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BY EMAIL

To: Regional Managers

From: Bill Howard
Director
Revenue Branch

Re: **Cruising Manual**

The purpose of this memo is to inform you that Amendment #1 to the 2004 *Cruising Manual* becomes effective on July 1, 2004. The new manual can be downloaded from the following Internet site:

<http://www.for.gov.bc.ca/hva/manuals/cruising/index.htm>


The transmittal document for Amendment #1 is attached.

Comments or questions about this manual should be referred to Don Rorison, Cruising Projects Specialist, Revenue Branch at 250-356-7674 or Reed Vickers, System Analyst, Revenue Branch at 250-387-8358.

Please refer all public or hard copy requests for the manual amendments to Crown Publications, 521 Fort Street, Victoria, British Columbia, V8W 1E7, telephone 250-386-4636 or facsimile at 250-386-0221.



VANCOUVER 2010

for 
Bill Howard
Director
Revenue Branch

Attachment



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Table with manual details: MANUAL TITLE (Cruising Manual), AMENDMENT NO. (Amendment No. 1), ISSUE DATE (July 1, 2004), PUBLICATIONS CO-ORDINATOR (Judy Laton), AUTHORIZATION (W. Howard, Director, Revenue Branch)

Please make the following changes to your copy of the above Ministry manual. Please insert the following specified pages and file this notice immediately after the Amendments Tab.

Table with 4 columns: ACTION (Remove/Insert), (VOL.) CHAPTER-SECTION-SUBJECT, PAGE(S), COMMENTS. Contains rows for removing and inserting various sections like Table of Contents, Chapters 2, 3, 8, Appendices, and Index, plus a Transmittal Sheet and Memo.

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Refer to Figures F.1 and F.2

(<http://www.for.gov.bc.ca/hva/manuals/cruising/forms.htm>) for the cruise plan form and Figure F.3 (<http://www.for.gov.bc.ca/hva/manuals/cruising/forms-01.htm>) for the cruise plan check form.

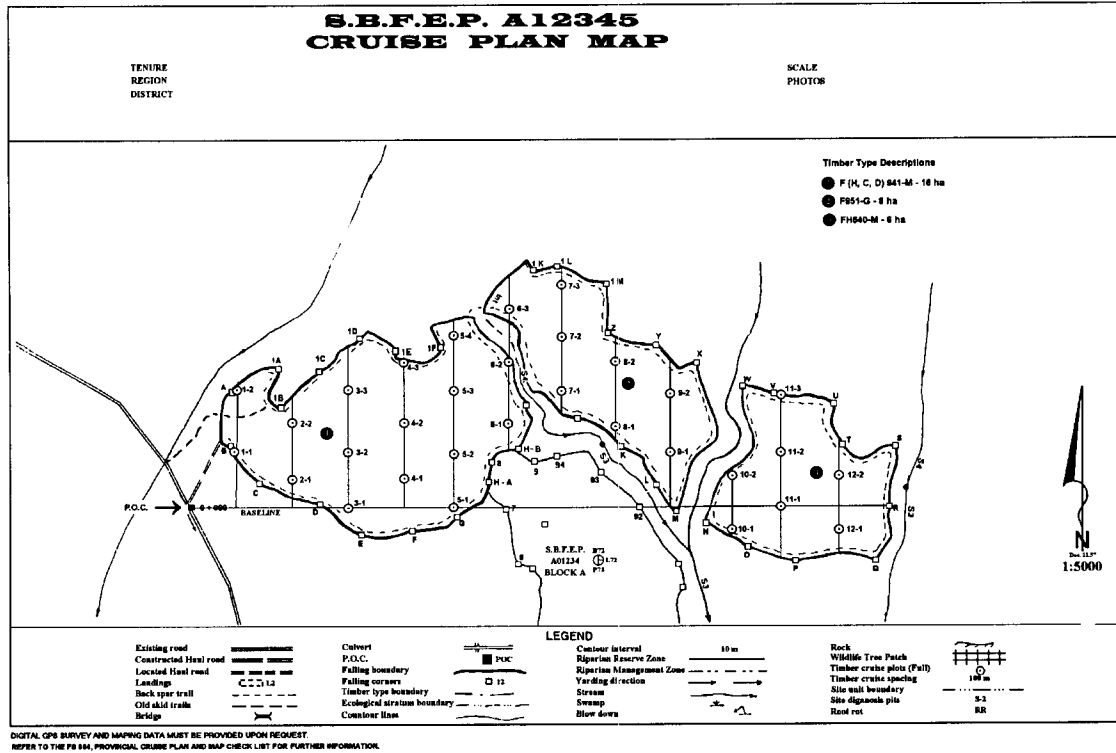


Figure 2.1 Cruise Plan Map.

The cruise plan map must contain the information in Section D of the Provincial Cruise Plan and Map Checklist (FS 694).

