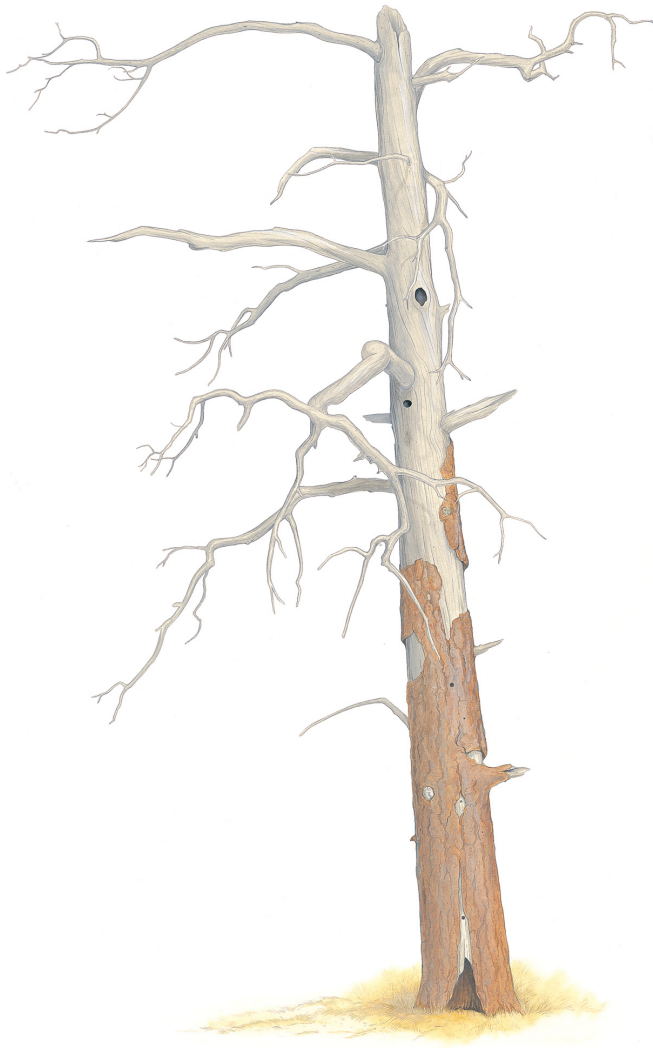


Managing Wildlife/Dangerous Trees

– A safety guide for qualified persons –

June 2008



An initiative of the Wildlife Tree Committee of British Columbia in cooperation with:



WORKING TO MAKE A DIFFERENCE



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FOREWORD

This training course provides information and technical procedures for understanding tree hazards and establishing appropriate safe work practices in situations where there is potential exposure of workers involved in silviculture treatments to dangerous trees. It also provides information on habitat quality that can be used to retain high-value wildlife trees where opportunities exist to assess both tree hazards and wildlife tree habitat value.

Silviculture activities create minimal site disturbance and typically follow activities having higher ratings for level of disturbance (e.g., logging or site preparation). Consequently, this course primarily focuses on worker safety and tree defects which can be visually inspected and rated as having “high defect failure potential.”

Persons who wish to learn more about wildlife/danger tree assessments and to obtain certification as a wildlife/danger tree assessor for forestry activities should take the regular “Wildlife/Danger Tree Assessor’s Course for Forest Harvesting and Silviculture.”

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WHAT IS THE WILDLIFE TREE COMMITTEE OF BRITISH COLUMBIA?

The Wildlife Tree Committee (WTC) is a multi-agency committee composed of representatives from the provincial Ministry of Forests and Range and Ministry of Environment, WorkSafeBC, industry and labour, and public interest groups from across the province. Formed in 1985, the WTC is the advisory body acting on behalf of the three signatory agencies and representing all wildlife tree matters in British Columbia.

The Wildlife Tree Committee mandate is:

To promote the conservation of wildlife trees and associated stand-level biodiversity in a safe and operationally efficient manner; in forest, park and urban environments.

Two major objectives of the WTC are to:

- ensure the maintenance and enhancement of wildlife trees in order to sustain the species dependent on them (about 80 species, or 15% of the province's birds, mammals, and amphibians); and
- foster cooperation and understanding between the various interest groups.

The WTC believes that managed forests, high standards of worker safety, and maintenance of valuable habitat for wildlife tree-dependent species are mutually compatible if cooperative action is taken to integrate these goals.



Wildlife Tree Committee website: www.for.gov.bc.ca/hfp/values/wildlife/WLT/index.htm

COURSE BACKGROUND

This course provides guidance for the identification of potentially dangerous trees prior to forest activities that create low to negligible ground vibration or disturbance (e.g., silviculture treatments, fire fighting with hand tools).

WorkSafeBC recognizes a Qualified Person (QP) as a person experienced in the specified work activity and who, by reason of education, training, experience or a combination thereof, is able to recognize and evaluate hazards associated with trees, with due regard for the anticipated work activity and possible disturbance of the tree(s). The course purpose is to develop the skills of the QP so that they are better able to competently develop safety plans and management strategies to protect valuable wildlife trees.

Those participants wishing to become a certified wildlife/dangerous tree (WDT) assessor should have a minimum of three years of practical field experience in forestry or a related field and take the two-day Wildlife/Dangerous Tree Assessors Harvesting and Silviculture module. A QP is not a certified WDT assessor unless they have taken and passed the WDT Assessor's certification course.

The course will be offered on an ongoing basis throughout British Columbia to:

- WorkSafeBC field inspectors; and
- Foresters, biologists, silviculturalists, tree planting supervisors, forestry technicians, and others involved in performing or supervising silviculture treatments in forestry operations.

Qualified persons are recognized by WorkSafeBC, Ministry of Forests and Range, and the Ministry of Environment. The course is not mandatory, but upon completion of this one-day course the QP will be competent in identifying important attributes of wildlife trees, including:

- their potential as wildlife habitat;
- their failure potential; and
- appropriate safety decisions regarding trees.

COURSE GOALS AND OBJECTIVES

Goals

The goal of the **Managing Wildlife/Dangerous Trees in Silviculture Course** is to present information, practical field experiences and methods to identify and manage:

- valuable wildlife trees with desirable habitat features; and
- hazardous tree defects and how to maintain a safe worker environment..

Objectives

Participants in the **Managing Wildlife/Dangerous Trees in Silviculture Course** will be trained to:

- **recognize existing and potential wildlife trees**, identify wildlife tree use, and understand the importance of wildlife trees and how to integrate them into silviculture activity plans; and
- distinguish between safe and dangerous trees, thereby enabling them to **determine tree hazards and related safe work procedures appropriate for dealing with wildlife and dangerous trees in silviculture settings, as well as along roadsides accessing silviculture work sites.**

AGENDA

MANAGING WILDLIFE/DANGEROUS TREES IN SILVICULTURE

(Schedule may vary depending on audience and location of field sites, and instructor needs)

- 8:00 a.m. Welcome participants
Introduce instructor and participants
- 8:15 a.m. Introduction to wildlife trees
- what is a wildlife tree?
 - wildlife tree classification
 - importance of wildlife trees
- 8:45 a.m. Wildlife/dangerous tree assessment
- what is a dangerous tree?
 - relevant *Workers Compensation Act* regulations
 - level of disturbance and exposure
 - site assessment overview/ stratification
 - dangerous tree inspection
 - safety procedures
- 10:00 a.m. Mobilize for field site
- 11:00 a.m. Site assessment
and wildlife/dangerous tree field assessment
- Participants will stratify a work site, record site hazards and assess wildlife/dangerous trees for hazards and wildlife habitat value. Participants will carry out practical field identification and determine tree danger ratings and safety procedures for various trees. Site safety plans will then be developed by the group as a closing exercise.
- 2:00 p.m. Adjourn

Materials Required

All necessary classroom materials and field supplies will be supplied by the instructor.

The participant is responsible for providing the following essential items for field exercises:

- personal gear, including rain gear (mandatory);
- hard hat (mandatory);
- boots with ankle support (mandatory; caulk boots recommended for coastal locations);
- binoculars (recommended);
- diameter tape (optional); and
- 6-ring field notebook (mandatory).

WHAT IS A WILDLIFE TREE?



A wildlife tree is any standing dead or live tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife.

The special characteristics (known as habitat features) are often defects in trees that provide opportunities for wildlife that can include feeding, nesting, shelter, over wintering or hibernation, and perching. The habitat features commonly observed include spike, fork and broken tops, cavities, loose bark, large platform limbs and brooms.

Depending on their cause of death, specific tree defects and condition, and the type of work activity, some wildlife trees can be dangerous. A discussion of tree danger rating is found in the upcoming sections.

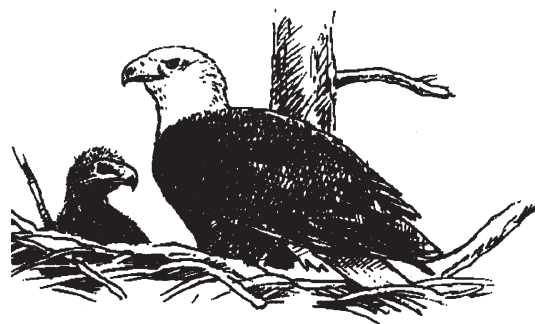
Trees in various stages of life, death and decay are important components of the structure and function of all natural forest ecosystems. Wildlife trees are part of this cycle of life and death. They are constantly being formed by biotic and abiotic factors such as insects, fungi, fire and weather.

In British Columbia, more than 80 species of birds, mammals and amphibians depend on wildlife trees for nesting, feeding and shelter. Some wildlife trees are protected under Section 34 of the provincial *Wildlife Act*, which reads as follows:

“A person who, except as provided by regulation, possesses, takes, injures, molests or destroys

- (a) a bird or its egg,*
- (b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl, or*
- (c) the nest of a bird not referred to in paragraph (b) when the nest is occupied by a bird or its egg*

commits an offence.”



In forestry operations planners attempt to provide habitat suitable for both the present and future needs of wildlife in a variety of ways. Wildlife Tree Patch reserves are commonly planned when areas are developed for logging. Single trees or small groups of trees may also be left for habitat purposes. It is important that wildlife tree retention areas (either patches or single trees) left during harvesting are protected and that wildlife tree recruitment be further promoted during the implementation of silviculture projects. This module will help silviculture planners, supervisors and workers understand how to recognize valuable wildlife habitat features in trees and know how to implement safe work procedures when working near wildlife trees.

WILDLIFE TREE CLASSIFICATION SYSTEM FOR B.C.

The Wildlife/Danger Tree classification system used in B.C. describes each class of wildlife tree in several ways. This includes a simple, general description of each class, a list of the wildlife uses associated with that class, and a summary of the decay characteristics. Although this classification system is based on the decay pattern of thick-barked conifers, such as Douglas-fir and ponderosa pine, it is broadly applicable to all British Columbia native trees (conifers and broad-leaved deciduous).

The deterioration and decay processes occur in various stages, corresponding to the tree classes described below. Conifers have nine tree classes, whereas deciduous trees have six classes, reflecting their accelerated decay and fall-down rates as compared to conifers.

Class 1:

These are live, healthy trees with NO structural defects or injuries that have associated decay and which could compromise the structural strength of the tree. Some live trees may show signs of deterioration or slight damage, such as dead branches, sound live forked or secondary tops, or minor physical injuries (e.g., healed-over stem scrapes). In most cases, these DO NOT have associated decay which might compromise the tree's structural strength.

Class 2:

These are live trees, but have some VISIBLE EXTERNAL DEFECT which can affect the tree's structural strength or introduce decay. The first stages of deterioration often begin while the tree is still alive. The invasion is led by fungi or wood-boring beetles. Wildlife trees that are alive or in the early stages of decay attract birds that build large open nests, such as Ospreys, Bald Eagles and Great Blue Herons, or cavity excavators such as woodpeckers.

Class 2 trees have one or more of the following defects:

- Fungal conks and/or internal decay;
- Tree cavities;
- External stem scars;
- Stem cracks/splits (must have associated decay; not a simple dry check);
- Dead tops (including secondary tops and forks);
- Broken tops;
- Large dead limbs (>10 cm diameter);
- Damaged roots (from disease, fire or mechanical damage);
- Excessive lean (>30%) AND damaged/diseased roots or a poor anchoring soil ("sweep" is not a lean defect);
- Large canker face;
- Unusual stem swellings (may indicate hidden decay); or
- Insect or fire damage such that tree is likely to die relatively soon (i.e., become a Class 3 tree).

Class 3, 4 and class 5 conifers:

The tree has died, and decay begins or continues. Class 3 trees are RECENTLY dead, still bearing their fine branches and twigs, and the bark is “tight”. Class 4 trees have lost their fine twigs and only have larger, coarse limbs left, and bark has begun to loosen or shed from parts of the stem. Class 5 trees have usually lost all their limbs; tops are generally intact although they may be weakening. Woodpeckers will chisel out nesting cavities, taking advantage of the outer shell of sapwood that protects eggs and nestlings. As time passes, the tree continues to rot and soften.

Class 5 broad-leaved deciduous:

This is the tree class for deciduous trees before they fall to the ground as coarse woody debris. By this stage, the sapwood and heartwood are soft, portions of the bole have broken away, and most of the limbs are gone. Class 5 for deciduous trees is roughly equivalent to classes 6 – 7 for coniferous trees.

