

# **6**

## **Stump Cruising**

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## 6.1 Introduction

The methods described in this chapter are prioritised by safety considerations and the most accurate answer obtainable.

- all species, including deciduous, must be tallied,
- all stumps and/or felled trees, including non-merchantable (species and size) must be tallied,
- appropriate timber merchantability specifications will be used. Refer to Sections [4.3.1.16](#) and [5.2.7](#).
- if the volume can be isolated through the official scale, then utilize the scale volume plus a residue and waste volume for the area, and
- if there are situations that arise and the following methods do not apply, contact the Regional Cruising Coordinator in the area.

### 6.1.1 General Procedures

The standards provide the basis for the sampling system to be used, and the rules for consistent and accurate measurement and compilation of the stumps and tree heights.

The application of a 100 percent stump cruise of an area is currently the most accurate method of volume determination available to the Ministry of Forests, Lands and Natural Resource Operations where unauthorized harvest (UTH) has occurred. The 100 percent stump cruise methodology eliminates the chance of statistical variation that may be attributed to plot sampling.

The regression coefficients and equations used in the conversion of stump diameter to diameter breast height (DBH) are listed in the February, 1989 FRDA publication “Stump and Breast Height Diameter Tables for British Columbia Tree Species”, report #062.

[www.for.gov.bc.ca/hfd/pubs/Docs/Frr/Frr062.htm](http://www.for.gov.bc.ca/hfd/pubs/Docs/Frr/Frr062.htm)

Refer to the following tables in the appendices:

Butt Taper – Mature – FIZ A, B and C – Coast  
Constants for Species and Zones

Crown cutting authorities specify a 30 cm stump height.

The following information must be provided with the volume estimate:

- the source of the tree heights – the sample tree heights must originate from the same BEC subzone and the same timber type. Tree heights may be available for the stump cruise area if it was previously cruised. If the area was not previously cruised, tree heights are measured from an adjacent and similar timber type (within the same BEC subzone) for each major species in the stump cruise,
- data listing or plot summaries and evidence of data reconciliation,
- age in 10s reported on the tally card, to determine which loss factors were used in the compilation,
- traverse sheets and tally cards must be signed,
- record the type of instruments used,
- the notes recorded correctly and ground slope recorded which is required to calculate horizontal distance.(i.e.,  $HD = \cos(1/\tan(\text{slope}\%/100))$  See Distance Slope Correction in appendices), and
- maximum closing error allowed is 1 percent. However, if the UTH is a 100 percent cruise an area measurement is not required to compile volume. An area is required if there will be a penalty rate set on a per hectare basis or if the stump cruise is a fixed area plot sample.

The reliability of the estimate is a function of the following:

- the degree of fit of the stump to DBH conversion equations, volume equations, loss factors and height curves to the harvest area,
- the non-sampling error (fieldwork), and
- the accurate transfer of data to the compilation program.

In order to review the degree of fit of the taper equations used in the stump cruise compilation program, the following process should be followed:

- Measure the height and DBH of trees in adjacent, similar timber types within the same biogeoclimatic subzone. The trees may be sample trees used for the height curves.
- Determine the volume estimate of these trees using the compilation program.
- Measure the diameter inside bark at stump height of these same trees by cutting bark windows at 30 cm above POG or a similar method.

- Determine the volume estimate of these same trees using the diameter inside bark and measured tree height in the stump cruise compilation program.
- Compare these 2 volume estimates to determine the degree of fit of the equations used for the stump cruise area.

### 6.1.2 Stump Cruising - Volume Calculations

The detailed compilation of stump cruise data is as follows:

- the species, age and Forest Inventory Zone (FIZ) that the stump cruise area is located in determines the regression coefficients used in the regression equation that is used to convert the stump diameter inside bark (dib) and stump height measured from the point of germination (POG) to an equivalent DBH outside bark (dob). Refer to Figure 4.12 for point of germination illustrations. The stump dib may be measured in centimetres (cm) or radius class units (1 rad = 2 cm) and the stump height is measured in cm. The POG is used for measuring stump height because the stump to DBH conversion equations are based on POG.

Tree heights are measured from an adjacent and similar timber type (within the same BEC subzone) for each major species (comprising 20 percent or more of the volume on the area) in the stump cruise and these are used to produce DBH curves by the compilation program. Minor species (comprising less than 20 percent of the volume on the area) can be grouped with a major species within the same forest type or have their own height curve produced provided that there are 20 or more height samples collected. The compilation program analyzes various mathematical descriptions of the curve and selects the curve with the lowest standard error of the estimate for volume.