2.1.2 Scale-Based Stumpage Assessment - Timber Sales or Cutting Permits

General Conditions:

- all species listed under Section 6.3.2 of this manual shall be cruised,
- the minimum tree sizes are specified in Chapter 6,
- all references to "plots", "cruise plots", and "measure plots" must be interpreted as Full Measure Plots unless specified otherwise,
- Sampling Error objective is based on full measure and count plots (unless specified otherwise),
- all plots must originate from the harvest area. Plots in areas 100 percent reserved from cutting must not be used in the compilation. If an area is reserved after cruising, the sampling error requirements may be waived if it is evident that the sampling error objective would have been achieved prior to the placement of the reserve,
- all measure and count plot data originating from the harvest area must be used in the cruise compilation, and
- cruises are the responsibility of the district that contains fifty percent or more of the cruise area.

Minimum Tree Counts (All Species, Tree Classes 1, 2, 3, 5, 7, 8, 9)

Variable Plots	Fixed Plots
5.0	10.0

- a. The minimum average tree counts are required for all cruises that do not meet the minimum sampling error requirements. (e.g., where 1.0 plots or more per hectare are cruised but sampling error is not achieved).
- b. If the timber types are very open and the minimum tree count can not be achieved with a BAF 2 prism, then the minimum tree count requirement may be waived.
- c. Include tree classes 1, 2, 3, 5, 7, 8, 9 of all species listed in Section 6.3.2. Also include trees that meet the minimum DBH specifications, but are converted to a tree class 6 in the compilation because they are too short for a merchantable log.

Sampling Error Objective:

1. The scale-based cutting authorities sampling error objective is 15.0 percent at 2 standard errors based on the total stand (before reduction).

2. Where this is not achieved, cruise at least 1.0 measure plot per hectare. Where 1.0 plot per hectare will not be achieved in the cruise plan, a grid smaller than 100 metres is required.
3. Count plots that contain tree species that have not been measured in a full measure plot in the same timber type must be converted to measure plots.
4. The maximum grid spacing:
 - cutting authorities less than 250 ha - 200 m square grid, and
 - cutting authorities greater than or equal to 250 ha - 250 m square grid.

Sections 2.1.2.1 to 2.1.2.3 are subject to the requirements listed under Section 2.1.2 unless otherwise stated.

2.1.2.1 Sampling Requirements

1. Count plots are not permitted in partial cut cruises. For clear-cut cruises, a ratio of one count plot to one measure plot is permitted if at least 1.0 plot per hectare is cruised or the minimum sampling error is achieved based on the measure plots only, then the ratio of count plots to measure plots is not limited.
2. All plots must originate from the harvest area. Areas where no cutting is prescribed such as Riparian Management Zones with 100 percent retentions are to be excluded from the cruise.
3. If a range of leave tree or cut tree stems per hectare are reported in a site plan then the average of the highest and lowest number will be used to determine the percent reduction input into the cruise compilation.
4. Helicopter Single Stem - less than or equal to 20 percent of the stand volume will be harvested. The trees must be marked prior to cruising.

The cruising options are as follows:

- a. establish variable plots and the 15.0 percent sampling error requirement will be based on the cut trees,
- b. two measure plots per hectare with an average of 2.0 cut trees per plot, or
- c. 100 percent cruise.

2.1.2.3 Comparative Cruises

Refer to the *Interior Appraisal Manual* for situations when comparative cruise data may be used in appraisals.

1. Definitions:

- the new cutting authority is the area that will be appraised, and
- the parent cutting authority is the area from which cruise data will be borrowed.

2. Factors for determining the level of data to validate that the cruise is comparable:

Requires more data

Cutting Authority large - 100 000 m³

Licensee cuts a small percent of beetle

Nearby cruises not similar

Species and size vary in area

Type labels inaccurate

Sufficient time to harvest

Poor past performance

Requires less data

Cutting Authority small – 5 000 m³

Licensee cuts a large percent of beetle

Nearby cruises similar to each other

Species and size uniform in area

Type labels accurate

Insufficient time to harvest

Reliable past performance

The above factors must be considered by the Licensee's RPF and Ministry of Forests in determining the amount of work required to justify use of a specific comparative cruise. It is recommended that the licensee's RPF contact the Ministry to agree on the level of data required. The following matrix can be used as a guide.

Factors	Condition/Points	Condition/Points	Condition/Points
Cutting Authority size m ³	>100 000 / 5	20 000 – 100 000 / 3	<20 000 / 1
Licensee percent beetle cut	<25% / 5	25% - 75% / 3	>75% / 1
Cruise types similar	Dissimilar / 3	Similar / 2	Very Similar / 1
Species & size variability	Variable / 3	Average / 2	Uniform / 1
Type label accuracy	Inaccurate / 3	Average / 2	Accurate / 1
Sufficient time to harvest	Some / 15	Little / 5	No time / 1
Past performance	Poor / 10	Average / 5	Good / 1

0 to 13 points	Site Plan with a minimum of 2 plots per timber type
14 to 23 points	Site Plan with a minimum of 6 plots per timber type
24 points or greater	A full cruise

3. Requirements to ensure that the new and parent areas are comparable.

2.2 Types of Cruise

2.2.1 100-Percent Cruise

The Regional Manager may direct that for certain forest stands and valuable species, a 100-percent cruise is required.