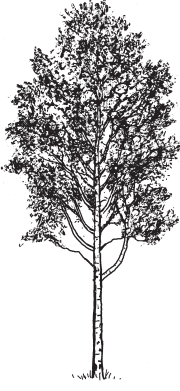
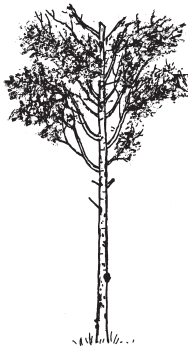
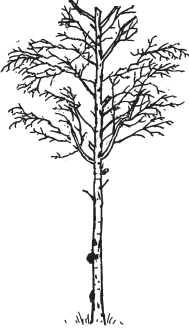
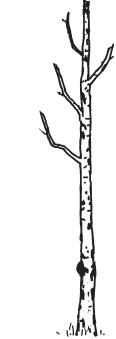


Classes 6 and 7:

When the tree reaches these stages, weaker excavators, such as nuthatches and chickadees, can make their nest holes in the soft wood. Branches are often broken off, and slabs of bark loosen from the trunk. Decay is advanced in the upper portions of the trunk. The loss of tree limbs creates knot holes and natural cavities, many of which are soon converted into homes by a variety of animals. Over the years, the tree becomes shorter as portions of the top snap off at weak points. Throughout stages 6 and 7, chunks of bark and sapwood are sloughed off and the upper bole of the tree has broken away. Generally up to half ($\frac{1}{2}$) of the original top height of the tree has broken away. Once the softer heartwood is exposed, wildlife trees are used less by woodpeckers and more by other animal species. Class 6 for deciduous trees represents a dead fallen tree.










Classes 8 and 9 (conifers only):

In the final phases of tree decay, all the sapwood is gone and the heartwood is completely rotted through. By class 8, only about one third ($\frac{1}{3}$) or less of the original tree height remains – the heartwood is highly decayed and is often visible as brown-cubical sloughing fragments. At class 9, the stump and the mound of woody debris that surrounds it become an ideal site for new plant growth, providing a ready supply of moisture and nutrients. It has now become suitable habitat for amphibians, such as the clouded salamander, that require moist, thermally buffered environments.

British Columbia's wildlife tree classification system: native broad-leaved deciduous

Tree class	LIVE		DEAD			
	1	2	hard → 3	spongy → 4	soft 5	dead fallen 6
					approx. 1/2 original height 	

British Columbia's wildlife tree classification system: conifers

Tree class	LIVE		DEAD						
	1	2	Hard →		Spongy →		Soft		
			3	4	5	6	7	8	9
						approx. 2/3 original height 	approx. 1/2 original height 	approx. 1/3 original height 	dead fallen 
Description	Live/healthy; no decay; tree has valuable habitat characteristics such as large, clustered or gnarled branches, or horizontal, thickly moss-covered branches.*	Live/unhealthy; internal decay or growth deformities (including insect damage, broken tops); dying tree.*	Dead; needles or fine twigs are present.	Dead; no needles or fine twigs – only coarse limbs present; 50% of branches lost; loose bark; top usually broken.	Dead; most branches/ bark absent; some internal decay.	Dead; no branches or bark; sapwood/ heartwood sloughing from upper bole; decay more advanced.	Dead; extensive internal decay; outer shell may be hard; lateral roots usually completely decomposed; hollow or nearly hollow shells.		Debris; downed trees or stumps.
Uses and users	Nesting (e.g., Bald Eagle, Great Blue Heron colonies, Marbled Murrelet); feeding; roosting; perching.	Nesting/roosting ¹ – strong PCEs ² (woodpeckers); SCUs ³ ; large-limb and platform nests (Ospreys); insect feeders.	Nesting/ roosting – strong PCEs; SCUs; bats.	Nesting/ roosting – PCEs; SCUs; insect feeders.	Nesting/ roosting – weak PCEs (nuthatches, chickadees); SCUs; bats; insect feeders.	Weaker PCEs; SCUs; insect feeders; salamanders; small mammals; hunting perches.	Insect feeders; salamanders; small mammals; hunting perches occasionally used by weak cavity excavators such as chickadees.		Insect feeders; salamanders; small mammals; drumming logs for grouse; flicker foraging; nutrient source.

¹ Large witches' brooms provide nesting/denning habitat for some species (e.g., fisher, squirrels).

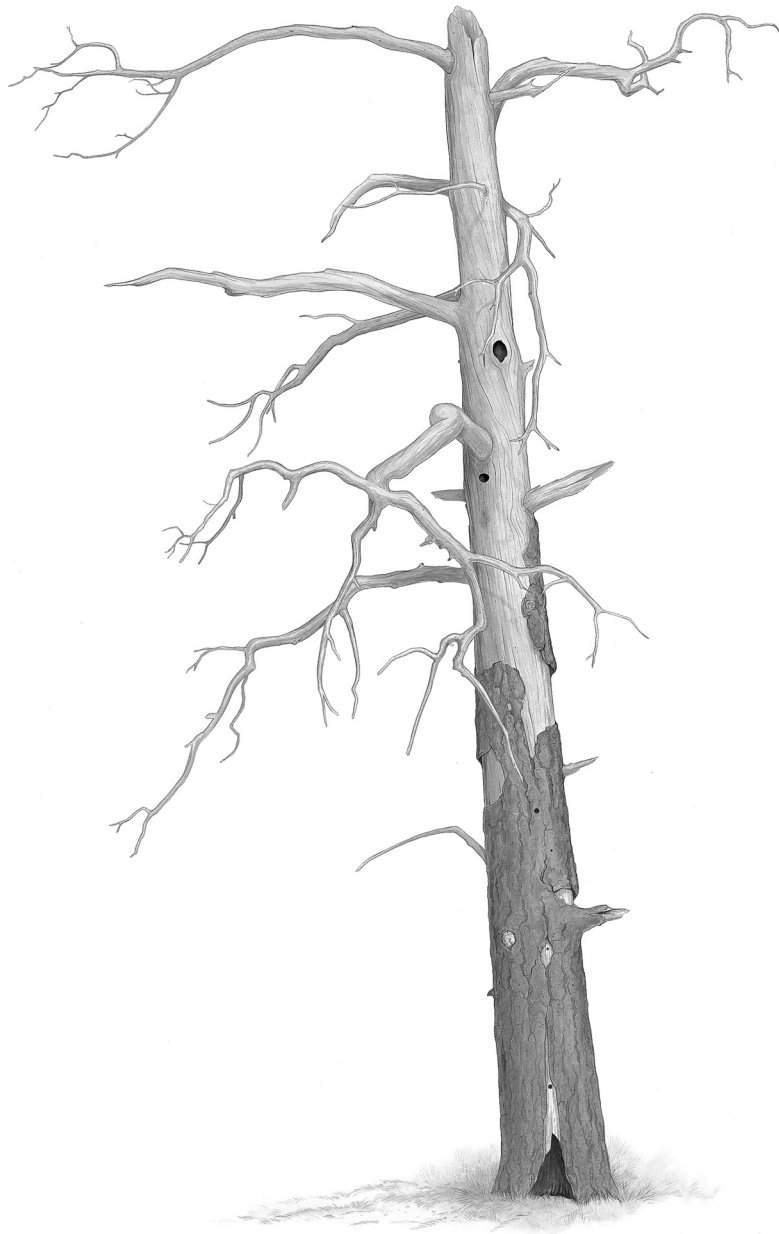
² PCE = primary cavity user

³ SCU = secondary cavity user

* This classification system does not recognize root disease trees specifically. Such trees become unstable at or before death.

WHAT CONSTITUTES GOOD WILDLIFE TREE HABITAT?

When considering the needs of wildlife it is important to recognize that all trees are not equal in value. Given the large number of wildlife tree-dependent species and wide range of wildlife uses of these trees, there can be no simple system for determining which trees provide the best habitat for wildlife. The most significant indicators of wildlife tree quality are height and diameter, decay stage, location, distribution and cause of death.



General Wildlife Tree Characteristics:

- greater than 15 m in height preferable;
- greater than 30 cm dbh preferable (interior);
- greater than 70 cm dbh preferable (coastal);
- tree classes 2 - 6 most valuable;
- windfirm, sound root system;
- broken top;
- some large branches;
- some intact bark with space behind loose bark;
- nest cavities, feeding excavations; and
- some evidence of decay (visible fungal conks or open cavity).



WHAT IS A DANGEROUS TREE?

A Dangerous Tree is defined by the Occupational Health and Safety Regulations (section 26.1) to mean a tree that is a hazard to a worker due to:

- (a) its location or lean,
- (b) its physical damage,
- (c) overhead conditions,
- (d) deterioration of its limbs, stem or root system, or
- (e) any combination of the conditions in (a) to (d) above.

For most silviculture activities, the dangerous tree will be a tree that has become severely decadent or one that is recently disturbed by wind or other disturbance.

Consider the following simple equation that illustrates the relationship between risk, tree hazard or condition, and exposure (i.e. work activity or location). The procedures for determining whether a tree is dangerous to workers and the appropriate steps and safety procedures for mitigating the hazard are described in the following sections.

$$\text{RISK} = \text{HAZARD} \times \text{EXPOSURE}$$

DETERMINING TREE DANGER RATING

There are four steps required to complete the task of tree danger rating:

Step 1 Conduct site assessment overview. Stratify your work site into areas of similar site features (e.g. block edges, low lying wet areas versus steep dry sites, clearcut areas versus tree retention areas, deciduous versus coniferous stand types, etc.). Look for site factors that suggest tree decline or potential for tree failure. Refer to Table 1.

Determine level of ground or tree disturbance and type of work activity.

Step 2 Conduct tree inspections. Assess the various strata, looking for trees with visual hazard indicators.

Step 3 Make the appropriate safety decision (either Safe or Dangerous), and implement necessary actions.

Step 4 Provide documentation of assessed trees and assessed areas (includes date, location, level of disturbance, site safety constraints, marking procedures and how dangerous trees have been managed).

In this course the Qualified Person (QP) is trained how to identify and inspect trees with hazardous defects for Low and Very Low Levels of Disturbance. The process for dangerous tree identification and management begins with having an understanding of the management objectives for a treatment area. The QP must then evaluate the site factors and tree defects that will create hazards for the treatment practices. These site factors include weather patterns, soil depth, tree health indicators, time since disturbance (e.g., harvest, insect outbreak or wildfire) and timing of the treatments.

Very low risk (VLR) activities

Some activities result in negligible levels of ground or tree disturbance, and have low exposure time to potential tree hazards. Consequently the risk of injury due to tree hazards is very low. For the most part these are field reconnaissance activities that involve foot travel and survey or layout work, or travel on roads and trails with light vehicles (pickups, ATVs) to work areas. Very low risk activities include:

- forest surveys;
- stand reconnaissance;
- tree marking;
- road and cutblock engineering and layout;
- general light vehicle travel (pickups, ATVs); and
- foot travel (walking, hiking, horseback riding).

For these situations, workers should be instructed to keep a “heads-up” awareness of their surroundings and stay away from any obvious overhead tree hazards (e.g., insecurely lodged trees; hanging tops or limbs), and observe standard operating procedures for weather-related work shutdown (e.g., wind speed, fog, snow, rainfall).

NO pre-work site inspection is required for the Very Low Risk activities listed above.

Step 1: Conduct a Site Assessment Overview

Prior to going out to the field, review all available information relevant to the site (e.g., recent air photos, forest cover and terrain maps, silviculture prescriptions, site plans, etc.). Review the management objectives for the site. It is imperative that all dangerous tree strategies are compatible with the management strategies for the site.

The site/stand factors shown in table 1 should be reviewed during a walkthrough of the site and prior to individual tree inspection. The site overview provides a context for inspection of individual trees (i.e. it will identify overall site problems such as steep slopes, high fire intensity, root rot, or high wind throw susceptibility). This process also enables you to stratify the work site into areas having similar treatment (e.g., full plant versus fill-plant, or site preparation versus no site preparation) or stand issues (e.g., areas of high intensity fire versus low intensity fire, or dry areas versus wet areas). Assessors must also integrate knowledge gained by reviewing trees that recently failed.

Information about the site/stand indicators found in the site overview can provide useful clues as to the condition and potential danger of individual trees. This is a crucial part of the assessor's review of a worksite and will be important in developing a solid site safety plan.