- The tree data is now in standing tree format. The tree volume is calculated by the Kozak taper equation in the compilation program that has specific coefficients for the species and the FIZ group where the area is located. The equation produces a gross tree volume for the tree from the DBH outside bark (dob) and height that is assigned to the tree from the height DBH curve, and
- the net volume factors for decay, waste and breakage (DWB) by FIZ, species, diameter class, and risk group are then applied to reduce the gross volume to a net merchantable volume. Reference is the Ministry of Forests, Lands and Natural Resource Operations publication - "Metric Diameter class Decay, Waste and Breakage Factors, All Forest Inventory Zones - 1976". This is the volume from the measured stump height (cm) to a minimum top dib (cm) specified in the cruise control card or Map Area Statement minus an allowance for DWB. The DWB deductions are based on MFLNRO Inventory decay and taper data collected for all commercial species and the data is partitioned into Forest Inventory Zones (FIZ's) and Public Sustained Yield Units (PSYU's). In some circumstances local factors apply to a portion of a FIZ. All volumes are reported in cubic metres by species.

### 6.1.3 Sampling Errors

Potential sources of sampling errors are:

- variation between the decay, waste and breakage for the FIZ and PSYU versus the actual site. The age in 10's and tree classes recorded on the stump cruise tally cards determine the maturity class and risk group,
- variation between the equation to convert from stump diameter to DBH versus the actual DBH. For example, the standard error for spruce noted in [FRDA report 062](#) is as follows:

Spruce: 1.46 cm - coefficients are based on a sample of 3054 trees in FIZ's K and L.

- variation between the calculated tree volume based on the volume equation and the actual volume. The only way to measure this variation is to fall/buck and scale trees from the same timber type that was harvested and perform a taper study, and
- variation between the height DBH curve and the actual tree heights for the harvested trees. The important factors are that the timber type used for the source of the tree height data is similar to the harvested timber type and the full range of diameter classes measured in the stump cruise are represented in the height curves.

## 6.2 Boundaries

- Locate legal survey posts and confirm the boundary location. Re-establish cut block boundaries from original traverse notes if necessary.
- Closed traverse the UTH area to the tolerances set out in Section [3.5](#) of the *Cruising Manual* under cruise based allowable errors.
- If the unauthorised harvest will result in an administrative penalty under Section 52 of the [Forest and Range Practices Act](#) and Section 13 of the [Administrative Orders and Remedies Regulation](#), then a closed traverse of the area will be required since the penalty levied is in dollars per hectare.

## 6.3 Measurement Methods

The following methods are listed in order of preference. If stumps are lower than 30 cm height at the point of germination (POG), record the actual height as the additional volume removed will be included with the UTH volume in the compilation.

### 6.3.1 Method 1: Areas Less than 10.0 ha

Conduct a 100 percent cruise of the trees if the trees are still full length. If the trees have been bucked into log lengths, scale them as per scaling procedures outlined in the [Scaling Manual](#).

If the UTH area is within a homogeneous pine or pine and spruce timber type of a density of 1 000 stems per hectare or more and greater than 3.0 ha, method 2 may be used.

### 6.3.2 Method 2: Areas Greater than or Equal to 10.0 ha

The sampling intensity must be sufficient that a sampling error of plus or minus 8 percent is achieved at the 95 percent confidence interval.

If the sampling error cannot be achieved, establish 400 m<sup>2</sup> (0.04 ha) plots at an intensity to cover at least 10.0 percent of the area. A grid spacing of 60 m should be sufficient to ensure plot coverage of 10.0 percent of the area.

Establish 400 m<sup>2</sup> (11.28 m radius) fixed area plots on a systematic grid. Record all of the necessary information for each stump in the plot (i.e., pith of stump is within 11.28 m of plot centre).

## 6.4 Timber Available For Measuring

This method can be used if the timber is safe to measure and the cruiser or scaler can match the tree to its stump.

The following points apply to all options under Section [6.4](#).

### 6.4.1 Tally Card - FS 205S

Use the [Figure 6.4 FS 205S Ministry of Forests, Lands and Natural Resource Operations Stump Cruise Tally Sheet](#), unless the timber will be scaled. If the timber is scaled, use the FS 161 residue and waste tally sheet.

Record the Enforcement Action Administrative Review and Appeals (ERA) system case file number (i.e., DPA960001) in the licence and cutting permit header box.

Code column 26 of each stump cruise tally sheet with a unique letter (A to Z) or number (0 to 9). This code will simplify the field data reconciliation in the cruise compilation.

### 6.4.2 Field Measurements

If performing a cruise of the felled trees, complete the [Figure 4.1 Cruise Tally Sheet – FS 205C \(front side\)](#), as you would for a regular fixed area cruise and record all of the necessary information including pathological indicators and quality remarks. The cruiser must sign and date each tally card.