2.2.2 Sampling Patterns-General

Samples within cutting blocks from previous operational cruises of the area may be used in the sampling plan if they meet the standards set in this manual.

Referring to the following types of sampling methods, systematic sampling in conjunction with a grid to locate the plots must be used for appraisal type cruises unless permission is granted by the Regional Manager to use one of the other sampling patterns.

2.2.2.1 Systematic Sampling

In systematic sampling, plots are at fixed intervals with a minimum of two full measure plots per timber type. One full measure plot in a timber type is acceptable if falling boundary amendments isolate some plots after cruising. The sampling intensities (hectare per plot ratios) must be consistent and the base sampling grid spacing must be the same for each timber type.

In addition:

1. The cruise grid should be aligned in cardinal directions (i.e., North/South or East/West) unless otherwise approved in a cruise plan, and the grid should be referenced to the point of commencement (P. of C.) and should use 1/2 of the grid interval.
2. The maximum plot spacing listed in Section 2.1.2 (4) will ensure adequate coverage of the area for timber typing and tree and terrain information.
3. The sampling grid horizontal distances must be equidistant between plots and strips. The options are square grid or staggered grid. The option selected must be used consistently for all cruises in a licence area. Refer to Figure 2.1 for an example of a staggered grid.
4. Where plots must be added to an existing cruise area, they must be positioned in a systematic random way so they cover the entire timber type(s) that has the highest coefficient of variation. The following method is recommended for adding plots to an existing cruise:

- a. determine the number of additional plots required using the coefficient of variation from the statistical summary report. Adding 10 percent to the number of plots is recommended for a safety margin. If the number of plots meets or exceeds 1.0 plots/ha for the whole cruise area, then the maximum sampling intensity will be 1.0 plots/ha,
- b. determine the new grid for the cutting authority area to obtain the additional number of plots required,
- c. lay the new grid over the original grid by positioning the new plot over top of the original plot that is nearest the P. of C.. Use the same cruise grid orientation,
- d. disregard the overlapping plot and locate the new plots on the cruise map, and
- e. determine the bearings and distances to the new plots from the nearest original plots. This will reduce the amount of traversing required to establish the new plots.

The new grid must be submitted with a cruise plan to the Ministry of Forests district office for approval at least 30 days prior to the commencement of field work.

2.2.2.2 Cruising Road Rights-of-Way

The following procedures are used where road rights-of-way require cruising:

- a. The fixed area plot centres will be located at the midpoint between the R/W edge and centre line and on alternating sides of the R/W centreline.
- b. The plots will be circular and 5 metre radius.
- c. The minimum sampling intensity will be 2.5 percent of the R/W area.
- d. Where timber on road rights of way within a cut-block is removed under a road permit (R.P.) after the block is cruised, the cruise plots that are within the area of the R.P. shall be included in the cruise compilation for the cutting permit and the area of R.P. will be removed from the cruise compilation.
- e. Refer to the requirements in section 2.1.2.3 of this manual where comparative cruising is permitted by the Appraisal Manual.

2.2.2.3 Cruising Patch Cuts

The following sampling procedure must be used for cruising patch cut, patch cut with reserves and group selection silviculture systems:

1. Overlay a 100 m grid on the cruise plan map after the patch cuts are accurately located within the block and mapped.

2. Increase or reduce the grid interval in multiples of 5 m until a minimum of one plot per hectare is obtained in the harvest areas.
3. Individual patch cut falling corners may be used as tie points for the cruise plots with the bearing and distance to each plot documented in the cruise plan.
4. Sampling must be confined to the harvest area, therefore use border plots if timber outside the boundary influences a full plot.
5. If the cruise was originally designed for a silviculture system not listed above then Section 2.2.2.3 does not apply.

2.2.2.4 Moving Plots

In order to achieve the planned sampling intensity if the cruise plan reveals that numerous plots will be located on block edges it is recommended that the grid interval is reduced so that the minimum sampling intensity is achieved. Plots cannot be moved.

2.2.2.5 Probability Proportional to Prediction

"Three P" sampling (Probability Proportional to Prediction) is a sampling technique which randomly selects the sample trees but one basic requirement is that each tree in the entire sale area must be estimated. This method is often used to increase efficiency in comparison to a 100 percent cruise. Three-P sampling is currently being reviewed for potential applications in appraisal cruising.

2.3 Sampling Errors

Cutting authorities must include all commercial species.

In timber cruising a complete record of all trees of merchantable size on the sale is seldom practical, so sampling becomes necessary. The object of sampling is to estimate the volume on only a portion of the area, and convert this to a total area basis.

