

What is a Dangerous Tree?

A dangerous tree is any tree (regardless of size) that is hazardous to people or facilities because of:

- location or lean
- physical damage
- overhead hazards
- deterioration of limbs, stem or root system
- a combination of the above.

Determining Tree Danger Rating

There are five steps required to determine tree danger rating:

- STEP 1 Conduct site assessment overview.
- STEP 2 Determine level of ground or tree disturbance and type of work activity.
- STEP 3 Conduct visual tree inspection.
- STEP 4 Make the appropriate safety decision.
- STEP 5 Provide documentation of assessed trees and assessed areas (includes date, location, LOD, marking procedures, and how danger trees have been managed)

Documentation

The certified tree assessor must document the following information on the FS 502c field card or other retrievable format:

- assessor's name
- date and time of assessment
- location of assessed area or trees (where appropriate this should be mapped to scale)
- marking protocol for individual trees assessed as "Safe" or "Dangerous" (i.e., paint or ribbon colour)
- location and method of identifying no-work zones (i.e., location mapped or described, and type of boundary flagging used)
- locations of areas assessed as safe (map or describe location and include relevant boundary flagging or tree marking procedures)
- type of work activity the area was assessed for (e.g., road travel, workers in area using heavy equipment, tree falling etc.)
- describe how the above information was communicated to appropriate personnel (i.e., develop a safety plan).
- documentation must be available and retrievable (e.g., copied to fire file).

Table 1. Site assessment overview (for all tree species)

How to use this table: The following site/stand factors should be reviewed during a walk through of the site, 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 damaged roots and soil condition, extent of burn damage or windthrow hazard). Specific tree defect failure ratings are summarized in Tables 3a and 3b.

Site/Stand Factors	Hazard Indicators/Influences
Stand history and condition	<ul style="list-style-type: none"> • evidence of past tree failure • natural disturbance history (e.g., old burn, old root rot area) • stand age and structure • tree species composition • evidence of root and/or stem diseases • soil or slope instability • sites where air tanker or water scooper aerial drops have recently occurred • sites recently disturbed by heavy equipment • sites where blasting has recently occurred
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 (e.g., ridge crests) • prevailing winds (e.g., valley bottom outflows) • 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 (clays, bedrock)
Crown condition	<ul style="list-style-type: none"> • stress cone crop • thinning foliage • chlorosis • rounded crown • small live crown (<20%) • crown imbalance (majority of branch weight on one side)
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.

* Trees with small live crown proportions and low stem taper have poor crown balance. This can increase their blowdown/falldown hazard, especially if the rooting system is weak.

Table 1. Continued

<p>Severity of fire/burn</p>	<ul style="list-style-type: none"> • depth of burn • amount of root burn • damage to anchoring soil layer • amount of basal stem burn 												
<p>Canadian Forest Fire Danger Rating System</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: left;">Fuel Type</th> <th style="text-align: left;">BUI Threshold Value</th> </tr> </thead> <tbody> <tr> <td>C-1</td> <td>>40</td> </tr> <tr> <td>C-2, C-3, C-4, C-5, C-6</td> <td>>60</td> </tr> <tr> <td>C-7</td> <td>>80</td> </tr> <tr> <td>D-1</td> <td>>30</td> </tr> <tr> <td>M-1, M-2, M-3, M-4</td> <td>>40</td> </tr> </tbody> </table>		Fuel Type	BUI Threshold Value	C-1	>40	C-2, C-3, C-4, C-5, C-6	>60	C-7	>80	D-1	>30	M-1, M-2, M-3, M-4	>40
Fuel Type	BUI Threshold Value												
C-1	>40												
C-2, C-3, C-4, C-5, C-6	>60												
C-7	>80												
D-1	>30												
M-1, M-2, M-3, M-4	>40												
<p>Time since fire</p>	<ul style="list-style-type: none"> • Buildup Index values are above the established thresholds and there is continuous active burning within the area of work • More than three days with continuous burning have passed since the last assessment 												

Determining Wildlife Tree Value

Generally, the following characteristics indicate the relative habitat value of a wildlife tree.