Record the total length of each tree in the height field and include the height of the stump in the total tree length.

Record the DBH of the felled trees and account for the stump height when determining DBH.

Use the [Figure 6.4 FS 205S Ministry of Forests, Lands and Natural Resource Operations Stump Cruise Tally Sheet](#), if measuring the stump heights and diameters. Record the total tree lengths in the margin of the tally sheet beside each stump tally.

All stumps and corresponding trees must be numbered. Each stump and its corresponding tree must be numbered with the same unique number.

## 6.5 All Stumps Removed From the UTH Area (i.e., Land Cleared, Road is Built)

### 6.5.1 Option 1

Perform a variable plot cruise or fixed area cruise in the adjacent timber as per the *Cruising Manual* to determine the net volume per hectare.

Measure the length of the timber edge along the UTH area and space the plots equally along the timber edge.

### 6.5.2 Option 2

Use the net volume per hectare from the cruise information for an adjacent cutting authority if the timber types were the same on the forest cover map.

### 6.5.3 Option 3

Use aerial photographs (approximate scale 1:3000 is recommended) taken before and after the UTH occurred. Ensure that before and after aerial photos are enlarged to the same scales for photo interpretation. Use the following procedure to determine a volume estimate for the UTH:

1. A qualified photo interpreter can identify the tree count by species removed from the UTH cleared area based on the pre-harvest and post harvest aerial photographs. The UTH boundary must be transposed to the aerial photographs using legal map references and iron pin (legal references) wherever possible.
2. Field staff must attend the site and measure tree heights and diameters at breast height (DBH) of all species identified on the pre-harvest aerial photos that were cut from the UTH area. Selected measured trees of various heights must be stem mapped with bearing and distance recorded to points on the ground that are visible on the post-logging aerial photograph. This will assist the photo interpreter in determining the tree heights of the cut trees on the pre-harvest aerial photographs.
3. The tree height and DBH data estimated for the removed trees must be plotted onto a height DBH curve by species (x-axis DBH, y-axis height). The height/DBH relationship will be used to interpolate tree diameters for the tree heights that were estimated by the photo interpreter for the removed trees.
4. Using the tree heights estimated by the photo interpreter and the diameters interpolated from the height DBH curve, compute a merchantable volume for the UTH using the cruise compilation program.

## 6.6 Portions of Trees Removed (i.e., Shake Blocks or Special Forest Products Removed From a Segment of Tree(s))

Use the residue and waste tally sheet FS 161 to record the missing and remaining portions of the tree using scaling procedures in the [Scaling Manual](#). Code the missing portion(s) as "A" for remaining and "U" for missing under the "Waste/Residue Class" column. These codes will permit segregation of the removed and remaining volumes in the Block Type Summary Report of the residue and waste systems reports.