2.2.2.7 Probability Proportional to Prediction

In sampling there are two major sources of error:

Sampling error or errors in quantities of measurements. Sampling error is the difference between results that would have been obtained by a 100 percent cruise and the result that is obtained by a sample cruise. That is they are errors caused by samples not being absolutely representative of the natural variable conditions over the entire area.

1. The sampling error can be calculated and has been set at:

- see section 2.1.2 for scale-based sales, and
- see section 2.1.3 for cruise-based sales.

2. Measurement error or errors in quantities of measurements.

The calculated sampling error can be seriously misleading if the basic data is unreliable.

If reliable volume estimates are to be obtained measurement errors must be controlled. Constant care and checking is required on all direct measurements (see Section 3.6, Check Cruising).

The population sampled is the cutting unit and, therefore, all samples on which the stand statistics are based must be systematically located within the proposed cutting boundary so that the forest area is adequately sampled.

References:	<p><i>Standard Procedures for Line and Polygon Mapping Using Global Positioning Technology</i></p> <p>Ministry of Sustainable Resource Management web site: http://www.gov.bc.ca/bvprd/bc/channel.do?action=ministry&channelID=-8393&navId=NAV_ID_province</p>
	<p><i>Forest Practices Code of BC Act Boundary Marking Guidebook</i></p> <p>Ministry of Forests web site: http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/bound/boundtoc.htm</p>

3.1.7 Mapping

The minimum mapping standards for the cruise plan and final map are as per Sections 3.1.7.1 and 3.1.7.2 (also see Figures 2.1 and 3.2).

3.1.7.1 Cruise Plan Map Standards

1. The cruise map will be legible and of good quality 1:5 000 or 1:10 000 scale.
2. The map will provide neat and clear lines, lettering and numbers.
3. The cruise map and Cruise Area Summary shall include the following:
 - a. tenure,
 - b. forest region and district,
 - c. scale used,
 - d. timber supply area,
 - e. north arrow and declination,
 - f. cut block(s) must be identified as mature or immature,
 - g. timber type lines and description, including a forest cover map of the cruise and adjacent areas,
 - h. plots must be numbered (measure and count identified), and

- i. types, area and summary, see Section 7.3, Card Type C, timber type label codes.
- j. existing and proposed roads,
- k. adjacent logging and burn history,
- l. inventory region and compartment number,
- m. UTM grid (Small Business Tenures),
- n. Forest Inventory Zone, and
- o. PSYU.

3.1.7.2 Final Cruise Map Standards

Cruise maps must accompany the compilation report, and must be produced as required under Section 3.1.7.1 plus:

1. Scale of 1:5000, 1:10000 or as approved by the District Manager.
2. Plots used in the compilation are to be clearly indicated and numbered on the map.
3. Locations of baselines (when used), boundary tie lines, points of commencement and actual strip line location with direction of travel must be indicated,
4. Contour lines are recommended and must be indicated in such a fashion that they are clearly legible and indicative of local topographic features.
5. Physiographic features must be shown.
6. Legal survey features must be shown.
7. Forest and non-forest type boundaries must be clearly indicated.
8. Status clearance boundaries and cutting boundaries must be shown.
9. Any other features of significance with respect to the sale of Crown timber (i.e., windfall areas, fire areas, insect or disease infestations, fish-bearing streams), and contour logging considerations must also be shown.
10. Digital GPS Survey and mapping data must be provided upon request by the Ministry of Forests if GPS technology is used.

A tree that is forked below DBH will be measured as two trees. If the diameter tape can not be wrapped around the circumference of the tree at DBH because the forks are too close together, then measure the diameter at the nearest opportunity above the fork and adjust for DBH accordingly. Note on the tally card that the diameter has been estimated. Refer to Figure 3.11.