Wildlife Tree Value	Characteristics
<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>	<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) • active or recent wildlife use (feeding, nesting, denning) • large brooms present • tree structure suitable for wildlife use (suitable for large nest, hunting perch sites, bear den, etc.) • largest tree for site (height and/or diameter) and veteran trees • locally important wildlife tree species • favourably located for use with wildlife
<p>MEDIUM</p>	<ul style="list-style-type: none"> • large, stable trees that will likely develop two or more of the above attributes
<p>LOW</p>	<ul style="list-style-type: none"> • trees not covered by high or medium categories

Note: Under section 34 of the Wildlife Act, no tree with the nest of an eagle, osprey or heron can be disturbed.

Table 2. Levels of disturbance for unprotected workers in various fire-related work activities*

Level of Disturbance (LOD)	Type of Work Activity
Very Low Risk (VLR) *	<ul style="list-style-type: none"> • surveys • stand reconnaissance • patrolling ** • tree marking, boundary marking • fire guard/control line layout • establishing hose lays in green (unburned) areas • burning off • road or trail travel with light vehicles (ATVs, pickups <5500 kg GVWR) in green (unburned) areas
1 (Table 3)	<ul style="list-style-type: none"> • fire control and mop-up with hand tools and/or water hoses (manual activities only) • establishing hose lays in black (burned) areas • road or trail travel with light vehicles (ATVs, pickups <5500 kg GVWR) in black (burned) areas • road travel with heavy vehicles (>5500 kg GVWR) and on ballasted and PERMANENT roads (a cleared right-of-way) • tree bucking • slashing
2 and 3 (Table 3a)	<ul style="list-style-type: none"> • road travel with heavy vehicles (>5500 kg GVWR) on non-ballasted TEMPORARY roads or trails (no cleared right-of-way) Includes unguarded heavy equipment travel such as skidders • manned pump sites • tree falling *** • use of heavy mechanized equipment • use of light and intermediate helicopters where workers are exposed to rotorwash
4 (Table 3b)	<ul style="list-style-type: none"> • use of medium and heavy helicopters where workers are exposed to rotorwash • fire camps, fire bases • staging and marshalling areas

*NOTE Risk can be considered as a combination of tree hazard (condition) AND exposure to that hazard (i.e. work activity and location). RISK = HAZARD x EXPOSURE

NOTE Very Low Risk (VLR) activities usually result in negligible amounts of ground or tree disturbance and have very low exposure time to potential tree hazards. Consequently, the risk of injury or damage due to tree hazards is very low under these circumstances. **Workers should keep a “heads-up” and stay away from any obvious dangerous trees and overhead tree hazards (e.g., insecurely lodged trees; hanging tops or limbs). A pre-work inspection is not required for VLR activities except for foot patrolling

***NOTE Does not include falling dangerous trees

Wind Influence

Workers must be aware of wind conditions and the influence of wind on tree stability. Strong winds increase the potential of trees failing. Potentially dangerous trees within reach of work areas must be removed or managed by a certified assessor who determines whether the tree is safe or dangerous, and manages it in accordance with the established practices. If wind conditions become strong enough (winds set whole trees in motion and cause branches to break and fly in the air, walking is impeded by the wind), workers should consider leaving the work area and go to a safe refuge.

