SECTION 8.12

ESTABLISHMENT OF PERMANENT GROWTH SAMPLES IN NATURAL STANDS

TABLE OF CONTENTS

8.12 ESTABLISHMENT OF PERMANENT GROWTH SAMPLES IN NATURAL STANDS

8.121 Office Preparation and Field Reconnaissance

8.122 Field Training

8.123 Plot Location and Marking

8.1231 Location and Access Description

8.1232 Tie Point

8.1233 Tie Line

8.1234 Plot Centre

8.124 Plot Establishment

8.1241 Plot Shape and Size

8.1242 Plot Radius and Circumference

8.1243 Division of the Plot into Segments

8.1244 Tree Tagging

8.125 Sub-plot Establishment

8.1251 Sub-plot Shape and Size

8.1252 Sub-plot Radius and Circumference

8.1253 Division of the Sub-plot into Segments

8.1254 Tree Tagging

8.126 Tree Measurements and Miscellaneous Remarks

8.1261 Tree Description

8.1262 D.B.H. or Small Tree Height Measurement

8.1263 Tree Class

8.1264 Pathological Indicators (suspect characters)

8.1265 Crown Class

8.1266 Small Tree Count

8.1267 Sample Trees for Age

8.1268 Sample Trees for Height

8.1269 Crown Closure

8.126.10 Topograph and Main Ground Cover

8.126.11 Stump Measurements

8.127 Stem Mapping

8.128 The Growth Sample Record Sheet

8.1281 The Front of the Growth Sample Record Sheet

8.1282 The Back of the Growth Sample Record Sheet

8.129 Quality Control, Sample Mapping, and Return of Field Sheets

8.1291 Inspection Items

8.1292 Allowable Errors of the Measured Data

8.1293 Sample Mapping

8.1294 Return of Field Sheets
8.12 ESTABLISHMENT OF PREMANENT GROWTH SAMPLES IN NATURAL STANDS

Growth plots in natural stands are established to monitor the rates of growth, mortality, changes in stand structure, and stand development to maturity or cutting age. Stands are selected for sampling by means of a detailed analysis of previous surveys of the management unit. Required growth plots are located as a sub-sample of the six-point ground sample.

Growth plots are usually established on the second, fourth and sixth point of the six-point sample in the desired stratum. Sampling crews are instructed when and where to establish growth plots in natural stands.

8.12.1 Office Preparation and Field Reconnaissance

Obtain the most recent forest cover maps and status maps (sampling is only carried out on Crown land) and note possible areas for sample establishment. Then collect the latest air photos with coverage of those possible areas for sample establishment. The numbering of growth samples is by compartment and increases in numerical order, so obtain a growth sample index of the samples already established in relevant compartments in order to assign the correct number to each new sample.

For lists of the special equipment used in growth and yield natural stands and of the standard equipment used in inventory field work see Appendix 8-1 and 8-2 respectively.

To attain operational efficiency, carry out a field reconnaissance of the possible areas for sample establishment. Eliminate unsuitable areas, examples of which in even-aged stands are:

A. Those containing too many veterans (i.e. more than 6-8 per ha).

B. Those that exhibit extremely varying conditions of site and species composition.

C. Those in which stands may be too old to allow for at least two remeasurements.

Examples of unsuitable areas for sample establishment in all-aged or residual stands are:

A. Those too small to accommodate a six-point sample.

B. Those that exhibit extremely varying conditions of site and species composition.

Further details on strata selection are to be agreed to by the regional Inventory Officer and the Growth Monitoring Section of the Inventory Branch.
Field Training

All personnel involved in growth sample establishment are to attend a short training course to familiarize them with the field procedures. Then crews should work under direct guidance for a period of time sufficient to gain a full understanding of the different phases of the work and to obtain reasonable efficiency in the collection of field measurements.