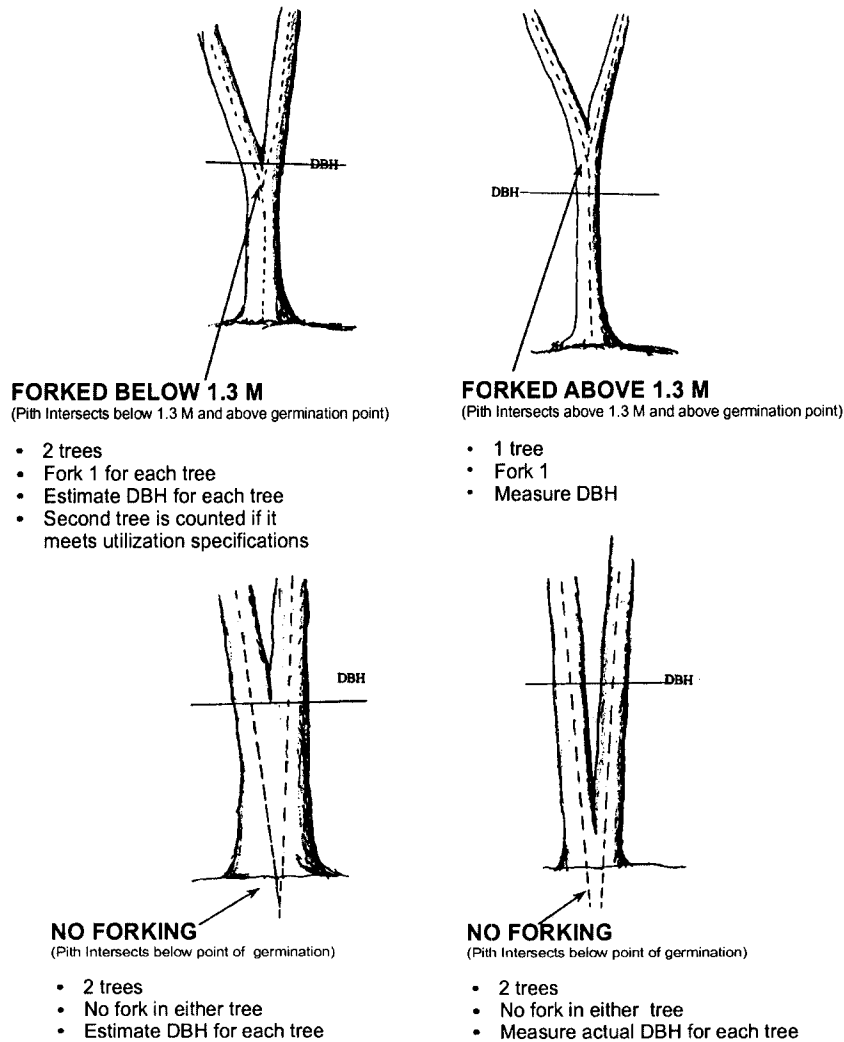


Figure 3.11 Two Trees or One.

Also see Section A.4.2.4 for details regarding forks and crooks.

A tree that is forked at or above DBH will be measured as one tree. If there is swelling at DBH due to the fork, measure the tree at the nearest available location and estimate the diameter at DBH. Note on the tally card that the diameter has been estimated.

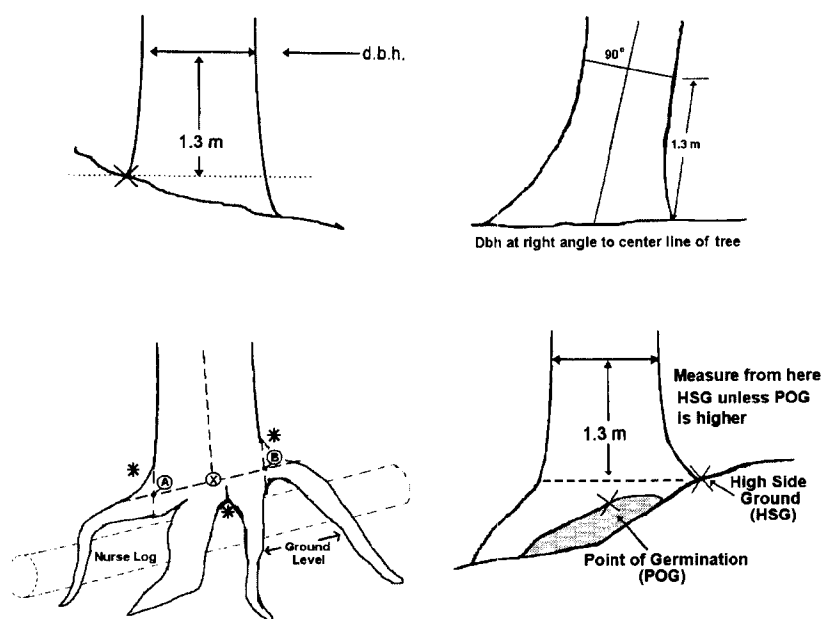
If there are burls, galls or swelling obstructing a normal taper measurement for a tree at DBH, then measure above and below the abnormalities and estimate the diameter from the two measurements. Note on the tally card that the diameter has been estimated.

Do not make allowances for missing bark at DBH.

DBH must still be established at 1.3 m from the high side ground when there is snow on the ground.

Trees or logs that have been cut into pieces or that have had pieces removed will be measured if 50 percent or more of their gross volume is still on site. Measure DBH 1.0 metres from the butt end of the log. The tree height will be measured or estimated from the butt end of the log to the top plus 0.3 metres to allow for a stump height.

The plot radius for the logs will be measured to their DBH using the same method as for uprooted trees (see Section 3.4.1.4). Compile these areas as separate treatment units and timber types if the area is greater than or equal to 1.0 hectares.



High side location when POG clearly above ground level, nurllogs/stumps, hummucky/rocky ground, erosion and upturned stumps.

- ⊗ POG defined by the midpoint of the low root centre and a transect line to the midpoint of the highroot centre.
- Ⓐ to Ⓑ The POG is the point where this transect line intersects the tree pith.
- * Indicates incorrect locations for highside and POG on this tree.