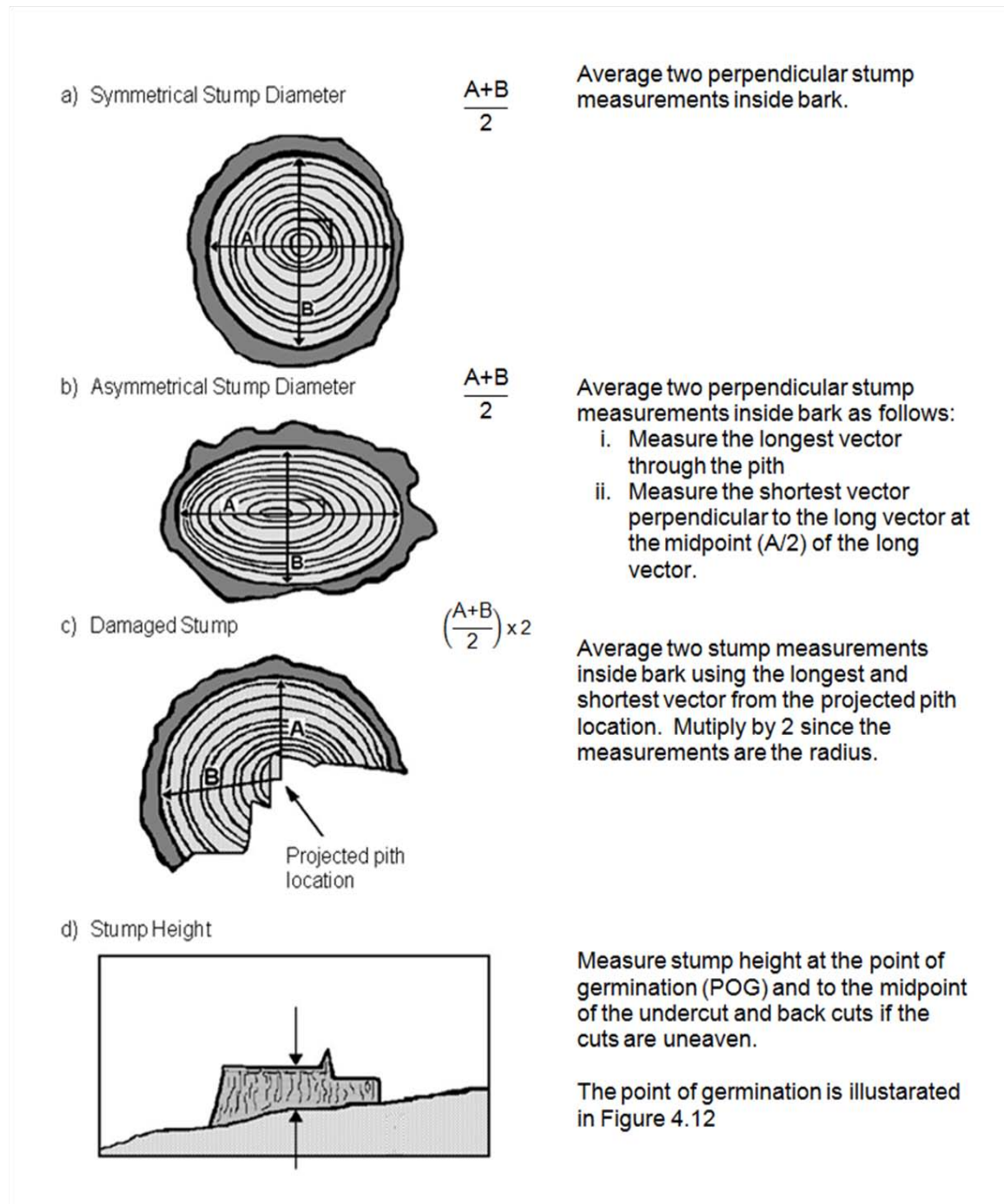
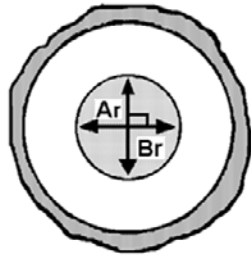


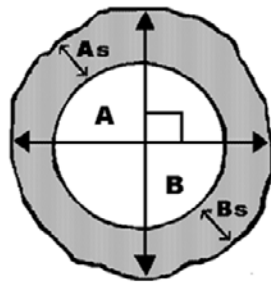
**Figure 6.1 Examples of Recommended Stump Measurements.**

## a) Stumps with Heartrot &gt; 50% of Stump Diameter



- i. Determine stump diameter inside bark using long and short vectors -  $\frac{A+B}{2}$
- ii. Determine the rot diameter using long and short vectors -  $\frac{A_{rot} + B_{rot}}{2}$
- iii. If the rot diameter is greater than half the stump diameter, record scar or scar and frost crack to ensure that the stump is compiled as Risk Group 2.

## b) Dead Stumps



- i. Determine stump diameter inside bark using long and short vectors -  $\frac{A+B}{2}$
- ii. Determine average thickness of the sap rot -  $\frac{A_{s} + B_{s}}{2}$
- iii. If the average sap rot thickness is 1/6 or more of the average stump diameter, record the stump as a tree class 4 (dead useless). If not, record the stump as tree class 3 (will be compiled as highest risk group).

Figure 6.2 Examples of Risk Group Determinations for Stumps.

## 6.7 Stump Cruise Tally Sheet (FS 205S)

### 6.7.1 Card Type 9

Record the Enforcement Action Administrative Review and Appeals (ERA) system case file number (i.e., DPA960001) in the licence and cutting permit header box. The first three characters identify the administrative organization unit, the next two characters identify the fiscal year, and the last four characters identify the number of the incident in the Administrative Organizational Unit (AOU) for the reporting year. The ERA file number must be recorded in the locality description boxes in Card Type A of the Map Area Statement.

Complete the [Figure 6.4 FS 205S Ministry of Forests, Lands and Natural Resource Operations Stump Cruise Tally Sheet](#), and sign and date each one.

Code column 26 of each stump cruise tally sheet with a unique letter (A to Z) and/or number (0 to 9). This code will simplify the field data reconciliation of the cruise compilation.