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

<p>D = dangerous</p>	<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"> i) Insecurely lodged trees (a tipped tree that is likely to shake free of the support trees and fall to the ground) ii) 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 decadent and unstable: <ul style="list-style-type: none"> i) >50% of tree cross-sectional area damaged, burned, scarred, decayed or fractured; ii) class 5-8 trees with heart rot conks along the majority of the length of the stem; or iii) >50% of lateral support roots are damaged or with advanced decay • 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)
<p>S = safe</p>	<p>All other trees</p>

Tree Lean

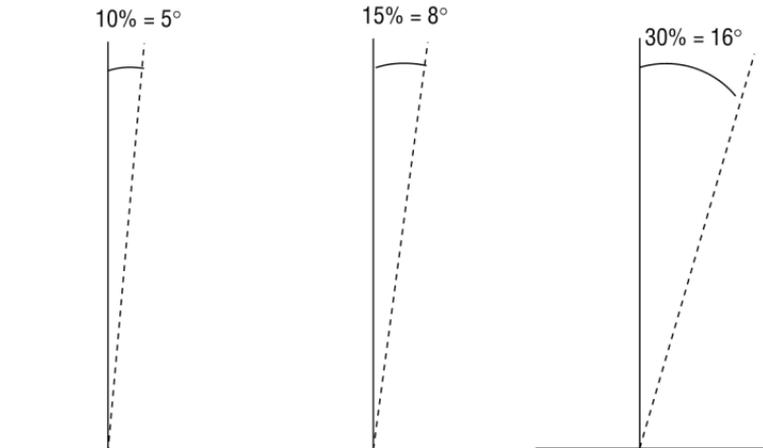


Table 3a. Dangerous Tree Criteria for Level 2 and 3 Disturbance Activities

NOTE: Any tree defects as described in the boxes below will be rated as DANGEROUS for level 2 and 3 disturbances. Trees with lesser defects can be rated SAFE for level 2 and 3 – take care to not brush these trees and to fall and

Defect Category	Species Group	
	Douglas-fir, larch, pines, spruces	Western redcedar, yellow cedar
Hazardous top (HT)	<ul style="list-style-type: none"> Class 2-5 trees: Defective top (any size; eg., secondary top) where structural weakness is evident; OR Class 4 and 5 trees: defective top (e.g., secondary top) which have >30% of tree height 	<ul style="list-style-type: none"> Class 2-5 trees: Defective top (any size) as a fork, co-dominant or multiple stem where structural weakness is evident
Dead limbs (DL)	<ul style="list-style-type: none"> Dead limbs >10 cm diameter with structural weakness Cracked, decayed, broken or hung-up limbs 	<ul style="list-style-type: none"> Dead limbs >15 cm diameter with structural weakness Cracked, decayed, broken or hung-up limbs
Witches' broom (WB)	Brooms >1 m diameter on live or dead branches AND evidence of decay, cracking or failure	n/a
Split trunk (ST) (includes frost, lightning, wind- and impact-induced cracks)	Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood	Class 2 and 3 trees: Crack or split >2 cm wide extending >50% of tree diameter into stem AND evidence of decay in surrounding stemwood Class 4-8 trees: Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood
Stem damage (SD) (includes scarring, fire, machine, and animal damage or butt rot)	<ul style="list-style-type: none"> >50% of tree cross-sectional area damaged, burned, scarred or fractured 	<ul style="list-style-type: none"> >50% of tree cross-sectional area damaged, burned, scarred or fractured
Thick sloughing bark or sloughing sapwood (SB) (bark applicable to Douglas-fir, larch, pond-erosa pine and cotton-wood >50 cm dbh)	Large pieces of bark or sapwood separated and sloughing from bole of tree	Bark n/a <ul style="list-style-type: none"> Long slabs of sapwood hanging from bole of tree
Butt and stem cankers (CA)	>50% of butt or stem circumference as a perennial canker face*	n/a
Fungal fruiting bodies (CM)** (conks and mushrooms)	<p>Any heartrot fungus present</p> <p>Exception: For veteran and dominant trees, if <i>Phellinus pini</i> conks present BUT No other visible defects/damage to stem that allow oxygen exchange (e.g., broken top, scarring, nest cavity, etc.) = SAFE; *Sap-rotting fungi present on any tree <30 cm dbh where saprot depth is >5 cm</p>	n/a
Tree lean (TL) (for class 1-3 trees)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope) For candelabra-branched trees, where candelabras are predominantly on lean side of tree - lean >10% toward target/work area and tree has rooting problems
Tree lean (TL) (for class 4-8 trees)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots, shallow, compacted or wet soils, cracked or lifting root mat, steep slope)
Root inspection	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots	Occurrence of any of the following : root pull or lifting root mat; visible damage or decay to roots