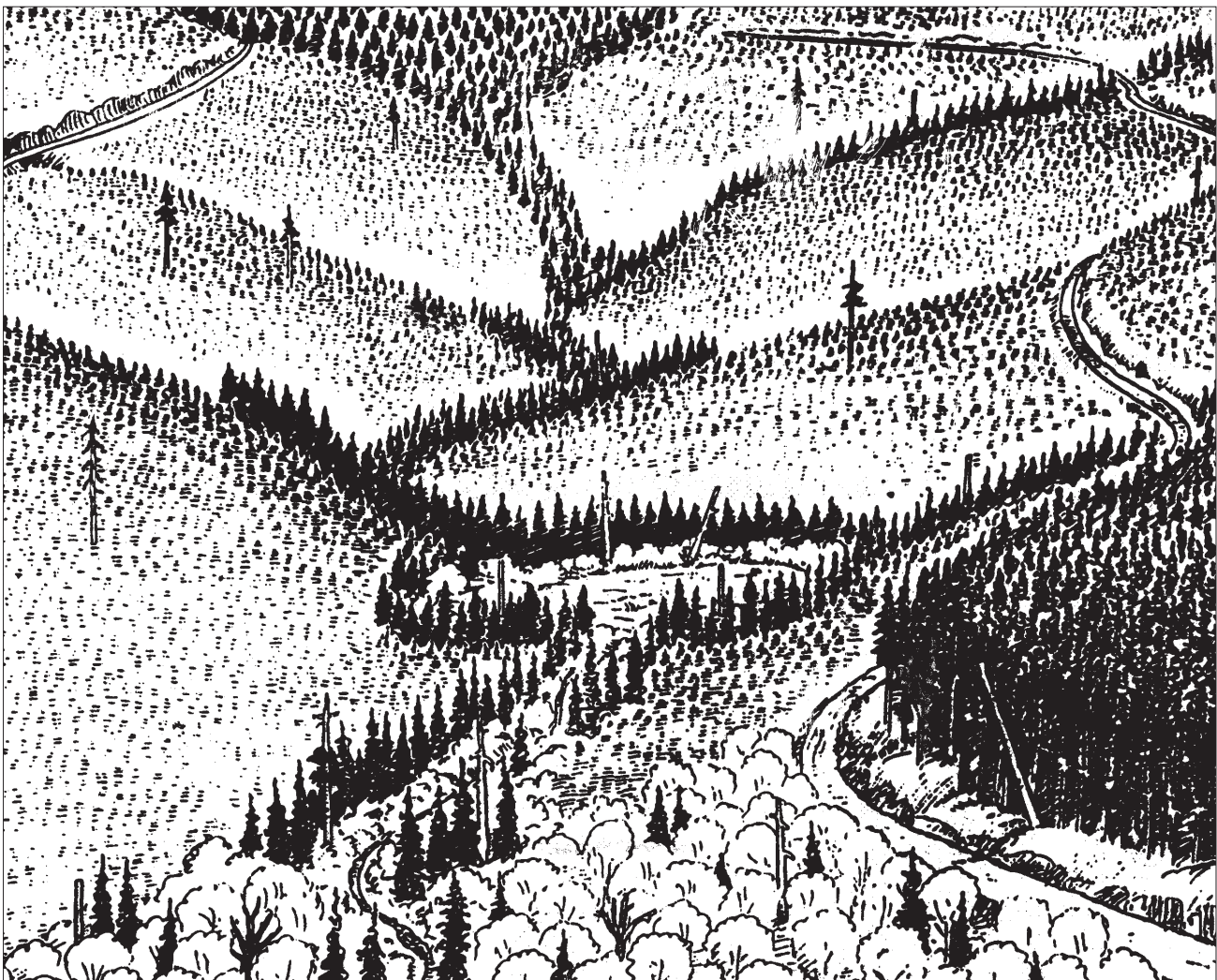


Table 1. Site Assessment Overview (for all tree species)

Site/Stand Factors	Hazard Indicators/Influences
Stand history and condition	<ul style="list-style-type: none"> • evidence of past tree failure • disturbance history (natural or human-caused, including wildfire damage; age, condition and location of mechanically harvested “stubs”) • general age, condition and density • tree species composition • evidence of root and/or stem diseases
Common rain, snow and ice conditions	<ul style="list-style-type: none"> • high snow or ice loading • high rain fall periods
Flooding	<ul style="list-style-type: none"> • high water table • evidence of water damaged/decayed roots • area prone to flooding
Windthrow potential	<ul style="list-style-type: none"> • topography • prevailing winds • evidence of significant windthrow • area of high or recent exposure • stems with height/diameter ratio >100 (i.e., very tall, slender stems) • saturated soils • shallow soils • restricted rooting depth • fine textured soils
Crown condition	<ul style="list-style-type: none"> • stress cone crop • thinning foliage • chlorosis • rounded crown • small live crown (<20% of tree height)
Resinosis	<ul style="list-style-type: none"> • higher than normal stem or basal pitch flow
Tree lean	<ul style="list-style-type: none"> • trees recently leaning due to windstorm, root damage, shifting root mat or other causes
Additional site-specific factors	<ul style="list-style-type: none"> • based on local knowledge (e.g., soil or slope instability)

Step 1 continued: Determine the level of ground or tree disturbance

Various work activities are associated with differing levels of disturbance (LOD). Table 2 shows the levels of disturbance for various forestry activities. Activities rated as low disturbance create minimal ground or tree disturbance and as a result, expose workers to very little danger. However, as the level of disturbance increases so does the potential danger of a tree defect failing as a result of disturbance activities. For the purposes of this training, a QP will only conduct tree assessments for activities rated as Very Low to LOD-1. If activities higher than LOD-1 are planned on the site, or activities will be undertaken during high wind speeds (i.e., >40 km/h) then a certified wildlife/dangerous tree (WDT) assessor must perform the tree assessments as a pre-work component of site safety planning.

Table 2. Levels of disturbance for unprotected workers in various work activities

Wind Speed Equivalency (km/h)	Level of Disturbance*	Example Types of Work Activities
<40	1	<ul style="list-style-type: none"> • tree planting • brushing • tree pruning (stems <20 cm dbh) • use of light-duty machinery (e.g., weed whips, brush saws) • road travel with heavy vehicles (>5500 kg GVWR) on ballasted and compacted roads • fire control with hand tools and/or water hoses
	2	<ul style="list-style-type: none"> • road travel with heavy vehicles (>5500 kg GVWR) on non-ballasted, non-compacted roads • maintenance or construction activities without heavy equipment (e.g., small machines such as “bobcats”) • tree pruning (stems >20 cm dbh) • juvenile spacing or slashing (stems <15 cm dbh) • tree bucking
40 – 65	3	<ul style="list-style-type: none"> • tree falling (any tree >15 cm dbh) • cable yarding • ground skidding • mechanical harvesting and forwarding • helicopter logging (lift <2200 kg) with workers exposed to rotor wash • use of light and intermediate helicopters where workers are exposed to rotor wash (e.g., helipads) • mechanical site preparation with heavy machinery • maintenance or construction activities with heavy equipment
+65	4	<ul style="list-style-type: none"> • trees adjacent to corridors in partial-cut cable logging operations • harvesting operations in structurally damaged stands (e.g., wildfire burns) • blasting • helicopter logging (lift >2200 kg) with workers exposed to rotor wash • use of medium and heavy helicopters where workers are exposed to rotor wash

* A dangerous tree assessment is only valid for the lowest level of disturbance at which the assessment has been done.

Table 2A is used to determine the equivalent Level of Disturbance associated for the Wind Speeds expected during the implementation of forestry activities – also known as the Wind Speed Equivalency. Inspections of trees for LOD-1 activities are applicable only when the forestry activities are performed during light winds, typically <40 km/hour. If activities are planned when wind speeds may exceed this limit, then “bump-up” the LOD rating to reflect the wind speeds expected during implementation. For example, where constant winds or frequent gusts (as opposed to infrequent gusts) will reach 40 - 65 km/h during the work activity then tree defects must be evaluated for LOD-3 by a certified WDT Assessor.

Therefore, in order to work under higher wind conditions, either stop work or reassess the potentially dangerous trees to an appropriate higher level of disturbance (e.g., LOD 3 for the 40-65 km/h wind speed equivalency).

Table 2A. Influence of wind speed on level of disturbance

Wind Speed (km/h)	Description	Level of Disturbance Equivalency
0 – 40	0-20 km/h: light breeze (dust and loose paper raised; small branches move) to 20- 40 km/h: fresh breeze (small trees sway; tops of large trees sway)	1 – 2
40 – 65	strong breeze (small branches fly in the air; whole tree in motion; resistance felt when walking against wind)	3
65+	gale (branches broken off trees; walking impeded)	4

Step 2: Visual Tree Inspection

The determination of tree safety/danger is generally a visual process. Only trees that are considered to be “suspect” or potentially dangerous after conducting “the site assessment overview” need a visual tree inspection. Where visual inspection identifies questionable root stability, the tree would usually be rated as “high defect failure potential,” and be considered dangerous unless further probing with a hand tool indicates that the roots are sound. Careful observation of potential tree defects and hazards is required (see below for discussion).

Tree hazards

A tree can be potentially dangerous if it has defects in its top, branches, stem or root system. The degree of hazard will vary with the size of the tree, type and location of the defect, the severity of any damage, the tree species, and nature of the work activity or target.

The dangerous tree assessment process requires that the QP is able to identify tree hazards and know how to recognize, evaluate and manage the identified hazards.

Live or dead tree defects

For LOD-1 activities, tree defects can be separated into three categories: insecure trees or hang-ups, highly decadent stem defects, and recent tree lean with root defects. Table 3 provides a summary of high failure potential tree defects associated with live or dead trees. Trees with NO defects or only defects that fall below the described high failure threshold are often rated safe. However, see Step 4 for further safety procedure information.

Table 3. Danger Tree Assessment Process for Level 1 Disturbance Activities – 3 Significant Hazard Indicators

D = dangerous	<p>D if tree has one or more of the following significant tree hazards that are at risk of imminent failure:</p> <ul style="list-style-type: none"> • Insecurely lodged trees or Insecure hang-ups <ul style="list-style-type: none"> – Insecurely lodged trees (a tipped tree that is likely to shake free of the support trees and fall to the ground), – Dislodged but hung-up limbs or tops (consider size and height above ground) at risk of shifting free during light winds or other tree motion; • Highly unstable tree: i) >50% of tree cross-sectional area damaged, burned, scarred, decayed or fractured; or ii) Spongy snags with heart rot conks along the majority of the length of the stem (e.g., class 5 - 6 conifers or class 4 deciduous) or soft snags (e.g., class 7 - 8 conifers or class 5 deciduous); or iii) >50% of lateral support roots are damaged or with advanced decay; and • Recent lean towards the work area AND decayed root system (>50% of roots have advanced decay) or damaged and lifting anchoring soil layer (consider soil conditions and anchoring).
S = safe	All other trees

For LOD-1, a tree will be considered dangerous if it has any of the significant tree hazards listed in Table 3. Trees with these types of defects are easy to spot and extreme care should be taken when approaching these trees.

Insecurely lodged trees or hang-ups

A potentially dangerous situation arises when a tree is partially uprooted and it becomes lodged against another tree. A QP must look for clues about the stability of this lodged tree. Indicators that the tree is securely lodged, and therefore SAFE, include the following:

- The support tree is stable and is at least as large as the tipped tree;
- The tipped tree is lodged into the stem or bole of the supporting tree;
- The tipped tree is free of stem defects that indicate it is failing (i.e., splits or internal rot indicators such as conks or cavities); or
- The support tree has strong and healthy limbs that show signs of securely bracing the tipped tree (e.g. abrasion marks).



A similar situation of tipped trees is when tops or limbs are partially suspended in a tree. A QP must look for signs of stability and determine whether the suspended limb or top could reach the work area and if the piece is large enough to cause harm. If the support tree has a healthy crown of large limbs



the risk of the limb/top dislodging and falling to the ground is minimal. Indicators that the limb/top is secure, and therefore SAFE, include the following:

- The limb/top is partially attached to healthy wood;
- The limb/top is caught and held close to the branch collar of strong limbs;
- The limb/top does not shift during winds;
- The limb/top lacks high decay indicators (e.g. conks, sloughing parts); or
- The support tree shows no signs of shifting (e.g. cracking limbs).



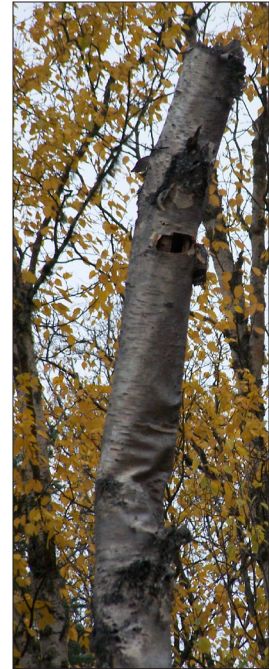
If there is any doubt that the tipped tree or suspended tops/limbs could shift free of the support tree it must be deemed dangerous!



Highly unstable tree

Invariably, this criteria can be the most difficult to evaluate for the QP. The key is unstable. A tree may be highly unstable because of significant stem damage inflicted to the tree, the tree is deteriorating with signs of advanced stages of decay, the tree has advanced stages of root decay, or a combination of the three factors. Ultimately the dangerously unstable tree will be a tree that one would consider to be at risk of imminent failure during the planned operating window for the LOD-1 activities.

Advanced root decay is considered dangerous when greater than 50% of the root diameter is decayed. For LOD-1 activities, rooting is considered dangerously compromised when greater than half of the major anchoring roots have advanced decay or are damaged (e.g. chopped or torn, or lifted out of the ground).



Stem damage

A tree is considered dangerously unstable when there is a wound to the stem that has removed or compromises >50% of the cross-sectional area of the stem. This situation becomes most precarious when the affected stem is a full height tree with a crown that is exposed to winds. A similarly high-risk tree is where a shallow stem wound exposes advanced stages of internal decay. In this situation, if there is >50% of the tree's cross-sectional area decayed, then the tree is at risk of failure and is considered dangerously unstable.