Figure 3.12 DBH in relation to high side.

3.5.5 Pathology

Pathological indicators are recorded when observed on the bole or a merchantable secondary leader (see Section A.4.2) of the tree. The exceptions are *Phaeolus Schweinitzii*, which will occur on the ground near the base of the tree and scars on the root collars. There are qualifications to many of the suspect characters such as age of scars, position of fork or crook, size of rotten branches, etc (please refer to Appendix 4, for a detailed description of pathology).

3.5.6 Tree Classes

All living and dead trees must be given the appropriate tree class code numbered from 1 to 9. It is essential that every tree be viewed from all sides before classification as Residual or Suspect.

Refer to Appendix 4 for diagrams and further information about residual and suspect trees.

Use the following age in 10s and tree class combinations:

Interior	<p>Enter 11 for the Age in 10's on the cruise tally card type 9. The tree classes will be coded as follows:</p> <ul style="list-style-type: none"> Older immature – tree class 1 Older immature - Suspect – tree class 2 Older Imm. Dead Potential – tree class 3 Dead useless – tree class 4 *Mature – tree class 5 Live Useless – tree class 6 *Mature-Dead Potential – tree class 7 Younger Immature – tree class 8 Younger Imm. Dead Potential – tree class 9 <p>* = except FIZ K and L Aspen and Cottonwood - see Table 17</p>
Coast	<p>Use the same coding as above for younger and older immature stands if there are not any trees older than 120 years old in a plot.</p> <p>If there are trees older than 121 years old in the plot then refer to Chapter 6, positions 21 and 22 for details regarding the age in 10s and tree class reporting.</p>

Refer to the tree class modification of Loss Factor Tables at the end of Table 17 for the age in 10s and tree class combinations when combining plots cruised before April 1, 2003 with newer cruise plot data.

3.5.6.1 Tree Class 1 (Older Immature)

These are living trees with none of the eight external pathological indicators.

3.5.6.2 Tree Class 2 (Older Immature)

These are living trees containing one or more of the following eight external pathological indicators of decay:

Conks, Blind Conks, scars, fork and/or pronounced crook, frost crack, mistletoe (trunk infection), rotten branches, dead or broken top.

All pathological indicators must be recorded for each tree where they occur in order for the computer to properly assign the appropriate loss factor. Tree classification will be made on the basis of the above signs of decay only. See "Metric Diameter Class Decay, Waste and Breakage Factors" for the specifications of Risk Groups and Table 18 for risk group assignments by pathological indicators.

3.5.6.3 Tree Class 3 (Older Immature Dead Potential)

Dead standing or down timber which is estimated to contain at least 50 percent of its original gross volume in sound-wood content. All dead potential standing and down trees must be tallied.

Trees with green and/or red needles are considered live trees and will be classified based on pathological indicators. Standing or windfall trees with grey or no needles will be considered dead trees.

Down stems in this class will be determined as "in" or "out" by measuring from DBH on the tree where it lies to the plot centre (see Section 3.4.1.4, Leaning or "Down" Trees). For net merchantable volume compilation, dead potential stems will have the highest Risk Group factor for that particular species.

The 50 percent or more firmwood rule is the key consideration. Consider the resistance to decay of the species and the local climate (refer to Table 19 for the Sound Wood Factors for saprot and formulas to assist in the determination of 50 percent soundwood content).

Decay should be determined at various intervals on the tree. Tables are available to estimate cross-sectional area of decay. For example, the outer one-third of a tree represents one half the volume. Also, the bottom third of a tree contains approximately one half of its volume. Other tables are available which show the percentage of volume

of the tree in each 10 m log. By estimating percent firmwood in each 10 m log, the firmwood percent of the tree can be determined.

1. Dead Standing

Decay percent is difficult to assess on standing trees, "Sounding" with an axe or equivalent implement can be helpful. Before sounding, look for overhead hazards that may be dislodged.

2. Dead Down

Good judgement must be exercised in applying tree classes to down material. Since some species are more resistant to decay than others, decisions will therefore be influenced by the tree species involved as well as by local climatic conditions. C, Cy, F, S, P and L are the most decay resistant species and are less likely to exhibit extensively sloughing bark and conks. Other species exhibiting these characteristics are more likely to be "Dead Useless". However, it should be remembered that in drier areas, dead and down Pl and Py may be entirely bark-free yet still be relatively sound.

Pathology is required on all dead potential trees on the coast, dead potential hemlock in the interior hemlock partitions and dead potential white pine for use in the log grade algorithms.

The only exception to the green and/or red needle rule is for *abies lasiocarpa* in the Interior, where the following guidelines will apply:

Indications – One or More Must be Present

1. Sap-rot and/or,
2. Deep checking and/or,
3. Loose or shedding bark.

Contraindications – None can be Present for Tree Classes 3, 7 and 9 Trees

1. Live Cambium.
2. Green needles.
3. Pitching that has not hardened over and is still sticky to the touch.
4. Live bark beetles are present.