NOTE: Structural weakness includes decay, cracking, breakage, embedded bark or cracking at forks or multiple stem unions, presence of conks, stem scars, and woodpecker cavities.

¹ A secondary top is a growth leader which forms after the breakage or die-back of the original tree top.

** Footnotes can be found on page 7 (on reverse).

Table 3a. Dangerous Tree Criteria for Level 2 and 3 Disturbance Activities (concluded)

NOTE: Any tree defects as described in the boxes below will be rated as DANGEROUS for level 2 and 3 disturbances. Trees with lesser defects can be rated SAFE for level 2 and 3 – take care to not brush these trees and to fall and yard away if possible.

Defect Category	Species Group	
	Hemlock, true firs	Broad-leaved deciduous
Hazardous top (HT)	<ul style="list-style-type: none"> • Class 2-5 trees: Defective Top (any size e.g., secondary top) where structural weakness is evident; OR • Class 4 and 5 trees: Defective top (e.g., secondary top) >20% of tree height 	<ul style="list-style-type: none"> • Class 2-5 trees: Defective top (any size) in the form of a fork, co-dominant or multiple stems where structural weakness is evident; OR • Where dead top >20% of tree height
Dead limbs (DL)	<ul style="list-style-type: none"> • Dead limbs >10 cm diameter with structural weakness • Cracked, decayed, broken or hung-up limbs 	<ul style="list-style-type: none"> • Dead limbs >10 cm diameter with structural weakness • Cracked, decayed, broken or hung-up limbs
Witches' broom (WB)	Brooms >1 m diameter on live or dead branches AND evidence of decay, cracking or failure	n/a
Split trunk (ST) (includes frost, lightning, wind- and impact-induced cracks)	Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood	Crack or split >2 cm wide extending >25% of tree diameter into stem AND evidence of decay in surrounding stemwood
Stem damage (SD) (includes scarring, fire, machine, and animal damage or butt rot)	<ul style="list-style-type: none"> • >50% of tree cross-sectional area damaged, burned, scarred or fractured 	<ul style="list-style-type: none"> • >25% of tree cross-sectional area damaged, burned, scarred or fractured
Thick sloughing bark or sloughing sapwood (SB) (bark applicable to Douglas-fir, larch, pond-erosa pine and cotton-wood >50 cm dbh)	n/a	Large pieces of bark separated and sloughing from bole of tree
Butt and stem cankers (CA)	n/a*	<ul style="list-style-type: none"> >20% of butt or stem circumference as a perennial canker face* >50% of butt or stem circumference as a canker face on a dead tree
Fungal fruiting bodies (CM) ** (conks and mushrooms)	Any heartrot fungi present; OR Sap-rotting fungi present on trees <60 cm dbh where saprot depth is >6 cm	<ul style="list-style-type: none"> • Any heartrot fungi present; OR • Sap-rotting fungi present on trees <60 cm dbh where saprot width is >6 cm
Tree lean (TL) (for class 1–3 trees)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >15% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)
Tree lean (TL) (for class 4–8 trees)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)	Lean >10% toward target/work area AND tree has rooting problems (e.g., damaged roots; shallow, compacted or wet soils; cracked or lifting root mat; steep slope)
Root inspection	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots	Occurrence of any of the following: root pull or lifting root mat; visible damage or decay to roots affects >50% of lateral roots.

