impact the target, with nearly equal likelihood. This is the case in a frequently used area that is fully exposed on one side to the assessed tree or a constantly occupied area that is partially protected from the assessed tree. Examples include a suburban street next to the assessed street tree or a house that is partially protected from the assessed tree by an intermediate tree.

High- The failed tree or branch will most likely impact the target. This is the case when a fixed target is fully exposed to the assessed tree or near a high-use road or walkway with an adjacent street tree.

Consequences of Failure

Negligible - low-value property damage or disruption that can be replaced or repaired, and do not involve personal injury.

Minor - low-to-moderate property damage or small disruptions to traffic or a communication utility.

Significant - property damage of moderate- to high-value, considerable disruption, or personal injury.

Severe - serious personal injury or death, damage to high-value property, or disruption of important activities.

Likelihood Matrix

Likelihood of Failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Risk Rating Matrix

Likelihood of Failure & Impact	Consequences of Failure		
	Minor	Significant	Severe
Very likely	Moderate	High	Extreme
Likely	Moderate	High	High
Somewhat likely	Low	Moderate	Moderate
Unlikely	Low	Low	Low

Appendix 2 Basic Tree Risk Assessment Form

ISA Basic Tree Risk Assessment Form

Client _____ Date _____ Time _____

Address / Tree location _____ Tree no. _____ Sheet _____ of _____

Tree species _____ dbh _____ Height _____ Crown spread dia. _____

Assessor(s) _____ Time frame _____ Tools used _____

Target Assessment

Target number	Target description	Target zone: Target within drip line	Target zone: Target within 1x Ht.	Target zone: Target within 1.5x Ht.	Occupancy rate (1 – rare, 2 – occasional, 3 – frequent, 4 – constant)	Practical to move target?	Restriction practical?
1							
2							
3							
4							

Site Factors

History of failures _____ **Topography** Flat ☐ Slope ☐ _____% **Aspect** _____

Site changes None ☐ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe _____

Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ _____% Describe _____

Prevailing wind direction _____ **Common weather** Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe _____

Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ **Foliage** None (seasonal) ☐ None (dead) ☐ Normal _____% Chlorotic _____% Necrotic _____%

Pests _____ **Abiotic** _____

Species failure profile Branches ☐ Trunk ☐ Roots ☐ Describe _____

Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☐ Wind funneling ☐ _____ **Relative crown size** Small ☐ Medium ☐ Large ☐

Crown density Sparse ☐ Normal ☐ Dense ☐ **Interior branches** Few ☐ Normal ☐ Dense ☐ **Vines/Mistletoe/Moss** ☐ _____

Recent or planned change in load factors _____

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown ☐ LCR _____%

Dead twigs/branches ☐ ____% overall Max. dia. _____

Broken/Hangers Number _____ Max. dia. _____

Over-extended branches ☐

Pruning history

Crown cleaned ☐ Thinned ☐ Raised ☐

Reduced ☐ Topped ☐ Lion-tailed ☐

Flush cuts ☐ Other _____

Cracks ☐ _____ Lightning damage ☐

Codominant ☐ _____ Included bark ☐

Weak attachments ☐ _____ Cavity/Nest hole ____% circ.

Previous branch failures ☐ _____ Similar branches present ☐

Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐

Conks ☐ Heartwood decay ☐ _____

Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐

Codominant stems ☐ Included bark ☐ Cracks ☐

Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐

Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐

Cavity/Nest hole _____ % circ. Depth _____ Poor taper ☐

Lean _____° Corrected? _____

Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure

Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Roots and Root Collar —

Collar buried/Not visible ☐ Depth _____ Stem girdling ☐

Dead ☐ Decay ☐ Conks/Mushrooms ☐

Ooze ☐ Cavity ☐ _____% circ.

Cracks ☐ Cut/Damaged roots ☐ Distance from trunk _____

Root plate lifting ☐ Soil weakness ☐

Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐

Likelihood of failure

Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Risk Categorization

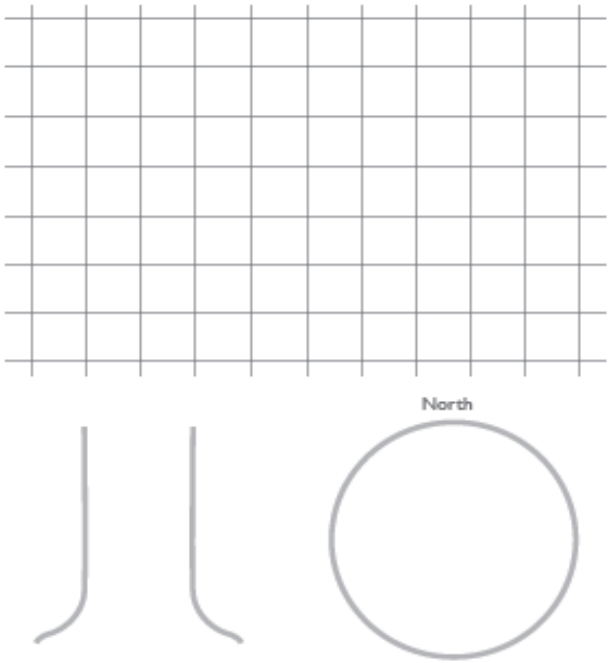
Condition number	Tree part	Conditions of concern	Part size	Fall distance	Target number	Target protection	Likelihood: Failure: Improbable	Likelihood: Failure: Possible	Likelihood: Failure: Probable	Likelihood: Failure: Imminent	Likelihood: Impact: Very low	Likelihood: Impact: Low	Likelihood: Impact: Medium	Likelihood: Impact: High	Likelihood: Failure & Impact (from Matrix 1): Unlikely	Likelihood: Failure & Impact (from Matrix 1): Somewhat	Likelihood: Failure & Impact (from Matrix 1): Likely	Likelihood: Failure & Impact (from Matrix 1): Very likely	Consequences: Negligible	Consequences: Minor	Consequences: Significant	Consequences: Severe	Risk rating of part (from Matrix 2)
1																							
2																							
3																							
4																							

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low



Notes, explanations, descriptions _____

_____

_____

_____

_____

Mitigation options _____ Residual risk _____

_____ Residual risk _____

_____ Residual risk _____

_____ Residual risk _____

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐ Work priority 1 ☐ 2 ☐ 3 ☐ 4 ☐

Overall residual risk Low ☐ Moderate ☐ High ☐ Extreme ☐ Recommended inspection interval _____

Data ☐ Final ☐ Preliminary Advanced assessment needed ☐ No ☐ Yes-Type/Reason _____

Inspection limitations ☐ None ☐ Visibility ☐ Access ☐ Vines ☐ Root collar buried Describe _____

Appendix 3 Occupancy Rates

An estimated amount of time the target is within the target zone.

Use corresponding numbered codes (1-4):

1. Rare – targets are very uncommon in the target zone.
2. Occasional – the target is present infrequently or irregularly.
3. Frequent – the target is present for a large portion of the day or week.
4. Constant – the target is present at all times or nearly all times.