If there is any doubt after applying the indicators and contraindications, then the tree will be classified as green.

3.5.6.4 Tree Class 4 (Dead Useless)

Dead standing trees that have less than 50 percent of their original gross volume in firmwood content or otherwise fails to meet the criteria of a dead potential tree as described in Section 3.5.6.3 will be classified as "dead useless" trees. Only dead useless standing trees will be tallied (dead useless down trees are *not* tallied). Dead useless trees are considered standing if they are leaning into another tree. Dead useless standing trees will not be compiled for volume, but along with Live Useless trees, provide a record of snag density in the stand for appraisal purposes. Only trees equal or greater than 3 m high and equal or greater than the minimum utilization diameter must be tallied. Estimate their actual observed height and the original DBH, not an estimate of the stems original height.

3.5.6.5 Tree Class 5 (Mature)

A mature conifer tree is defined as any tree over 120 years old. A mature deciduous tree is defined as any tree over 40 years old. The exceptions are:

- a. Aspen and Cottonwood in FIZ K and L where tree classes 5 or 7 will be used for trees 141 years and older,
- b. Coastal cruises where there are trees between 121 and 140 years old, then tree classes 5 and 7 will be used for trees 141 years and older.

A reasonable number of mature ages should be sampled along with the age drilling of the main stand component.

3.5.6.6 Tree Class 6 (Live Useless)

Live Useless trees are trees that have only one or two live limbs. They are combined with TC 4 for the compilation of percent snags. This tree class must not be confused with a Tree Class 2 tree, which has a high proportion of rot due to conk.

Cedar and Cypress The tree must be almost completely rotten or hollow with just a thin shell of sound wood remaining. The low proportion of sound wood must be obvious (i.e., rotten or hollow knots, and large open scar).

Hemlock, Balsam, Fir, Pine & Spruce The tree must be broken off in the lower or middle thirds (i.e., at least the top third must be missing) with only a few live branches and almost completely rotten or hollow.

3.5.6.7 Tree Class 7 (Mature Dead Potential)

This class is a combination of Veteran and Dead Potential so that the correct loss factor tables are applied in the compilation. The guidelines for TC 3 and TC 5 apply.

3.5.6.8 Tree Class 8 (Younger Immature)

Younger immature coniferous trees (except Lodgepole Pine) are trees up to and including 80 years of age and Lodgepole Pine are trees up to and including 60 years of age. Younger immature deciduous trees are trees that are up to 20 years of age. When cruising FIZ K and L Aspen and Cottonwood, tree class 8 will be trees that are up to and including 80 years of age.

On the Coast, when the age in 10s is 13 or 14, tree class 8 trees will be trees up to 120 years of age.

3.5.6.9 Tree Class 9 (Younger Immature Dead Potential)

This class is a combination of Immature and Dead Potential so that the correct loss factors are applied in the compilation. The guidelines for TC 3 and TC 8 apply.

3.5.7 Quality

Stem quality information forms the basis for a computerized grading system. Quality remarks are also used for the experimental interior Douglas Fir quality and the interior log grade algorithms (refer to Appendix 7). They are recorded when observed 30 cm or more above the high side of the tree. This data collection is currently optional in the interior.

The quality class information will be collected on all commercial living and dead potential trees (refer to Chapter 6, Positions 45-51, required on the coast for immature, partial harvest cutting authorities, woodlots, Small Business Forest Enterprise Program Timber Sales).

3.5.8 Damage Codes

Standard cruising methods as outlined in Chapter 6 and Appendix 6 of the *Cruising Manual* are to be followed.

Damage codes are to be used when damage is identifiable.

Code the trees as they appear at the time of the cruise with no attempt to guess what the future condition of the trees will be.

3.5.9 Ages

Ninety-five percent of all trees must be in the correct age class. Sufficient trees must be bored for age to ensure the correct maturity classes. The number of trees that need to be drilled will be dependent upon the maturity profile in each plot.

For over mature stands, the establishment of age is not critical except for interior cedar over 141 years as it requires a different top diameter for compilation.

The age in 10s on the Cruise Tally Sheet is required for all measure and count plots. This age is used in each plot to assign the correct loss factor table, determine maturity and for stratification.

It is important that height as well as age be taken on each age sample tree because the height is used to estimate the years to boring height to obtain total age.

The age correction to Dbh is found in Appendix 9.

Age of sample trees is determined by a ring count from an increment borer core, taken at diameter breast height (DBH).

The pith must be included in at least half the sample tree cores on each plot. In cases where the pith is not contained in the core, and is missed by an estimated three years or more, the tree must be rebored.

"Age bored at 1.3 m must be accompanied by a sample tree height. The Site Index is then determined by using the bored height age (1.3 m trees above high side) and the height of the sample tree. The Total Age of the Age Sample Tree is determined by adding the boring height age to the years to boring height (as determined by the Site Index)."