NOTE: Structural weakness includes decay, cracking, breakage, embedded bark or cracking at forks or multiple stem unions, presence of conks, stem scars, and woodpecker cavities.

* Perennial cankers are generally circular to lens-shaped cankers that can persist for years, and slowly expand at about the same rate as the radial growth of the affected live tree. They gradually take on a sunken appearance as tissues under the dead cambium do not grow along with the surrounding wood. They are sometimes called "exploding cankers."

** If identity of wood decay fungus cannot be determined (e.g., saprot or heartrot), then default to Dangerous rating. Where *Phellinus pinis* present, if the stem has structural damage such as a broken top or scarring which allow oxygen exchange or other stress indicators (e.g., resinosis, damaged roots), OR if there are conks distributed along the bole length, then default to Dangerous rating.

*** An alternate safe work procedure for dealing with fungal conks on live trembling aspen is described in Appendix 7.

Table 3b. Danger Tree Assessment Process for Level 4 Disturbance Activities

When conducting level 4 disturbance assessments, only the following four types of trees are rated safe. All other trees will be rated Dangerous for Level 4 activities.

Level 4 Disturbance

S = Safe if tree is one of the following:

- class 1 tree (all species)
- class 2 trees with NO structural defects (all species) (usually wind- or snow-snapped green trees, light fire scorching).
- class 2 cedars with LOW failure potential defects (refer to table below)
- class 3 conifers with NO structural defects (tree recently killed by insects, climate or light intensity fire—these will have no structural damage or decay)

D = Dangerous all other trees (fall tree; create a no-work zone; or remove hazardous parts)

CLASS 2 CEDAR TREES ARE SAFE **FOR LOD 4** IF THEY FIT THE FOLLOWING CRITERIA:

Defect Category	Western Redcedar, Yellow cedar LOW FAILURE POTENTIAL
Hazardous top (HT)	Defective top (e.g. secondary top, spike) <30% of tree height, with no evidence of decay, cracking, failure or other structural weakness
Dead limbs (DL)	Dead limbs (no size limit) with no evidence of decay, cracking or failure
Split trunk (ST) (includes frost, lightning and wind-induced cracks; does not include dry checking)	Crack or split >2 cm wide extending <50% of tree diameter into stem; no evidence of decay in surrounding stemwood
Stem damage (SD) (includes scarring, fire damage, machine damage, animal damage or butt rot)	<50% of tree cross-sectional area damaged, scarred or fractured with no evidence of decay in remaining stemwood
Tree lean (TL) (for class 1 and 2 trees)	Lean <30% (16°) toward target/work area and tree has no rooting problems
Lean — candelabra branched trees (for class 1 and 2 trees) (where candelabras are predominantly on lean side of tree)	Lean <10% (5°) toward target/work area and tree has no rooting problems
Root inspection (RI)	No visible problems: no root pull or lifting root mat. Any visible structural damage to roots only affects <25% of lateral roots (remaining roots undamaged)

Any leave tree that is damaged during the work activity must be reassessed if work is to continue within reach of the tree.

Safety Procedures (for suspect trees that have been assessed)

Safe (S)

- tree safe to work around, no removal or modification necessary
- mark tree if required
- if necessary prior to further work occurring on site, reassess tree at a later time as an “indicator” tree (i.e., indication of site-specific changes to tree hazard due to changes in fire conditions).

Dangerous (D)

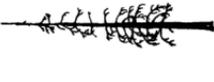
- mark tree if required
- remove tree
- remove dangerous part of tree (e.g., hazardous limb)
- flagged no work zone

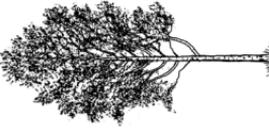
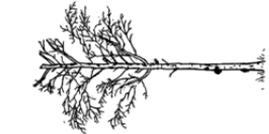
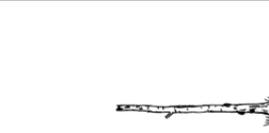
Reassessment of Trees

Re-assessment of previously assessed area should occur if:

1. Build-up index values are above the established thresholds and there is continuous active burning within the area of work, **or**
2. More than three days with continuous burning have passed since the last assessment, **or**
3. The work activity in the area creates more disturbance than what the area was originally assessed for.