If the stump cruise is 100 percent measure, do not enter a plot size in the fixed area plot size on card type 9. Enter an "A" in column 77 of the map area statement. The plot size field will be overridden by the type areas in the map area statement, card type D.

The stump cruise tally sheet, Card Type 3 height sample trees cannot use the same tree numbers that are used on the Card Type 2's on the same tally sheet. If necessary, the tree heights may be entered on a separate tally sheet, however the plot must be used in the determination of the plot size calculation and assigned a unique plot number.

### 6.7.2 Card Type 3

#### 6.7.2.1 Positions 2 to 24

Common to Card Type 1 and 2.

#### 6.7.2.2 Positions 25 and 26 Tree Number

Sample trees must be numbered 99, 98, 97, etc. to prevent confusion with stumps numbered on the plot.

#### 6.7.2.3 Positions 27 to 29 Total Height

Enter the calculated height plus correction.

Tree heights must be selected from a similar timber type and nearest adjacent area wherever possible. Adjacent height curve equations or tree heights from existing data may be acceptable if the data is validated in the field.

## Height Sample Size

For each major species, a minimum of 20 tree heights are required per timber type evenly distributed throughout the full range of diameters at breast height (DBH) represented on the UTH area. These sample heights must be evenly distributed throughout each type or site-class (i.e., at least one sample height per plot for damaged stands). A species is considered major if it comprises 20 percent or more of the UTH area gross volume.

If it appears that a certain species exhibits a similar height/DBH relationship in two or more forest types in the same area, it is permissible to develop a common height - DBH curve; the tree heights for a given species must be similar throughout the DBH range common to the species. In this case only, a total of 20 sample trees need to be measured within the two or more forest types.

**A similar height/ DBH relationship means an average height variation that does not exceed 3 percent over the full range of DBH's between two sets of data.**

There are 3 options for sampling the height of a minor species, or species that are less than 20 percent of the UTH area gross volume. These options are listed in order of preference:

1. Select a minimum of 10 tree heights per minor species per timber type and evenly distributed throughout the full range of stump diameters measured on the UTH area. This data will be used to produce a height/ DBH curve.
2. Combine the minor species with another species within the same timber type and with a similar height/ DBH relationship.
3. In situations where only a few trees of a high value species are present, consider the following method. Measure two or more standing trees of the same species and 5 cm diameter class outside bark at the equivalent stump height as the stump measurement. Calculate the average for the measured tree heights and apply the average to the minor species trees.

## Height Sample Selection (Height/ DBH Curve)

All trees must be marked and numbered at the point of DBH (to facilitate checking) so that the number can be seen when standing at the plot centre.

Abnormal trees such as leaning trees, trees with heavy sweeps, broken tops or forks must not be used as height sample trees. Trees with minor forks or crooks may be used if these trees comprise a considerable portion of the stand.

Dead potential trees should not normally be selected as height sample trees. Assuming that these stems died as a result of low vigour and/or pathological depletion, their growth rate would be less than average, their heights could unduly bias that species' height/ DBH

curve. However, if a significant proportion of the population of a certain species is classed as dead potential, a representative number of dead potential stems should be sampled for height.

### **Height Sample Distribution (Height/ DBH Curves)**

Measurements of height and DBH are required so that height/DBH relationships can be developed. Therefore, height sample trees must cover the range of heights and DBH's in the stand. Each height curve must represent only one species and have at least 2 sample trees for each 10 cm DBH class unless 2 species exhibit similar height/DBH relationships. The reference point for DBH and height is the high side of the tree as shown in [Figure 4.12 Breast height in Relation to High Side.](#)

Height samples must be distributed as follows for each species:

|         |                                                      |
|---------|------------------------------------------------------|
| Measure | 1/4 in the dominant crown class                      |
| Measure | 1/2 in the co-dominant crown class                   |
| Measure | 1/4 in the intermediate and overtopped crown classes |

## Crown Classes

There are four crown classes as follows:

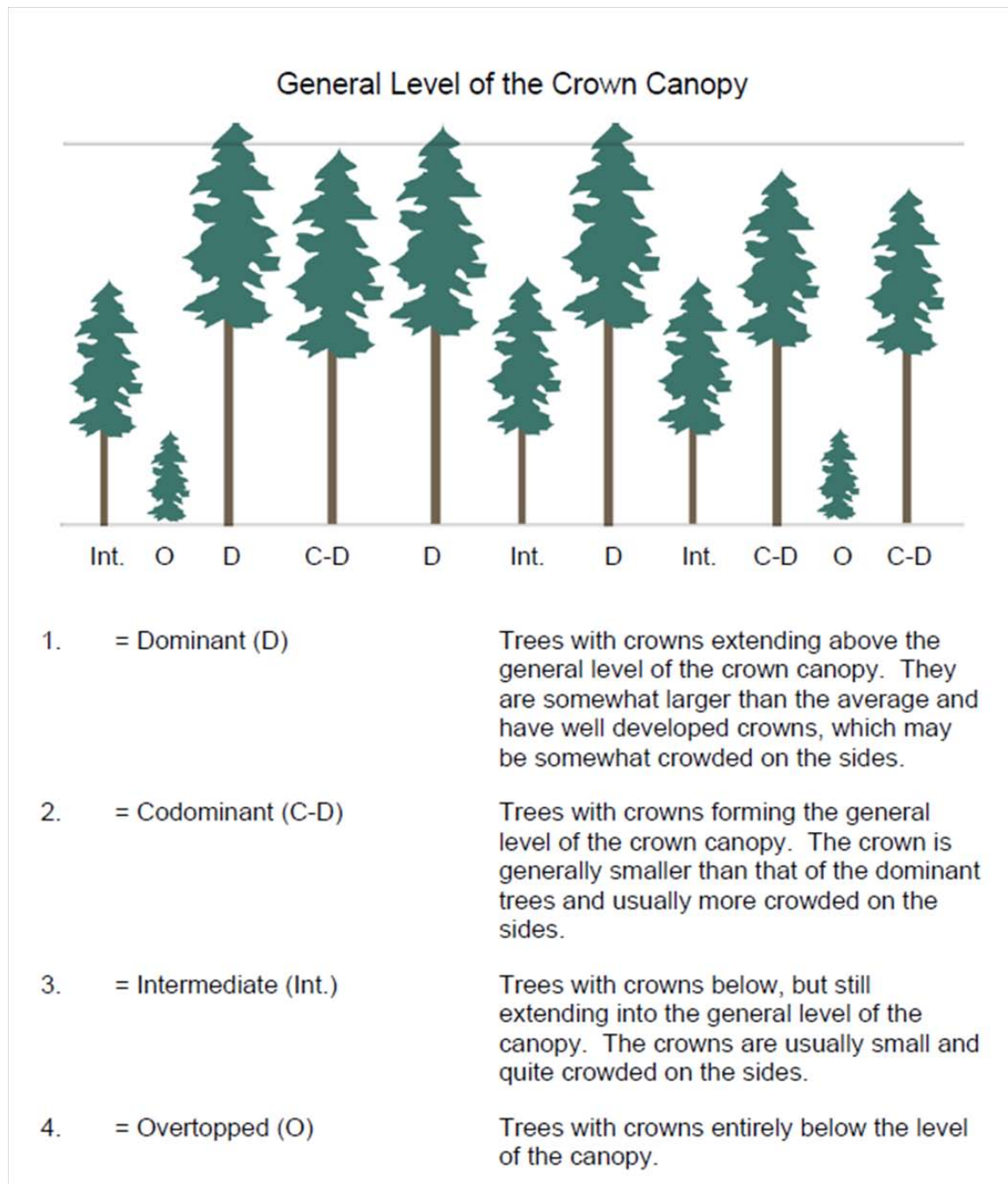


**Figure 6.3 Crown Classes.**

## Height Sample Measurements

Tree heights will be measured from the ground on the high side of the tree. The total height is measured to the highest point of the crown. The most important aspect of measuring a tree height is seeing clearly to the top and DBH or bottom of the tree.

Consideration must be given to:

1. Slopes: trees standing adjacent to each other for comparison may not be on the same contour or elevation (i.e., uphill or downhill).
2. Understory trees and underbrush.
3. Tree length of leaning trees must be measured if they lean more than 10 (ten) degrees from vertical. (Section [4.3.2.3.2](#))

Paint an "S" on the sample tree facing the direction that the sample tree height was measured from. Measure the length at a 90 degree angle from the direction of the lean. Apply the Pythagorean formula to calculate the tree length.

### 6.7.2.4 Positions 30 and 31 Species

See Section [4.3.2.4](#)

### 6.7.2.5 Positions 32 to 35 DBH

See Section [4.3.2.5](#)

### 6.7.2.6 Position 36 C/C Crown Class

Enter the Crown class for the tree by number code as shown in [Figure 6.3 Crown Classes](#).

### 6.7.2.7 Positions 37 to 39 Total Age (see Section 4.3.2.6)

The age of at least three co-dominant sample trees for each major species must be established for each forest type if the age of the forest type is as follows:

- coniferous – 90 to 150 years,
- deciduous – 20 to 60 years, or
- aspen/cottonwood (FIZ K and L) – 50 to 170 years.