Advanced stage of decay

Conifer tree classes 5 - 8 or deciduous tree classes 4 - 5 represent trees that have spongy to soft stems. With increasing time since death the decay processes will have weakened the stems to increasing degrees. Therefore, visual indicators that internal decay has compromised the stability of the stem will often be the

appearance of heart rot conks spread along the entire stem of the tree. For small diameter trees or top sections of trees (<30 cm DBH) having saprot fungi spread along the entire length of the stem is also an indicator of instability. A further high-risk indicator is the combined presence of heart rot conks and renewed foraging by primary cavity nesters (woodpeckers). The foraging further exposes internal wood to moisture and oxygen, thereby accelerating the rate of decay and weakening the stem.



Recent lean and root decay

Trees that exhibit recent lean are suspect. The QP must review such trees to determine the cause of the lean. If the tree shows signs of advanced root decay affecting >50% of the major support roots, then the tree is at high risk of failure. A tree's root strength is considered compromised if >50% of the root diameter is damaged or decayed. Therefore, if more than half of the tree's roots are compromised the tree is considered dangerously unstable.

A further situation that exists is where a tree's major anchoring roots have been damaged (e.g. by fire, flooding, mechanical or erosion) and there are visual indicators that the root plate is lifting out of the ground. If >50% of the root plate has lifted up and out of the ground then the tree should be considered dangerously unstable.



Recent windthrow causing root tearing and lift



Root damage by erosion affecting >50% of support roots

Signs of root damage may include a tear in the duff layer in an arc some distance out from the stem of the tree, or by the forest floor separating from the bole of the stem. These are indicators that the tree has shifted, but unless these are associated with other compromising indicators (root rot, high water table, exposure to strong winds) and recent lean, the tree is not at high risk of failure for LOD-1.



Fire damage affecting root stability



Rooting compromised by root disease (Armillaria)

When to Conduct Visual Tree Inspections

Visual tree inspections will initially be done prior to the project start-up. This early site review and dangerous tree detection will provide time to develop a site safety plan and to implement dangerous tree mitigation strategies prior to workers arriving on the site. Generally, the QP will need to perform dangerous tree detection and inspection:

- At the time of the initial on-the-ground field assessment;
- Prior to any workers entering the area to commence treatments;
- If an intervening winter has passed since the previous assessment;
- If a severe weather or disturbance event has caused widespread tree failures;
- If work activity in the area will create more disturbance than what the area was originally assessed for; and
- When trees within or adjacent to the work area appear visually “suspect” (i.e., they are damaged or potentially dangerous).

The QP must refer any questionable issues to a certified and qualified WDT Assessor if there is a desire to retain the tree(s) in question outside of a NWZ. Where visual inspection identifies questionable root stability or shell thickness and where the results of the visual inspection are inconclusive, the WDT Assessor can perform a detailed assessment involving root probing and/or stem sampling. In the absence of assessment by a WDT Assessor the suspect tree(s) will be defaulted as Dangerous and the appropriate mitigation strategies taken prior to work resuming.

The QP must view trees from different vantages to reduce the possibility of missing defects obscured by poor lighting, vegetation or other obstacles. To properly evaluate defects high in the canopy of trees, persons should use binoculars. Remember that weather conditions may also impair one’s ability to detect and evaluate defects.

High Stem Density Sites

The assessment of stands with high stem densities of dead or damaged trees per hectare (i.e. greater than 500 suspect stems per hectare) requires a high level of care, expertise and forward planning to integrate site factors with the tree assessment process. Therefore, site safety planning for high stem density situations (e.g., Mountain pine beetle or wildfire impacted stands) requires the training and expertise of a certified and qualified WDT assessor. Although the QP might assist the WDT Assessor in identifying suspect trees that require assessment, the QP is restricted to the search for, and inspection of, trees with significant hazard indicators.

STEP 3: Make the appropriate safety decision

Review the site assessment overview and tree inspection results. If there are a lot of suspect borderline trees at risk of wind induced tree failures, it is advisable to lower the acceptable wind speed threshold from 40 km/hour to perhaps 20 km/hr. The Beaufort scale of wind speeds (Table 1A) describes the wind speeds that workers can use to determine if winds exceed safe operating conditions.

After the initial visual inspection (checking for hazards/defects and site conditions such as lifting root mats) and, if needed, after consultations with a WDT Assessor, a safety procedure can be prescribed for a tree or trees. If a tree has a moderate to high wildlife tree habitat value consider removal of the hazardous part or installation of a no work zone versus the removal of the entire tree.

Safety Procedures (for “suspect” trees that have been inspected)

The QP must be sufficiently experienced and/or trained to be able to recognize and ensure workers avoid exposure to the above significant hazard indicators. Crews should be instructed to keep a “heads-up” for any of the 3 significant hazards and to stay away (generally greater than 1.5 defect lengths) from any trees showing these hazards. Regardless, any trees that the qualified person determines or suspects to be dangerous must be dealt with **BEFORE** any workers enter that area.

On the dangerous tree assessment field data card, select the safety procedure that you recommend be applied to the tree(s). It is your duty to prescribe the appropriate safety procedure based upon your tree and site assessment. Treatment or implementation is the responsibility of the management team. The following options are recommended.

For trees rated as **Safe (S)**, consider the following procedures:

- record tree as S: tree is safe for activities and exposure, retain tree – no removal or modification necessary (may affix a tag, paint or flagging as appropriate – but do not paint an “S”); and
- record tree as M: monitor the tree with low-risk defects (useful for a high value wildlife tree when there is concern about future tree failure and there is ongoing target exposure).

For trees rated as **Dangerous (D)**, consider the following procedures:

- dangerous; tree risk is high, fall tree;
- dangerous; remove the dangerous part(s) of the tree;
- dangerous; install a flagged no work zone of appropriate size and shape around the tree(s) and instruct workers to stay out of this area (generally 1.5 defect lengths in size);
- identify tree as Dangerous (may affix tag, paint or flagging if marking is required for work activity or site); and
- map the location of no work zones and trees recorded as Dangerous where treatment is planned to mitigate the hazard.



NOTE: Work crews must also observe wind speed conditions. After winds exceed 40 km/h, crews cannot be near any trees which might be suspect unless they have first been rated as safe by a certified danger tree assessor for the equivalent wind speed rating.

A tree can be declared as dangerous after the visual inspection.
The presence of one or more significant hazard indicators will result
in the tree receiving a dangerous (D) rating.

No Work Zones (NWZ)

A NWZ is a flagged area where no person shall enter except to remove specific tree hazards. The NWZ must be large enough to protect workers. This zone must include all the area on the ground that could be reached by any dislodged portion of the tree, were it to fail. The following guidelines apply to the use of NWZ:

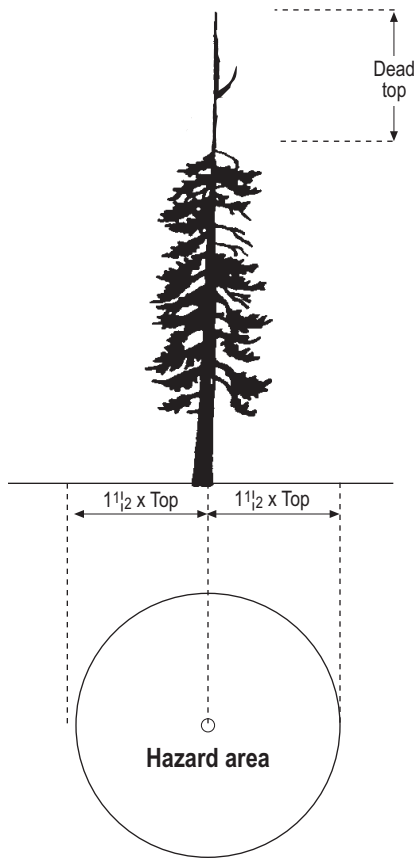
- NWZ will take into account the nature of the hazard and the lean of the tree.
- On steep ground, the NWZ will be extended downhill to protect workers.
- NWZ can be adjusted in size depending on the size of surrounding live timber (e.g., a small danger tree surrounded by much larger trees that “shield” the adjacent area have a NWZ radius less than 1.5 defect lengths).
- A kick-back area should be included for semicircular hazard zones. The size and shape of this area is determined by tree lean, condition and form (branching).

The most common types of NWZ are illustrated on the following pages.

A. Sound tree, no lean, hazardous top, flat ground

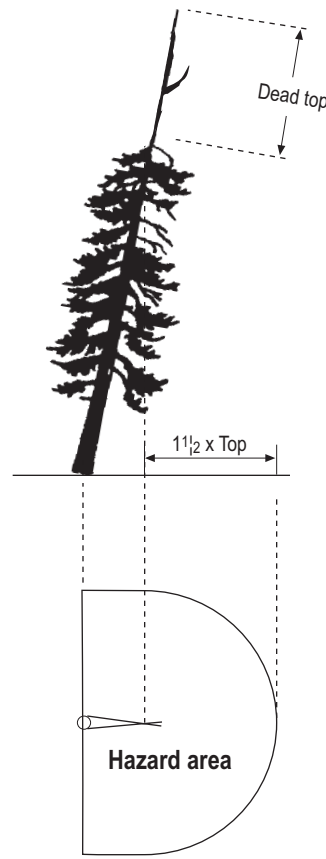
1. Determine the length of top that might dislodge.
2. Add $\frac{1}{2}$ of this length, to get a $1\frac{1}{2}$ top length distance.

This distance is the radius of the no-work zone.



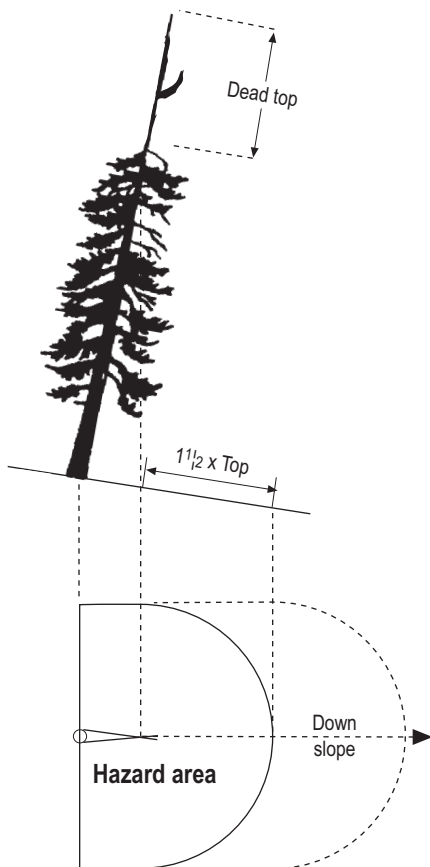
B. Sound tree with lean, hazardous top, flat ground

1. Determine the length of top that might dislodge.
2. Add $\frac{1}{2}$ of this length, to get a $1\frac{1}{2}$ top length distance.
3. Determine from the lean how far from the base of the tree the top might land.



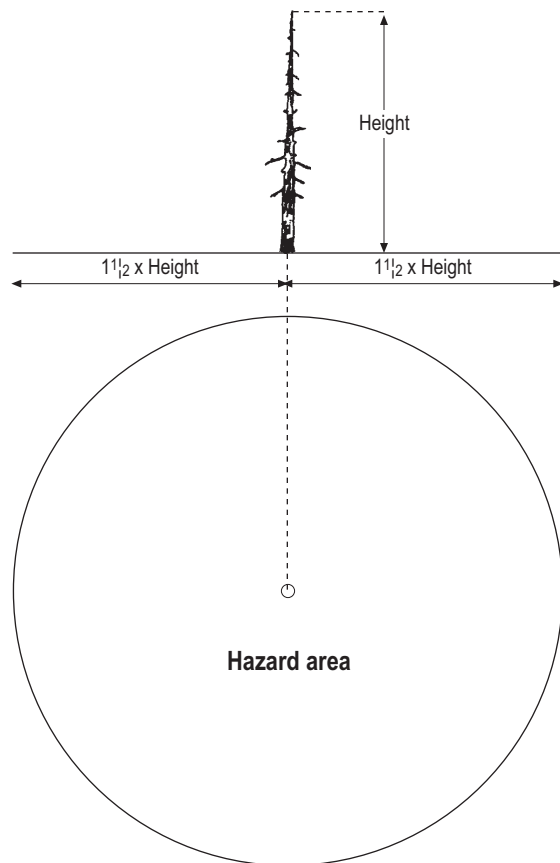
C. Sound tree with lean, hazardous top, on slope

1. Determine the length of top that might dislodge.
2. Add $\frac{1}{2}$ of this length, to get a $1\frac{1}{2}$ top length distance (horizontal distance from tree).
3. From the lean, determine how far from the base of the tree the top might land.
4. On slopes $>30\%$, extend the no-work zone downslope. This distance must be determined on a site-specific basis.



D. Unsound or hazardous tree, no lean, flat ground

1. Measure the height of the tree.
2. The no-work zone is a circle around the tree, with a radius of up to $1\frac{1}{2}$ times the height.