Tree Class Comparison for Conifers and Hardwoods (Broad Leaf Deciduous)

Tree class	DEAD									DEAD FALLEN
	LIVE			Hard			Spongy		Soft	
	1	2	3	4	5	6	7	8	9	
Conifer										
	Live/healthy: no decay or structural damage.	Live/unhealthy: internal decay or growth deformities or other structural damage (including stem damage, dead or broken tops); dying tree.	Dead: recently dead; needles or fine twigs present.	Dead: no needles/twigs; 50% of branches lost; only larger limbs remain; often loose bark.	Dead: most branches/bark absent; some internal decay.	Dead: very little branches or bark; sawwood/heartwood may be sloughing from upper bole; decay more advanced; lateral roots of larger trees usually softening.	Dead: extensive internal decay; outer shell may be hard; lateral roots usually completely decomposed; hollow or nearly hollow shells.	Dead: extensive internal decay; outer shell may be hard; lateral roots usually completely decomposed; hollow or nearly hollow shells.	Debris: downed trees or stumps.	

Tree class	DEAD						DEAD FALLEN
	LIVE		4		5		
	1	2	3	4	5	6	
Broad Leaf Deciduous							
	Live/healthy: no decay or structural damage.	Live/unhealthy: internal decay or growth deformities or other structural damage (including stem damage, dead or broken tops); dying tree.	Dead: no needles/twigs; 50% of branches lost; only larger limbs remain; often loose bark.	Dead: most branches/bark absent; some internal decay.	Dead: very little branches or bark; sawwood/heartwood may be sloughing from upper bole; decay more advanced; lateral roots of larger trees usually softening.	Dead: extensive internal decay; outer shell may be hard; lateral roots usually completely decomposed; hollow or nearly hollow shells.	Debris: downed trees or stumps.

Common Tree Species Name and Codes

<u>Tree Species</u>	<u>Code Symbol</u>
Douglas -fir	Fd
Western larch	Lw
Lodgepole pine	Pl
Pondersoas 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

CFFDR Fuel Type Descriptors

FBP System		
Fuel types		
Group	Identifier	Description
Coniferous	C-1	Spruce-lichen woodland
	C-2	Boreal spruce
	C-3	Mature jack or lodgepole pine
	C-4	Immature jack lodgepole pine
	C-5	Red & white pine
	C-6	Conifer plantation
	C-7	Ponderosa pine - Douglas fir
Deciduous	D-1	Leafless aspen
Mixedwood	M-1	Boreal mixedwood- leafless
	M-2	Boreal mixedwood- green
	M-3	Dead balsam fir mixedwood- leafless
	M-4	Dead balsam fir mixedwood- green
Slash	S-1	Jack or lodgepole pine slash
	S-2	White spruce/balsam slash
	S-3	Coastal cedar/hemlock/Douglas fir slash
Open	O-1a	Matted grass
	O-1b	Standing grass

* M-1 & M-2 are transitional between C-2 and D-1

Helicopter Category

Type 1 (Heavy)

Type 2 (Medium)

Type 3 (Intermediate)

Type 4 (Light)

The following listing provides examples of common aircraft by helicopter type, and is a useful guide when determining the appropriate level of disturbance for the type of aircraft being used.

Heavy Category: Bell 214, Kamov, Sikorsky 61 & 64, Boeing Vertol 107 & 234

Medium Category: K-Max, Bell 204, 212, 205

Intermediate Category: Long Ranger (206L), A-Star (AS350), Bell 407, EC 130

Light Category: Jet Ranger (Bell 206), Hughes 500, Hiller 12, EC 120, R22 & R44