If the age of the forest type is not within the above limits, the age of at least one co-dominant sample tree for each major species must be established for each forest type.

To determine the age in stump cruises, simply count the rings on the stumps.

Calculate the ages as follows:

1. Boring Height – always 1.3 m above high side (breast height).
2. Breast Height Age – enter the age of the tree measured at the boring height according to the ring count (pith counts for one year).
3. Correction – use the [Site Index Tables for British Columbia All Species](#) (Appendix 9). Go to the bottom of the appropriate Site Index Table and note the “Years to bh” (years to boring height) correction value based on the top height and counted age at DBH for the tree.
4. Total Age – the sum of the Breast Height Age and the Correction.

#### 6.7.2.8 Position 40 Partial Cutting

|            |             |
|------------|-------------|
| L          | Leave tree. |
| Blank or C | Cut tree.   |

[illegible]

**Figure 6.4 FS 205S Ministry of Forests, Lands and Natural Resource Operations  
Stump Cruise Tally Sheet.**

[illegible]

**Figure 6.56 FS 205S Ministry of Forests, Lands and Natural Resource Operations  
Stump Cruise Tally Sheet (side 2 of 2).**

## 6.8 Map Area Statement (FS 121)

A map area statement ([Figure 5.1 Front Side of Map Area Statement Form \(FS 121\).](#)) must be completed for stump cruises according to Chapter [5 Ministry of FLNR Map Area Statement \(FS 121\).](#)

### 6.8.1 Card Type B

The following positions in Card Type B are specific to stump cruises only:

#### 6.8.1.1 Position 78 Stump Diameter Measurement Type

Code "C" if the stump diameters inside bark are measured in centimetres.

Code "R" if the stump diameters inside bark are measured in radius class units (rads).

Stump height must be in centimetres above point of germination.

#### 6.8.1.2 Position 79 Diameter Measurements

Code "I" for inside bark.

#### 6.8.1.3 Position 80

Code "S" for stump cruise.

### 6.8.2 Card Type E

#### 6.8.2.1 Position 1

Height/DBH Description - Stump Cruises & Severely Damaged Stands

This card is used to calculate a height/DBH equation for a species within a stratum or forest type.

The sample trees for one major species occurring in two or more types can be combined into one equation, which will be applied against all trees of that species for the designated types.

The sample heights for two or more different minor species exhibiting similar growth characteristics can be combined with a major or minor species into one equation so that

all trees of the combined species in the Card Type E will have their heights calculated by the same equation.

Examples:

| CARD TYPE |                      | HEIGHT/DIAMETER DESCRIPTION |    |    |                |              |    |    |                   |        |        |           |    |          |          |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
|-----------|----------------------|-----------------------------|----|----|----------------|--------------|----|----|-------------------|--------|--------|-----------|----|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----|----|----|----|
|           |                      |                             |    |    | CALC. HT. ONLY | SPECIES USED |    |    | FOR THESE SPECIES |        |        | TYPE USED |    |          |          |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
|           |                      |                             |    |    |                |              |    |    | SP. #1            | SP. #2 | SP. #3 |           |    | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. |    |    |    |    |    |    |    |    |    |    |    |
| 1         | EXAMPLE              | 11                          | 12 | 13 | 14             | 15           | 16 | 17 | 18                | 19     | 20     | 21        | 22 | 23       | 24       | 25       | 26       | 27       | 28       | 29       | 30       | 31       | 32       | 33       | 34       | 35       | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |
| E         |                      | 1                           |    |    | 0              | F            |    | B  |                   |        |        |           |    | 0        | 1        |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         | DUPLICATE FROM ABOVE | 2                           |    |    | 0              | P            | A  | P  | W                 | P      | Y      |           |    | 0        | 3        | 0        | 4        |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      | 3                           |    |    | 1              | P            | A  | L  |                   |        |        |           |    | 0        | 3        |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      | 4                           |    |    | 0              | F            |    | C  |                   | H      |        | R         |    | 0        | 1        | 0        | 2        | 0        | 3        | 0        | 4        |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      |                             |    |    | 0              | F            |    | S  |                   | P      | L      | C         | T  | 0        | 1        | 0        | 2        | 0        | 3        | 0        | 4        |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      |                             |    |    | 0              | F            |    | B  | 1                 |        |        |           |    | 0        | 1        | 0        | 2        | 0        | 3        | 0        | 4        |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      |                             |    |    |                |              |    |    |                   |        |        |           |    |          |          |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      |                             |    |    |                |              |    |    |                   |        |        |           |    |          |          |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      |                             |    |    |                |              |    |    |                   |        |        |           |    |          |          |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |
| E         |                      |                             |    |    |                |              |    |    |                   |        |        |           |    |          |          |          |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |

Figure 6.6 Height/ DBH Description Card.

|            |                                                                                                                                                                                                                                                                                                                                                                                                |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example 1. | One height/ DBH equation will be produced from all the F and B sample trees (Card Type 3) submitted in Type 1. This equation will be labelled as an equation for F in Type 1. All F and B trees without heights (Card Type 2) in Type 1 will have their heights calculated by this equation.                                                                                                   |
| Example 2. | One height/DBH equation will be produced from all the Pa, Pw and Py sample trees (Card Type 3) submitted in Type 3 and 4. This equation will be labelled as an equation for Pa in Type 3. All Pa, Pw and Py trees without heights in Type 3 and 4 will have their heights calculated by this equation.                                                                                         |
| Example 3. | The height/DBH equation for PA in Type 3 will be used to calculate the tree heights of all L and Pa trees without heights in Type 3.                                                                                                                                                                                                                                                           |
| Example 4. | If producing one curve for all the species and there are too many species for one line, the species can be continued on the next line(s). The first species and first type on each line must be repeated (otherwise they will each be treated as separate curves).<br><br>The program will combine all these lines (in the example) and produce one curve. The column 14 can be either 0 or 1. |

#### 6.8.2.2 Positions 2 to 10

Common to all Card Types.

## 6.8.2.3 Positions 11 to 13

Not used.

## 6.8.2.4 Position 14 Calculated Height Only

| Code       |                                                                                                                                                                                                                                                                                             |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0 or blank | The sample trees from all the species (columns 15 to 22) and all the types (columns 23...) will be grouped together to calculate one height/DBH equation. The height from this curve will be used for all of the plot trees of the species and types entered on the line.                   |
| 1          | Sample trees from only the species used (columns 15 to 16), and only the type used (columns 23 to 24) will be used to make an equation. The heights from this equation will then be applied to all of the species (columns 15 to 22) and all the types (columns 23...) entered on the line. |

| CARD TYPE | HEIGHT/DIAMETER DESCRIPTION |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
|-----------|-----------------------------|----|----|----------------|--------------|-------------------|--------|--------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|--|--|--|--|--|
|           |                             |    |    | CALC. HT. ONLY | SPECIES USED | FOR THESE SPECIES |        |        |          |          |          | TYPE USED |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
|           |                             |    |    |                |              | SP. #1            | SP. #2 | SP. #3 | TYPE NO. | TYPE NO. | TYPE NO. |           | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. | TYPE NO. |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| 1         | 11                          | 12 | 13 | 14             | 15           | 16                | 17     | 18     | 19       | 20       | 21       | 22        | 23       | 24       | 25       | 26       | 27       | 28       | 29       | 30       | 31       | 32       | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |  |  |  |  |  |  |  |  |  |  |
| E         | EXAMPLE                     |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         | DUPLICATE FROM ABOVE        |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         | EXAMPLE                     |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |
| E         |                             |    |    |                |              |                   |        |        |          |          |          |           |          |          |          |          |          |          |          |          |          |          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |  |  |  |  |

Figure 6.7 Height/ DBH Description Card.

Column 14 determines how the equation will be formulated.

|            |                                                                                                                                                                                                                                                                                                                         |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Example 1. | if column 14 is <u>0</u> it means; the sample trees from <i>all</i> the species listed (F, C, H) and <i>all</i> the types listed (1, 2, 3, 4) will be grouped together to produce a curve. The heights for all F, C, H in types 1, 2, 3, 4 on card type 2 will be assigned from this curve.                             |
| Example 2. | if column 14 is <u>1</u> it means: the sample trees from only the first species- F - (columns 15 and 16) in the first type -3- (columns 23 and 24) will be used to produce a curve. The heights from this curve will <i>then</i> be applied to <i>all</i> of the species in <i>all</i> of the types listed on the line. |

#### 6.8.2.5 Positions 15 to 16 Species Used

If only one species is used, enter that species. If more than one species is used, then enter the major species. All trees of the species in positions 17 to 22 and type number in positions 23 to 80 will use this equation.

#### 6.8.2.6 Positions 17 to 22 For These Species

Enter the species which will be grouped with the species entered in the positions 15/16.

#### 6.8.2.7 Positions 23 to 24 Type Used

If only one type is used, enter that type. If more than one type is used, enter the type that has the Site Code and Type Identity (Card Type C fields) values that describe the whole group.

#### 6.8.2.8 Positions 25 to 80 For These Types

Enter the types whose species will be amalgamated.

Type numbers must be zero filled (e.g., 01, 02, etc.).