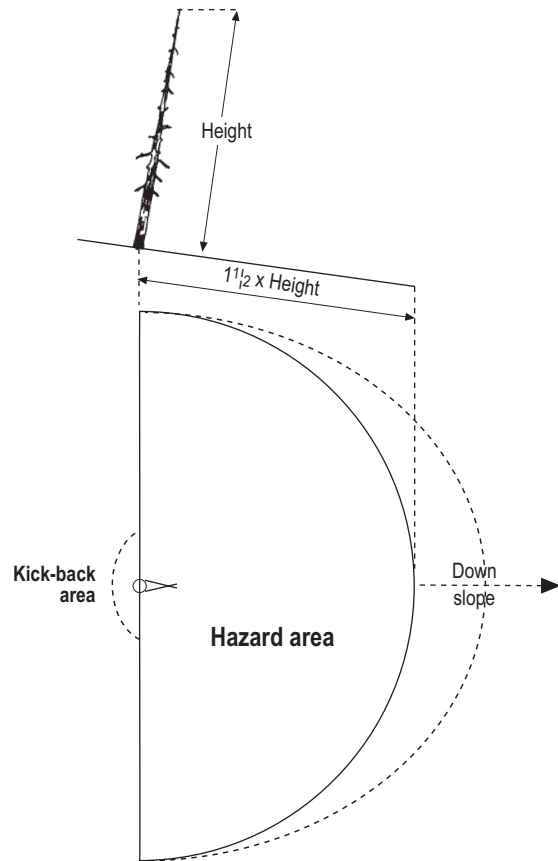
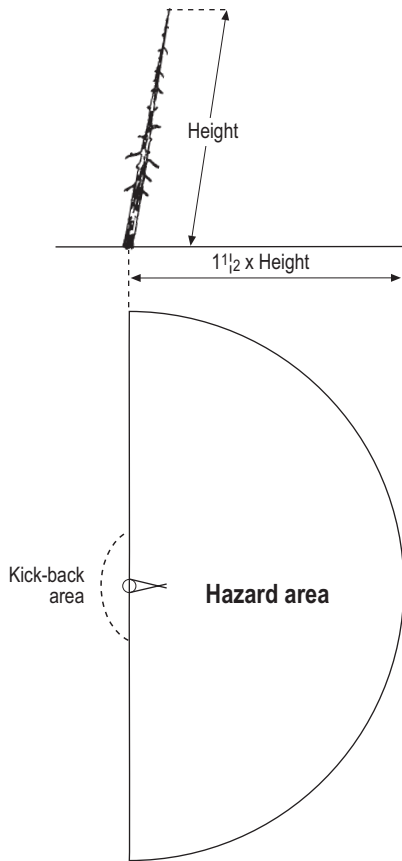


E. Unsound or hazardous tree, with lean, flat ground

1. Measure the height of the tree.
2. Add $\frac{1}{2}$ of this length to get a $1\frac{1}{2}$ tree length no-work zone.

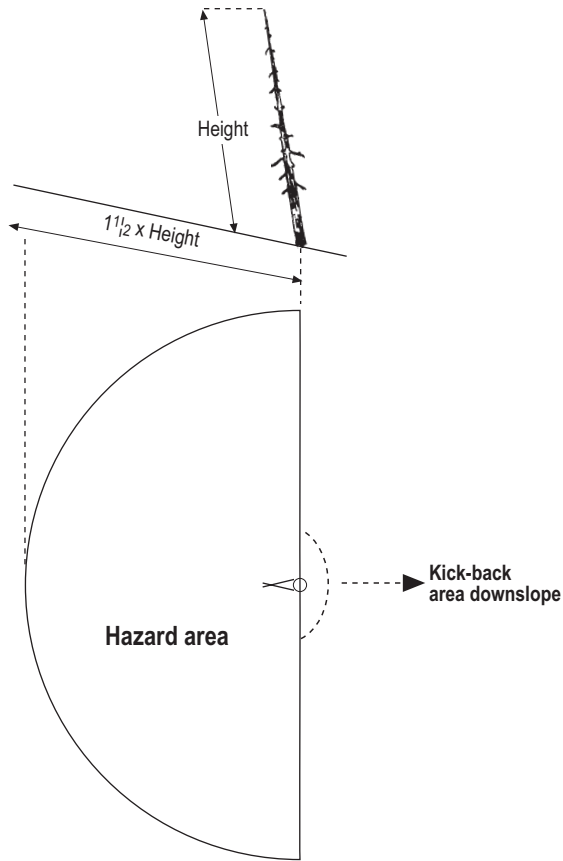
F. Unsound or hazardous tree, with lean, on slope

1. Measure the height of the tree.
2. The no-work zone is a half-circle extending up to 90° on each side of the lean, with a radius of $1\frac{1}{2}$ times the height of the tree.
3. On slopes $>30\%$, extend the no-work zone downslope. This distance must be determined on a site-specific basis.
4. Trees on a $>30\%$ slope need to be carefully assessed for their wildlife tree value, as the no-work zone will take up a large part of the treatment area.



G. Unsound or hazardous tree, uphill lean

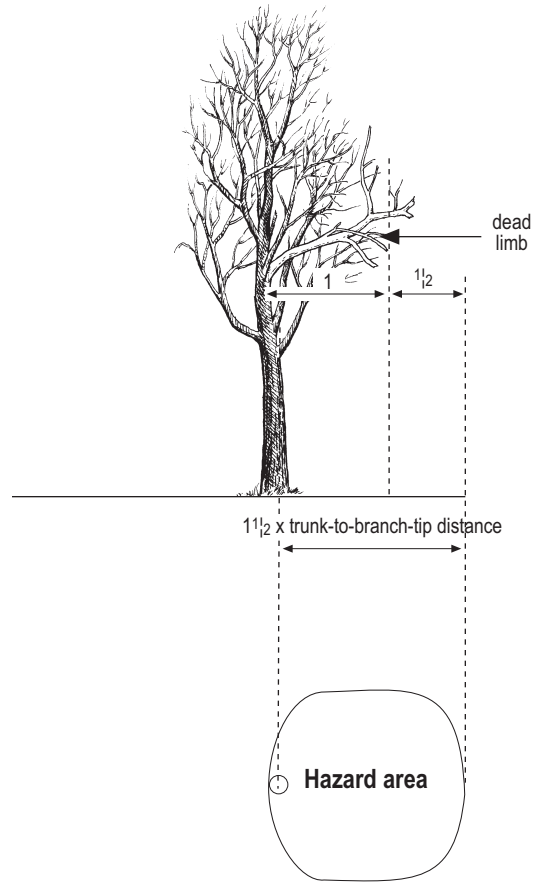
1. Where the tree slopes uphill, the no-work zone should be $1\frac{1}{2}$ times the tree height going upslope.
2. Where the tree slopes uphill, depending on the slope of the hill, a kick back area will be added on a site-specific basis.



H. Deciduous, sound tree, no lean, defective branches

1. Determine the length of defective limbs that might dislodge.
2. Add $\frac{1}{2}$ of this length to get a $1\frac{1}{2}$ limb length distance.

The $1\frac{1}{2}$ limb length distance must be calculated for all defective limbs on the tree

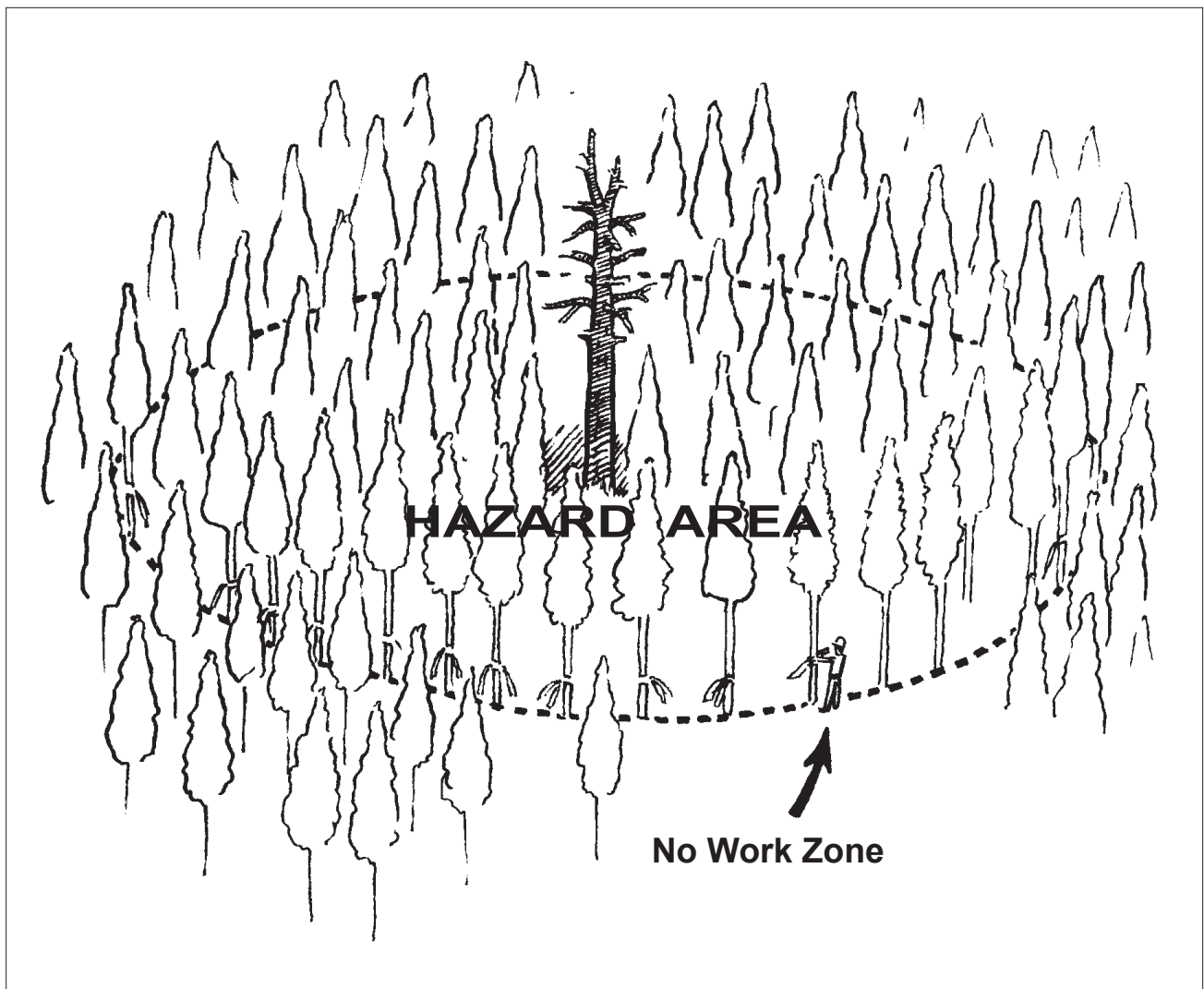


Flagging the NWZ

Mark the NWZ with a Hi-Viz colour flagging that is unique from all other flagging used on the site. The flagging must be easily identifiable and the colour communicated to ALL workers to indicate a NWZ.

Once the size of the hazard area has been determined by the QP, the NWZ should be flagged at sufficient intervals so that the workers will always be able to see the NWZ boundary from any position along its perimeter. No person is allowed to enter this zone EXCEPT to remove a specific tree hazard (i.e., only a qualified danger tree faller enters the NWZ to remove a dangerous tree adjacent to the work area).

Example of establishing a NWZ around a high value wildlife tree.



STEP 4: Provide documentation and communicate safety procedures

As part of fulfilling your duty of care, it is extremely important that a well documented, thought-out plan, process and decision are followed in the implementation of any dangerous tree mitigation program.

Once operational procedures and activities are in place to fulfill management policy and regulations, and these have been translated into a site safety plan, then those operational activities must be documented and meet accepted standards of care. The Site Assessment Overview Summary card is used to document site information used to develop a site safety plan for each treatment area (see Appendix 1), while the Dangerous Tree Field Data card can be used to record tree information (see Appendix 2).

The minimum documentation must include:

- Name of the Qualified Person(s) and/or WDT Assessor(s) who assessed trees and developed the site safety plan;
- Date and location of field assessments;
- Level of disturbance;
- Windspeed limits and other weather constraints;
- Marking procedures (i.e., flagging or paint colors, tags) used for assessed trees, assessed areas and NWZ;
- Locations of assessed trees and assessment areas;
- Locations of NWZ; and
- Use field cards, to provide documentation on individual tree assessments.