Tree class 3, 7 and 9 trees – record age as counted and corrected. Do not add the number of years that the tree has been dead.

back of the FS 205 cruise tally sheet for the definition of the allowable tree classes. The correct tree class is necessary to ensure that the correct loss factor tables are used in the compilation.

The age correction for the counted age of stumps will be based on the prorated age correction at breast height in the Site Index Tables (see Appendix 9). For example:

Interior Douglas Fir, counted 100 years on stump, tree height = 30 metres, the site index is 20 and the years to boring height is 9 years, therefore $100 + (9 * 0.3\text{m} / 1.3\text{m}) = 102$ years.

Record scar and/or frost crack on the FS 205S if the stump has heart rot showing and the diameter of the rot is greater than 50 percent of the diameter of the stump (see Figure 8.2). This will ensure that the stump is moved into risk group 2. Coding scar will move all species into risk group 2 except Hemlock in FIZ A and FIZ C, which will require coding both scar and frost crack. Spruce in FIZ A, B and C will require coding both scar and frost crack to move them into risk group 2.

Record dead stumps that have sap rot that extends more than 1/6 the stumps diameter as tree class 4 (dead useless) as this indicates less than 50 percent sound wood content (see Figure 8.2).

Record conk if present on the outside perimeter of the stump or phaeolus schweinitzii is growing on the ground near the base of the stump or on the exposed root. Recording conk will move the stump into the highest risk group.

8.6.4.2 Option 2

Establish 400 m^2 fixed area (11.28 m radius) plots on a systematic grid to determine the gross volume if the UTH area is ≥ 10 ha.

Classify all of the stumps according to their maturity in relation to the stand, their defect and whether they are live or dead. See also Section 3.5.6 of the *Cruising Manual* or the back of the FS 205 cruise tally sheet for the definition of the allowable tree classes. The correct tree class is necessary to ensure that the correct loss factor tables are used in the compilation.

The age correction for the counted age of stumps will be based on the prorated age correction at breast height in the Site Index Tables (see Appendix 9). For example:

Interior Douglas Fir, counted 100 years on stump, tree height = 30 metres, the site index is 20 and the years to boring height is 9 years, therefore $100 + (9 * 0.3\text{m} / 1.3\text{m}) = 102$ years.

Record scar and/or frost crack on the FS 205S if the stump has heart rot showing and the diameter of the rot is greater than 50 percent of the diameter of the stump (see Figure 8.2). This will ensure that the stump is moved into risk group 2. Coding scar will move all species into risk group 2 except Hemlock in FIZ A and FIZ C, which will

require coding both scar and frost crack. Spruce in FIZ A, B and C will require coding both scar and frost crack to move them into risk group 2.

Record dead stumps that have sap rot that extends more than 1/6 the stumps diameter as tree class 4 (dead useless) as this indicates less than 50 percent sound wood content (see Figure 8.2).

Record conk if present on the outside perimeter of the stump or *phaeolus schweinitzii* is growing on the ground near the base of the stump or on the exposed root. Recording conk will move the stump into the highest risk group.

8.6.4.3 Option 3

Use adjacent cruise information for the gross and net volume per hectare if the timber in the UTH area is the same as the timber type in the adjacent cruise information.

A.4 Pathological Classification of Trees

Within mature stands, or stands approaching maturity, (i.e., older immature stands) individual trees contain varying amounts of decay. Thus, in stands of this type the estimation of cull is subject to considerable error. Therefore, it would be advantageous to know which trees are likely to contain decay, particularly those which are likely to contain excessive amounts of decay. Recent pathological studies have shown that two broad classes of living trees are clearly recognizable in stands of this character. As the classification of trees is made on the basis of the presence or absence of external signs of decay, it is anticipated that each class of tree so defined will represent a different potential loss factor within the stand.

A.4.1 Class of Trees

All living trees measured on each sample plot will be classed as:

- residual, or
- suspect.

A.4.1.1 Suspect Trees

Suspect trees are living trees which bear one or more of the following external indications of decay, on or immediately adjacent to the trunk of the tree within the limits specified.

1. Conks.
2. Blind conks (swollen knots).
3. Scars.
4. Fork or pronounced crook.
5. Frost crack.
6. Trunk infections or mistletoe.
7. Rotten branches.
8. Dead or broken top.

"Suspect" classifications will be made on the basis of the above signs of decay only; no other abnormalities are to be used.

See Table 18 for Pathological Occurrence by Species and Forest Inventory Zones.

A.4.1.2 Residual Trees

Residual trees are living trees which bear none of the external indications of decay listed above.

It must be pointed out that these signs and defects are expressive of decay in the stand, rather than in individual trees. The amount of decay indicated by signs will be subject to considerable variation within species and individual trees. For example, frost cracks may be highly significant as indicators of decay on a particular species in the stand as a whole, but not as significant on individual trees.



① Conk



② Trunk Mistletoe



③ Frost Crack



④ Fork



⑤ Scar



⑥ Dead or Broken Top

Figure A.2 Suspect Trees.

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