Timing to Implement Operational Procedures

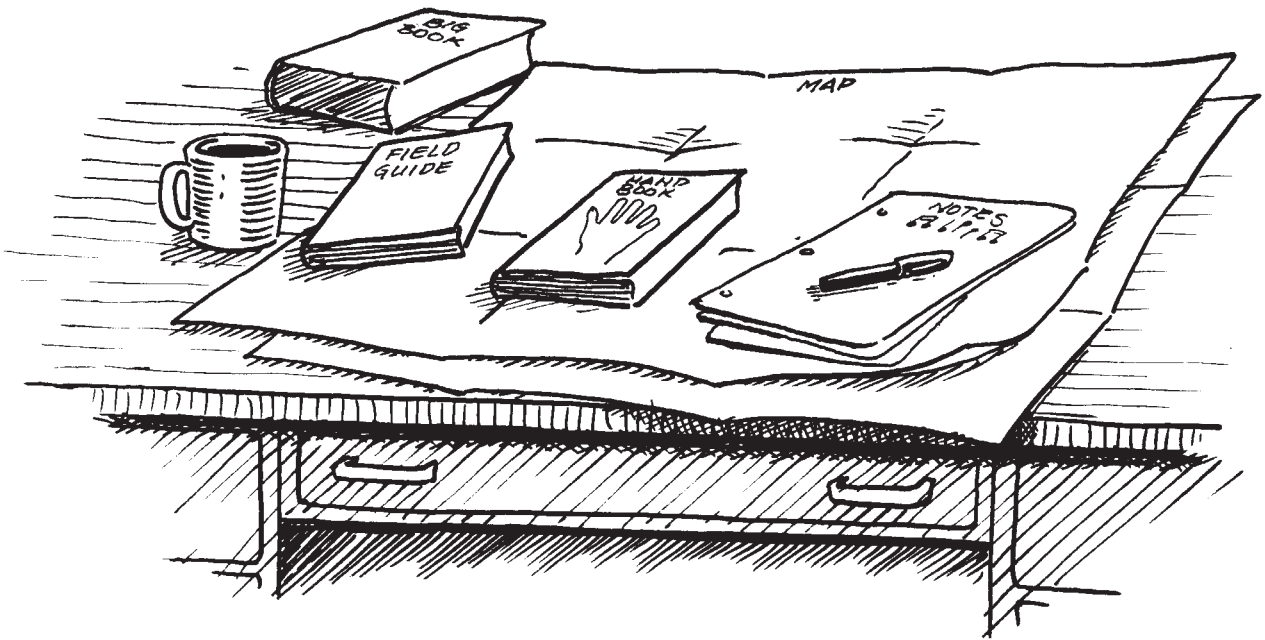
Follow-up as soon as possible on any treatment recommendations for identified dangerous trees or dangerous site issues (e.g., fell tree or remove hazardous parts). If dangerous trees cannot be removed in a safe manner then establish a NWZ prior to workers arriving on-site.

As part of due diligence, it is important to document the dates that mitigation plans were completed. It is also prudent to review the site following treatment to ensure no further hazards were created as a consequence of the treatments, and that all NWZ areas are still intact.

Reassessment of Trees

Trees assessed and recorded as SAFE must be reassessed if, prior to the work activity commencing, an intervening winter or major disturbance event has occurred, or if the level of disturbance has changed from the original assessment (e.g., LOD-1 planting becomes a LOD-3 for a heavy equipment site preparation treatment). If a reassessment for an LOD-1 activity is required, the QP will look for signs of disturbance to trees previously assessed and to visit new trees that exhibit any of the significant hazard indicators. This reassessment must be completed prior to allowing workers to return to the site. If the level of disturbance is upgraded above LOD-1 then a Certified DT Assessor must perform the site and tree reassessments.

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GLOSSARY

For the purposes of this text, the following terms and definitions will be used:

- biogeoclimatic subzone** A representative class of ecosystem under the influence of the same regional climate. It is associated with a distinct climax (or near-climax) group of plants. For example, the Sub-Boreal Spruce Moist Cool (SBSmk) subzone is characterized by a hybrid spruce-huckleberry-highbush cranberry plant association.
- biological diversity** The diversity of plants, animals and other living organisms in all their forms and levels of organization, including genes, species, ecosystems, and the evolutionary and functional processes that link them.
- blind conk** Sometimes called swollen knots; are significant indicators of decay. They typically appear as pronounced swellings around knots, and are the result of the tree attempting to heal over an old conk. Often the affected knot and new conk is partially covered by sound wood, which is implied by the term “blind” conk.
- canker** Dead portion of the cambium and bark on a branch or the main stem. Cankers can be raised or sunken and are sometimes surrounded by a raised lip of tissue.
- certified danger tree assessor** Someone who has passed one or more of the Wildlife/ Danger Tree Assessor’s course modules sponsored by the Wildlife Tree Committee of B.C., and who holds a valid certificate which signifies this designation. Certification is valid for four years.
- chlorotic** Yellowing of normally green foliage tissue due to lack of chlorophyll. Usually indicates poor growing conditions or some sort of tree stress (e.g., root disease).
- coarse woody debris (CWD)** Fallen trees or logs, and parts of trees on the forest floor at least 7.5 cm in diameter. CWD provides habitat for various small mammals, salamanders and numerous invertebrates. As it decays, it provides nutrients back to the forest soil.
- conk** The fruiting body of a wood decay fungus; bracket-like or reclined or flat on the host or ground, but not a mushroom. Usually woody or leathery in texture.
- dangerous tree** Means a tree that is a hazard to a worker due to (a) its location or lean, (b) its physical damage, (c) overhead conditions, (d) deterioration of its limbs, stem or root system, or (e) any combination of the conditions in paragraphs (a) to (d).
- dominant trees** The tallest trees of the main forest canopy layer.
- embedded bark** Bark that is pushed inside a developing branch or stem crotch, usually causing visible cracking and a weakened structure.
- forest activity** Any activity that requires workers to be in the field where they may be in the vicinity of living or dead trees.
- habitat** A specific kind of living space or environment that provides at least minimal conditions for one organism to live, or for a group to appear together.

- hazardous top:** A suspect or defective top section (live or dead) of a tree that may be hazardous because of visible structural weakness, especially if there is evidence of decay or cracking. The defect length is defined by the point of visible stem deformation (stem swelling or goiter, spike, multi-tops or candelabra, fork, kink or other such deformity) or stem damage that makes the top prone to failure.
- live cull** A live tree with some visible external defect such as a broken, dead, or forked top, split or scarred trunk, or fungal conks.
- live tree** A living, growing tree with good vigour, no structural problems, and no visible signs of disease or decay.
- no-work zone (NWZ)** A flagged area where no worker shall enter except to remove hazards. Workers will be informed about no-work zones prior to commencement of work on site. The size of NWZs is 1.5 times the defect length. This length can be modified (larger or smaller) depending on site-specific conditions.
- old growth** A forest that contains live and dead trees of various sizes, species composition, and age class structure that are part of a slowly changing but dynamic ecosystem. The age at which forests develop the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site characteristics and disturbance regime. Old growth is typically distinguished from younger stands by several of the following attributes: large trees for species and site; wide variation in tree sizes and spacing; accumulations of large, dead standing and fallen trees; multiple canopy layers; canopy gaps and understory patchiness; decadence in the form of broken or deformed tops or boles; and root decay.
- pathogen** A living organism that incites disease in a host.
- qualified person (QP)** A person experienced in the specified work activity and who, by reason of education, training, experience or a combination thereof, is able to recognize and evaluate hazards associated with trees, with due regard for the anticipated work activity and possible disturbance of the tree(s).
- raptor** A bird of prey such as an eagle, hawk, falcon or owl.
- recruitment** Wildlife tree management strategy of retaining standing live or dead trees that will become future wildlife trees.
- reserve** The retention of a various number of unharvested (reserved) trees, distributed either uniformly or in groups for purposes other than regeneration. Some of these purposes include wildlife habitat, biological diversity, and aesthetics. Reserves can be used with any silvicultural system. For purposes of wildlife tree management, a reserve can range in size from a single, outstanding wildlife tree, to a patch containing many wildlife trees on several hectares.
- resinosis** An abnormal flow of resin or pitch from conifers, often from the base or lower stem. Resinosis can indicate the presence of tree pathogens or damage.

- riparian area** The land bordering a river, stream, lake, reservoir, pond, wetland or spring. Riparian areas typically exemplify a rich and diverse vegetative mosaic reflecting the influence of available surface water.
- riparian management zone (RMZ)** That area located adjacent to a stream, wetland or lake of a width determined in accordance with the Riparian Management Guidebook.
- rust** A disease caused by infection with one of the rust fungi, often producing yellow to orange spores at some point during the infection.
- saprot fungi** A general group of fungal organisms which decay in the outer sapwood layer of trees. Saprots tend to be more commonly found on dead trees. Because of their shallow depth of penetration (2 cm – 5 cm is usual), they generally only contribute to tree structural failure on small diameter dead trees (e.g., <30 cm dbh).
- scaffold branching** Multiple stem and branch attachments characteristic of some deciduous trees. They consist of a system of co-dominant branches and lack a central leader.
- secondary top** A growth leader on a tree which usually forms after the breakage or die-back of the original tree top. Secondary tops (live or dead) can occur as single leaders, forks or multiple tops. They may be hazardous, especially if there is **evidence of decay or cracking at the point of the original top breakage or stem deformity**.
- seral stage** One of a chain of successional ecological stages leading to a climax plant community. For example, an early seral stage could be a grassy meadow or clearcut new stand with fire origin, a mid-seral stage could be a mixed hardwood/conifer forest, and a late seral stage could be a mature or old-growth forest.
- silviculture prescription (SP)** A planning system for collecting site-specific field data and developing forest management prescriptions before harvesting is allowed to take place.
- silvicultural system** A cycle of activities by which a forest stand, or group of trees, is harvested, regenerated and tended over time. These activities include harvesting, site preparation, reforestation and stand tending.
- sloughing** Starting to separate and eventually falling or breaking away from the tree trunk.
- spike top** The pointed dead tip of a living tree from which most of the needles and branches have fallen off. The length of this “spike-shaped” dead tip is variable and can sometimes be up to 1/3 or more of the tree height for species such as cedars. This top dieback may be caused by insects, disease, or climatic factors.
- stand level** The level of forest management at which a relatively homogeneous land unit can be managed under a single prescription, or a set of treatments, to meet well-defined objectives.
- stand-level structure** Components of a forest stand (including living and dead attributes, standing trees, canopy architecture and fallen dead trees) which together determine stand structure.

- stand management prescription** A document to describe activities to be carried out on a free-growing site to ensure the activities are planned and implemented to maintain or enhance inherent productivity of the site; to ensure resource values including biological diversity are identified and accommodated; and to set out a series of stand management activities capable of meeting the stated management objectives.
- stratification** Dividing or organizing an area, such as a cutblock, into distinct units based on site-specific factors such as treatment objectives, vegetation type or physiography.
- structurally damaged stand** A stand of trees which has been severely and extensively damaged, to the extent that a qualified person decides there is an undue risk of tree failure in the stand or site.
- stub** An artificially-created wildlife tree, mechanically cut from a class 1, 2 or 3 tree.
- suppression** Reduced tree growth and vigor due to excessive competition for light, moisture and nutrients.
- suspect tree** Suspect trees are any live or dead tree with a visible defect which could cause failure of the tree, either whole or in part, for the applicable level of disturbance. Suspect trees require a visual inspection as well as a site assessment by a qualified person or a certified danger tree assessor, in order to determine whether they are dangerous for a particular level of disturbance/type of work activity.
- uneven-aged management** A silvicultural system designed to create, maintain and regenerate an uneven-aged stand structure (a stand of trees consisting of three or more age classes). Single tree and group are uneven-aged silvicultural systems.
- veteran tree** A tree which is significantly older (usually 150 years of age or greater) than the trees of the main forest canopy. The tree may have survived one or more fires as evidenced by fire scars. Veteran trees are usually isolated in distribution and often extend well above the main tree canopy. Because of their large size, they usually provide valuable wildlife tree habitat for many decades.
- wildlife tree** A standing dead or live tree with special characteristics that provide valuable habitat for the conservation or enhancement of wildlife.
- Wildlife Tree Committee (WTC)** A committee organized in 1985 to find ways of maintaining wildlife tree habitat in timber harvesting and silviculture operations, without endangering the safety of forest workers.
See the WTC website at: www.for.gov.bc.ca/hfp/values/wildlife/WLT/index.htm
- Workplace** Includes all locations where a worker is or is likely to be engaged in work activities.

APPENDICES

APPENDICES

- Appendix 1: Site Assessment Overview Summary – Side 1
- Appendix 2: Dangerous Tree Field Data Collection Card – Side 1
- Appendix 3: Dangerous Tree Field Data Collection Card Sample
- Appendix 4a: Dangerous Tree Field Data Collection Card Guide – Side 1
- Appendix 4b: Dangerous Tree Field Data Collection Card Guide – Side 2
- Appendix 5: Measuring Tree Heights

Appendix 1: Site Assessment Overview Summary (with addition notes on side 2)

SITE ASSESSMENT OVERVIEW SUMMARY		
Location:		Date (mm/dd/yy):
Tenure Holder:		Tenure:
Stratum Identification:		Operation:
Assessor's Name:		
Forestry activity and LOD:		Planned start-up and end dates:
Stratum conditions (Describe leave trees - species, sizes, condition, ages and density distribution):		
WT management objectives (Describe constraints to NWZ, WT retention):		
Stand Density and Site History	Site Hazards	Common Tree Pathogens/Cause of Failure (List factors and severity/frequency)
Disturbance year	Bluffs/cliffs/sink holes	
Disturbance type	Gorges/streams/gullies	
Recent tree failure(s)	Rock talus/scree	
Past tree failure(s)	Steep/unstable terrain	
Fire intensity (L,M,H)	Recent edge/tree exposures	
Tree retention pattern - even clumps irregular	Snow/ice/fog	
	Windthrow risk	
Retention tree density (L, M, H)	Shallow/saturated soils	
Tree species mix	Stand decadence	
Tree age (dom/co-dom)	Other:	
Prevailing wind direction		
Wildlife tree use (L, M, H)		
Mitigation Strategies	Constraints	
Falling/machine clearing/blasting	Wind speed criteria	Evacuation routes
NWZ criteria	Weather	
Tree modification	Seasonal issues	Refuge area
		Road use control

Appendix 2: Dangerous Tree Field Data Collection Card (addition notes and sketches on side 2)

Printed Name:		Date:								
SITE ASSESSMENT										
Activity:										
Location:										
CP/Block:										
Site History: (e.g., year harvested, site preparation method and timing)										
DANGEROUS TREE FIELD DATA COLLECTION – LOD 1										
Inspections of trees for LOD-1 activities are applicable only when silviculture activities are performed in light winds (<40 km/hr). If wind speeds exceed 40 km/hr the workers must move to a safe area.										
Tree #	Tree Species	Tree Class	WT value (L, M, H)	Estimated Height (meters)	Estimated Diameter (cm)	Lean (L, M, H)	Significant Tree Defects (see below)			Dangerous Tree Management Strategy (i.e., Mark tree as Dangerous; Ribbon No Work Zone or Fall Tree)
							Insecurely lodged	Unstable stem	Recent lean & poor roots	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Notes:										
<p>Significant Tree Defects (definitions) - <i>A tree with one or more of the following defects is at risk of imminent failure and poses a significant hazard which must be addressed by a "Dangerous Tree Management Strategy"</i></p> <p>Insecurely lodged "trees" : A tipped tree that is likely to shake free of the support trees and fall to the ground.</p> <p>Insecurely lodged "hang-ups" : Dislodged but hung-up limbs or tops (consider size and height above ground) at risk of shifting free during light winds or other tree motion.</p> <p>Highly unstable tree : i) >50% of tree cross-sectional area damaged, burned, scarred, decayed or fractured; or ii) Spongy snags with heart rot conks along the majority of the length of the stem (e.g., class 5 - 6 conifers or class 4 deciduous) or soft snags (e.g., class 7 - 8 conifers or class 5 deciduous); or iii) >50% of lateral support roots are damaged or with advanced decay.</p> <p>Recent lean/poor roots : Recent lean <u>towards the work area</u> AND decayed root system (>50% of roots have advanced decay) or damaged and lifting anchoring soil layer (consider soil conditions and anchoring).</p>										
<p>Wind Speed Estimation: 0 - 20 km/hr wind: dust and loose paper is raised small branches move 20 - 40km/hr wind: small trees sway, tops of large trees sway 40 -65 km/hr wind: small branches fly in the air, whole tree in motion, resistance felt when walking against the wind</p>										
<p>Lean: Low (<10% or 5°) Moderate (<15% or 8°) High (>30% or 16°) </p>										

Appendix 3: Dangerous Tree Field Data Collection Card Sample

Printed Name: Peter Doneit				Date: Month – Day – Year						
SITE ASSESSMENT										
Activity: Tree planting – spring plant										
Location: New Forest Mills										
CP/Block: CP: 24 Block: 1543										
Site History: (e.g., year harvested, site preparation method and timing)										
Winter logged last year; scattered healthy trees and deciduous wildlife trees; no site prep										
DANGEROUS TREE FIELD DATA COLLECTION – LOD 1										
Inspections of trees for LOD-1 activities are applicable only when silviculture activities are performed in light winds (<40 km/hr). If wind speeds exceed 40 km/hr the workers must move to a safe area.										
Tree #	Tree Species	Tree Class	WT value (L, M, H)	Estimated Height (meters)	Estimated Diameter (cm)	Lean (L, M, H)	Significant Tree Defects (see below)			Dangerous Tree Management Strategy (i.e., Mark tree as Dangerous; Ribbon No Work Zone or Fall Tree)
							Insecurely lodged	Unstable stem	Recent lean & poor roots	
1	Fd	2	L	20	35	+L	D			Blue paint #1; pink flagging NWZ for hanging dead limb
2	Pl	5	M	15	30	-L		D		10m inside WTP edge; numerous conks and active cavity nest; pink NWZ
3	At	2		20	40	-M			D	Tree's roots lifted; blue paint #3 plus blue flagging – fall tree
4	Fd	3	M	20	30	0		S		Tree has one conk at 2m up from the base – safe and yellow flagged – No Action
5										
6										
7										
8										
9										
10										
Notes:										
Dangerous Trees are painted with BLUE number for reference. See map for locations of all D trees and the NWZs										
NWZ are flagged in PINK										
Suspect trees that did not meet Dangerous are flagged with YELLOW for reference (number written on the flagging)										
Significant Tree Defects (definitions) - <i>A tree with one or more of the following defects is at risk of imminent failure and poses a significant hazard which must be addressed by a "Dangerous Tree Management Strategy"</i>										
Insecurely lodged "trees" : A tipped tree that is likely to shake free of the support trees and fall to the ground.										
Insecurely lodged "hang-ups" : Dislodged but hung-up limbs or tops (consider size and height above ground) at risk of shifting free during light winds or other tree motion.										
Highly unstable tree : i) >50% of tree cross-sectional area damaged, burned, scarred, decayed or fractured; or ii) Spongy snags with heart rot conks along the majority of the length of the stem (e.g., class 5 - 6 conifers or class 4 deciduous) or soft snags (e.g., class 7 - 8 conifers or class 5 deciduous); or iii) >50% of lateral support roots are damaged or with advanced decay.										
Recent lean/poor roots : Recent lean towards the work area AND decayed root system (>50% of roots have advanced decay) or damaged and lifting anchoring soil layer (consider soil conditions and anchoring).										
Wind Speed Estimation: 0 - 20 km/hr wind: dust and loose paper is raised small branches move										
20 - 40km/hr wind: small trees sway, tops of large trees sway										
40 -65 km/hr wind: small branches fly in the air, whole tree in motion, resistance felt when walking against the wind										
Lean: Low (<10% or 5°) ↑ Moderate (<15% or 8°) ↑ High (>30% or 16°) ↑										

Appendix 4a: Dangerous Tree Field Data Collection Card Guide – Side 1

Managing Wildlife/Dangerous Trees Training for Qualified Persons Dangerous Tree Field Data Collection Card Guide

The sample field data card illustrates some basic conventions that can be used to consistently document observations and results made during the inspection of wildlife or dangerous trees. In this example, trees were assessed for a planned tree planting activity.

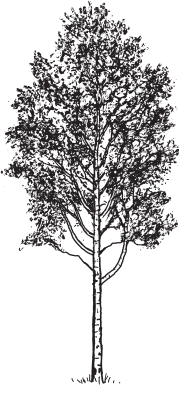
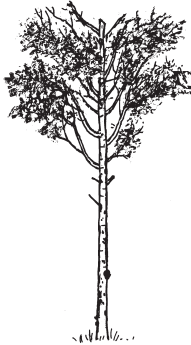
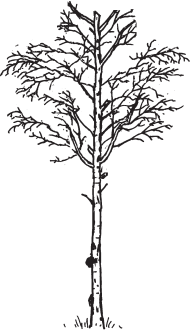
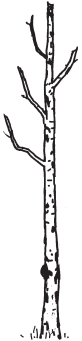


The visual tree inspection details are recorded for each suspect tree. If needed, record the category of defect as either “S” (Safe) or “D” (Dangerous). Remember – if in doubt then record a “D” rating and manage the tree as a Dangerous Tree, or seek the advice of a certified Wildlife/Dangerous Tree Assessor. For tree lean, consider recording the category of lean with a “+” to indicate the lean is away from the worksite, and a “-” to indicate the lean is towards the worksite. If the tree has zero lean then record “-L” (the tree or defect could fall into the work area) or simply “0”.

The Management Strategy of a tree with a “S” rating is simply recorded as “No Action”. For any tree with unknown or dangerous ratings, then record the management action to be taken. Remember, if the tree is dangerous, the tree must be either removed, have the dangerous defect removed, or the workers protected by installing a No Work Zone. Use the “Comments” section to record other pertinent details about the tree or the management strategies.










Common Tree Species Name and Codes		Determining Wildlife Tree Value	
TREE SPECIES	CODE SYMBOL	Generally, the following characteristics indicate the relative habitat value of a wildlife tree.	
Douglas-fir	Fd	WILDLIFE TREE VALUE	CHARACTERISTICS
Western larch	Lw	<p>HIGH a high value tree has at least two of the characteristics listed in the adjacent column and, where possible, is within the upper 10–15% of the diameter range distribution for the site</p> <p>MEDIUM</p> <p>LOW</p> <p><i>Note:</i> Under section 34 of the <i>Wildlife Act</i>, no tree with an active nest or the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl can be disturbed.</p> <p>When considering the needs of wildlife it is important to recognize that all trees are not equal in value. Given the large number of wildlife tree-dependent species and wide range of wildlife uses of these trees, there can be no simple system for determining which trees provide the best habitat for wildlife. The most significant indicators of wildlife tree quality are height and diameter, decay stage, location, distribution and cause of death.</p> <p>The following is a list of desirable attributes for a wildlife tree:</p> <ul style="list-style-type: none"> • greater than 15 m in height preferable • greater than 30 cm dbh preferable (interior) • greater than 70 cm dbh preferable (coastal) • some intact bark with space behind loose bark • nest cavities, feeding excavations • some evidence of decay (visible fungal conks or open cavity) • tree classes 2- 6 most valuable • windfirm, sound root system • broken top • some large branches 	
Lodgepole pine	Pl		
Ponderosa pine (Yellow pine)	Py		
Western white pine	Pw		
White spruce	Sw		
Engelmann spruce	Se		
Sitka spruce	Ss		
Subalpine fir	Bl		
Amabilis fir	Ba		
Grand fir	Bg		
Western hemlock	Hw		
Western redcedar	Cw		
Yellow cedar	Cy		
Black cottonwood	Ac		
Trembling aspen	At		
Paper birch	Ep		
Red alder	Dr		
Maple	Mb		

Appendix 4b: Dangerous Tree Field Data Collection Card Guide – Side 2

British Columbia's wildlife tree classification system: native broad-leaved deciduous

Tree class	LIVE		DEAD			
	1	2	hard → 3	spongy → 4	soft 5	dead fallen 6
					approx. 1/2 original height 	

British Columbia's wildlife tree classification system: conifers

Tree class	LIVE		DEAD						
			Hard →		Spongy →		Soft		
	1	2	3	4	5	6	7	8	9
						approx. 2/3 original height 	approx. 1/2 original height 	approx. 1/3 original height 	dead fallen 
Description	Live/healthy; no decay; tree has valuable habitat characteristics such as large, clustered or gnarled branches, or horizontal, thickly moss-covered branches.*	Live/unhealthy; internal decay or growth deformities (including insect damage, broken tops); dying tree.*	Dead; needles or fine twigs are present.	Dead; no needles or fine twigs – only coarse limbs present; 50% of branches lost; loose bark; top usually broken.	Dead; most branches/bark absent; some internal decay.	Dead; no branches or bark; sapwood/heartwood sloughing from upper bole; decay more advanced.	Dead; extensive internal decay; outer shell may be hard; lateral roots usually completely decomposed; hollow or nearly hollow shells.		Debris; downed trees or stumps.
Uses and users	Nesting (e.g., Bald Eagle, Great Blue Heron colonies, Marbled Murrelet); feeding; roosting; perching.	Nesting/roosting ¹ – strong PCEs ² (woodpeckers); SCUs ³ ; large-limb and platform nests (Ospreys); insect feeders.	Nesting/roosting – strong PCEs; SCUs; bats.	Nesting/roosting – PCEs; SCUs; insect feeders.	Nesting/roosting – weak PCEs (nuthatches, chickadees); SCUs; bats; insect feeders.	Weaker PCEs; SCUs; insect feeders; salamanders; small mammals; hunting perches.	Insect feeders; salamanders; small mammals; hunting perches occasionally used by weak cavity excavators such as chickadees.		Insect feeders; salamanders; small mammals; drumming logs for grouse; flicker foraging; nutrient source.

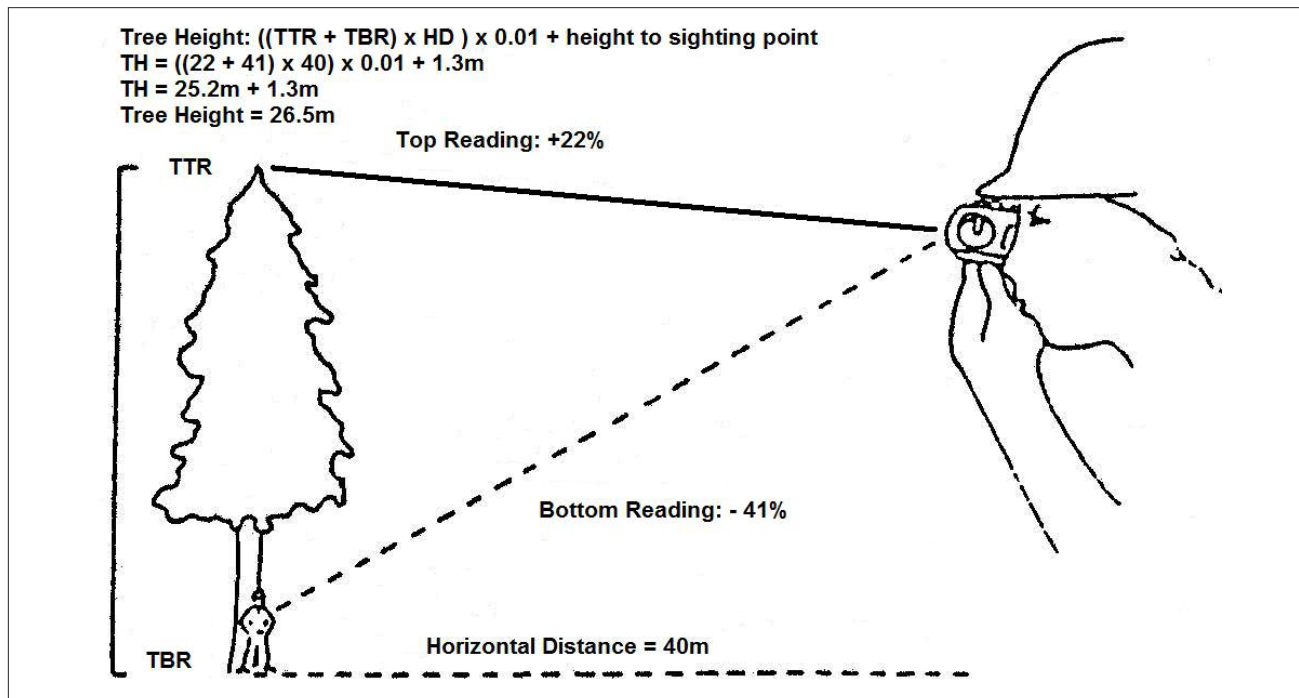
¹ Large witches' brooms provide nesting/denning habitat for some species (e.g., fisher, squirrels).

² PCE = primary cavity user

³ SCU = secondary cavity user

* This classification system does not recognize root disease trees specifically. Such trees become unstable at or before death.

Appendix 5: Measuring Tree Heights



The most common tool for measuring tree height is the Suunto clinometer. The ‘clino’ works on a pendulum principle and measures the angles to the top and to the base of the tree.

When these measurements are combined with a measured distance to the tree, the height of the tree can be calculated.

The Suunto makes it possible for you to estimate tree height based on two quick readings of the slope lines from your eye to the top and bottom of the tree.

To use the Suunto, hold it to your right eye and watch the internal movable scale, while looking at the target tree with your left eye. Tilt the instrument until you can see the top of the tree, and read the right hand side of the scale (in %). Make note of the reading, then tilt the instrument to the ‘base’ of the tree (actually, at dbh) and record the reading. Measure the horizontal distance you are from the tree, then calculate the tree height according to the following formula:

$$\text{Tree height} = (TTR + TBR) \times HD \times .01$$

where TTR = Tree top reading (%)
 TBR = Tree bottom reading (%) *
 HD = Horizontal distance from tree **

* Tree bottom readings are usually a negative %; ignore the negative sign and add the bottom % measurement to the top % measurement. In cases where you are looking uphill to sight both the top and bottom of the tree, and both % readings are positive, subtract the tree bottom % reading from the tree top % reading.

** Remember to derive the horizontal distance using slope tables.

BLANK FORMS

for

Duplication by participants for field work

Masters for Duplication (*all two sided*)

- Site Assessment Overview Summary – Side 1
- Site Assessment Overview Summary (continued) – Side 2
- Dangerous Tree Field Data Collection Card – Side 1
- Dangerous Tree Field Data Collection Card (continued) – Side 2
- Dangerous Tree Field Data Collection Card Guide – Side 1
- Dangerous Tree Field Data Collection Card Guide – Side 2

SITE ASSESSMENT OVERVIEW SUMMARY

Location:	Date (mm/dd/yy):	
Tenure Holder:	Tenure:	
Stratum Identification:	Operation:	
Assessor's Name:		
Forestry activity and LOD:	Planned start-up and end dates:	
Stratum conditions (Describe leave trees - species, sizes, condition, ages and density distribution):		
WT management objectives (Describe constraints to NWZ, WT retention):		
Stand Density and Site History	Site Hazards	Common Tree Pathogens/Cause of Failure (List factors and severity/frequency)
Disturbance year	Bluffs/cliffs/sink holes	
Disturbance type	Gorges/streams/gullies	
Recent tree failure(s)	Rock talus/scree	
Past tree failure(s)	Steep/unstable terrain	
Fire intensity (L,M,H)	Recent edge/tree exposures	
Tree retention pattern - even clumps irregular	Snow/ice/fog	
	Windthrow risk	
Retention tree density (L, M, H)	Shallow/saturated soils	
Tree species mix	Stand decadence	
Tree age (dom/co-dom)	Other:	
Prevailing wind direction		
Wildlife tree use (L, M, H)		
Mitigation Strategies	Constraints	Communication
Falling/machine clearing/blasting	Wind speed criteria	Evacuation routes
NWZ criteria	Weather	
Tree modification	Seasonal issues	Refuge area
		Road use control

Printed Name:

Date:

SITE ASSESSMENT

Activity:

Location:

CP/Block:

Site History: (e.g., year harvested, site preparation method and timing)

DANGEROUS TREE FIELD DATA COLLECTION – LOD 1

Inspections of trees for LOD-1 activities are applicable only when silviculture activities are performed in light winds (<40 km/hr). If wind speeds exceed 40 km/hr the workers must move to a safe area.

Tree #	Tree Species	Tree Class	WT value (L, M, H)	Estimated Height (meters)	Estimated Diameter (cm)	Lean (L, M, H)	Significant Tree Defects (see below)			Dangerous Tree Management Strategy (i.e., Mark tree as Dangerous; Ribbon No Work Zone or Fall Tree)
							Insecurely lodged	Unstable stem	Recent lean/poor roots	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Notes:

Significant Tree Defects (definitions) - A tree with one or more of the following defects is at risk of imminent failure and poses a significant hazard which must be addressed by a "Dangerous Tree Management Strategy"




Insecurely lodged "trees" : A tipped tree that is likely to shake free of the support trees and fall to the ground.

Insecurely lodged "hang-ups" : Dislodged but hung-up limbs or tops (consider size and height above ground) at risk of shifting free during light winds or other tree motion.

Highly unstable tree : i) >50% of tree cross-sectional area damaged, burned, scarred, decayed or fractured; or ii) Spongy snags with heart rot conks along the majority of the length of the stem (e.g., class 5 - 6 conifers or class 4 deciduous) or soft snags (e.g., class 7 - 8 conifers or class 5 deciduous); or iii) >50% of lateral support roots are damaged or with advanced decay.

Recent lean/poor roots : Recent lean **towards the work area AND** decayed root system (>50% of roots have advanced decay) or damaged and lifting anchoring soil layer (consider soil conditions and anchoring).

Wind Speed Estimation: 0 - 20 km/hr wind: dust and loose paper is raised small branches move
 20 - 40km/hr wind: small trees sway, tops of large trees sway
 40 - 65 km/hr wind: small branches fly in the air, whole tree in motion, resistance felt when walking against the wind

Lean: Low (<10% or 5°)  Moderate (<15% or 8°)  High (>30% or 16°) 

Managing Wildlife/Dangerous Trees Training for Qualified Persons

Dangerous Tree Field Data Collection Card Guide

The sample field data card illustrates some basic conventions that can be used to consistently document observations and results made during the inspection of wildlife or dangerous trees. In this example, trees were assessed for a planned tree planting activity.

The visual tree inspection details are recorded for each suspect tree. If needed, record the category of defect as either “S” (Safe) or “D” (Dangerous). Remember – if in doubt then record a “D” rating and manage the tree as a Dangerous Tree, or seek the advice of a certified Wildlife/Dangerous Tree Assessor. For tree lean, consider recording the category of lean with a “+” to indicate the lean is away from the worksite, and a “-” to indicate the lean is towards the worksite. If the tree has zero lean then record “-L” (the tree or defect could fall into the work area) or simply “0”.

The Management Strategy of a tree with a “S” rating is simply recorded as “No Action”. For any tree with unknown or dangerous ratings, then record the management action to be taken. Remember, if the tree is dangerous, the tree must be either removed, have the dangerous defect removed, or the workers protected by installing a No Work Zone. Use the “Comments” section to record other pertinent details about the tree or the management strategies.

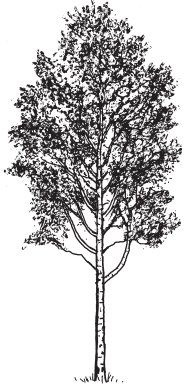
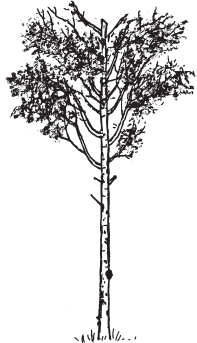
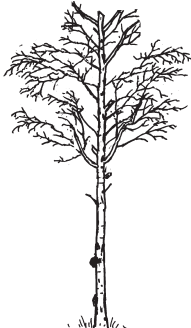
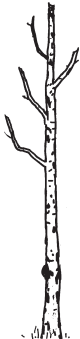


Common Tree Species Name and Codes	
TREE SPECIES	CODE SYMBOL
Douglas-fir	Fd
Western larch	Lw
Lodgepole pine	Pl
Ponderosa pine (Yellow pine)	Py
Western white pine	Pw
White spruce	Sw
Engelmann spruce	Se
Sitka spruce	Ss
Subalpine fir	Bl
Amabilis fir	Ba
Grand fir	Bg
Western hemlock	Hw
Western redcedar	Cw
Yellow cedar	Cy
Black cottonwood	Ac
Trembling aspen	At
Paper birch	Ep
Red alder	Dr
Maple	Mb

Determining Wildlife Tree Value	
Generally, the following characteristics indicate the relative habitat value of a wildlife tree.	
WILDLIFE TREE VALUE	CHARACTERISTICS
HIGH a high value tree has at least two of the characteristics listed in the adjacent column and, where possible, is within the upper 10–15% of the diameter range distribution for the site	<ul style="list-style-type: none"> • internal decay (heartrot or natural/excavated cavities present) • a sound, firm stem shell • crevices present (loose bark or cracks suitable for bats) • large brooms present • active or recent wildlife use (feeding, nesting, denning) • tree structure suitable for wildlife use (suitable for large nest, hunting perch sites, bear den, etc.) • largest trees for site (height and/or diameter) and veteran trees • locally important wildlife tree species • favourably located for use by wildlife
MEDIUM	<ul style="list-style-type: none"> • large, stable trees that will likely develop two or more of the above attributes
LOW	<ul style="list-style-type: none"> • trees not covered by high or medium categories
<p>Note: Under section 34 of the <i>Wildlife Act</i>, no tree with an active nest or the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl can be disturbed.</p> <p>When considering the needs of wildlife it is important to recognize that all trees are not equal in value. Given the large number of wildlife tree-dependent species and wide range of wildlife uses of these trees, there can be no simple system for determining which trees provide the best habitat for wildlife. The most significant indicators of wildlife tree quality are height and diameter, decay stage, location, distribution and cause of death.</p>	
<p>The following is a list of desirable attributes for a wildlife tree:</p> <ul style="list-style-type: none"> • greater than 15 m in height preferable • greater than 30 cm dbh preferable (interior) • greater than 70 cm dbh preferable (coastal) • some intact bark with space behind loose bark • nest cavities, feeding excavations • some evidence of decay (visible fungal conks or open cavity) • tree classes 2- 6 most valuable • windfirm, sound root system • broken top • some large branches 	










Managing Wildlife/Dangerous Trees Training for Qualified Persons

Dangerous Tree Field Data Collection Card Guide

British Columbia's wildlife tree classification system: native broad-leaved deciduous

Tree class	LIVE		DEAD			
	1	2	hard → 3	spongy → 4	soft 5	dead fallen 6
					approx. 1/2 original height 	

British Columbia's wildlife tree classification system: conifers

Tree class	LIVE		DEAD						
	1	2	Hard →		Spongy →		Soft		
			3	4	5	6	7	8	9
						approx. 2/3 original height 	approx. 1/2 original height 	approx. 1/3 original height 	dead fallen 
Description	Live/healthy; no decay; tree has valuable habitat characteristics such as large, clustered or gnarled branches, or horizontal, thickly moss-covered branches.*	Live/unhealthy; internal decay or growth deformities (including insect damage, broken tops); dying tree.*	Dead; needles or fine twigs are present.	Dead; no needles or fine twigs – only coarse limbs present; 50% of branches lost; loose bark; top usually broken.	Dead; most branches/ bark absent; some internal decay.	Dead; no branches or bark; sapwood/ heartwood sloughing from upper bole; decay more advanced.	Dead; extensive internal decay; outer shell may be hard; lateral roots usually completely decomposed; hollow or nearly hollow shells.	Debris; downed trees or stumps.	
Uses and users	Nesting (e.g., Bald Eagle, Great Blue Heron colonies, Marbled Murrelet); feeding; roosting; perching.	Nesting/roosting ¹ – strong PCEs ² (woodpeckers); SCUs ³ ; large-limb and platform nests (Ospreys); insect feeders.	Nesting/roosting – strong PCEs; SCUs; bats.	Nesting/roosting – PCEs; SCUs; insect feeders.	Nesting/roosting – weak PCEs (nuthatches, chickadees); SCUs; bats; insect feeders.	Weaker PCEs; SCUs; insect feeders; salamanders; small mammals; hunting perches.	Insect feeders; salamanders; small mammals; hunting perches occasionally used by weak cavity excavators such as chickadees.	Insect feeders; salamanders; small mammals; drumming logs for grouse; flicker foraging; nutrient source.	

¹ Large witches' brooms provide nesting/denning habitat for some species (e.g., fisher, squirrels).

² PCE = primary cavity user

³ SCU = secondary cavity user

* This classification system does not recognize root disease trees specifically. Such trees become unstable at or before death.