Plot Location and Marking

Location and Access Description

For the benefit of future re-measurement crews, describe in detail the access to, and the location of, the plot. When describing routes and distances to a tie point, always start from an easily identifiable point, the location of which is likely to remain unchanged during the intervening ten-year period between measurements. Describe the starting point (i.e. bridge crossing, main road junction, etc.) and from there, clock all kilometerage and note distances to road junctions, creek crossings, or to other prominent features on route to the tie point. Make a good description of the tie tree that includes species, diameter and location.

Tie Point

Since the growth samples will be remeasured every 10 years, the reference point or tie point should be a permanent topographic feature distinguishable on air photos and on the ground. Topographic features such as a road junction, a bend in the road, a creek junction, or a road crossing a creek, are good examples of a reference point. Choose a tie tree as close to the reference point as possible and mark it well. Blaze both sides of the tie tree in the direction of the tie line. Nail above the blazes aluminum growth plot markers (see appendix 8-3) and on them inscribe sample number, plot number, region number, compartment number, bearing and distance to first plot, and date of sample establishment. The aluminum marker is designed for use in either the natural stands or managed stands growth and yield program. To identify that it is a natural stands sample, place a check mark in the space provided under "natural." Each aluminum marker is divided into three sections. When used as a tie point marker complete only the middle and bottom sections of the marker.

In addition to the two aluminum plot markers and the two blazes, mark the tie tree with two strands of red plastic flagging tape, one above and one below the aluminum markers.
8.1233 Tie Line

From the tie point, the tie line is run to the three plot centres with a hand compass, clinometer (Suunto) and distance measuring tape. Follow the bearing set on the hand compass for the required distance. On broken terrain it may be necessary to advance by 20 m intervals, otherwise use 40 m intervals. Measure slope with the clinometer and make the appropriate correction for horizontal distance. Mark the tie line with a blaze on each side of the trees along it as well as with flagging tape both at approximately 10 m intervals; in stands with heavy undergrowth, decrease the interval whereas in stands with light or no undergrowth increase it.

8.1234 Plot Centre

When the required distance has been chained, mark the three plot centres with tubular aluminum stakes. Drive the stake into the ground for at least half of its length and erect a cairn of rocks around its base to support it firmly. For plots that are not to be stem mapped, select three trees around each plot centre and in the appropriate stem map columns record from the plot centre stake to each tree. This information will aid future remeasurement crews in re-locating the position of a centre stake that has been pulled out. Each respective plot centre is identical to the centre of the second, fourth and sixth point of the six-point ground sample. Mark the closest living tree (15 cm d.b.h. or greater) to the aluminum plot centre stake as the plot centre tree. Nail two aluminum growth plot markers to the plot centre tree at a point approximately 2 m above the ground. Inscribe the top section of each aluminum growth plot marker (see appendix 8-3) with sample number and plot number.

Record, on the bottom section of the aluminum marker, region number, compartment number, date of sample establishment and place a check mark in the space provided under "natural". If plot centre is also the tie point for the next plot on the tie line, then also fill out the middle section of the aluminum growth plot marker. Flag the centre tree with two strands of flagging tape, one above and one below the aluminum growth plot markers.

8.124 Plot Establishment

3.1241 Plot Shape and Size

Growth plots established in natural stands are fixed-radius circular plots. The plot radius is measured from the plot centre stake and all trees of measurable size are tagged inside the plot. To accommodate the stocking of different stands being sampled, variation in plot size is permitted. The objective of the sampling plan is to obtain 70 living stems that are 7.5 cm + d.b.h. per sample (3 plots). The basic
plot size is 0.025 ha with a radius of 8.92 m (0.075 ha sample size). In open stands increase the plot size to 0.035 ha with a radius of 10.56 m (0.105 ha sample size) and in dense stands decrease it to 0.015 ha with a radius of 6.91 m (0.045 ha sample size). Only these variations in plot size are permitted.

Since stocking can vary among the three plots of a sample and because the three plots have to be the same size, do not choose the plot size until each plot has been examined. This means that the measuring crew is advised to proceed to the last plot on a tie line and then work toward the tie point.

8.1242 Plot Radius and Circumference

Having established the plot centre, mark the plot circumference with plot string. Measure the selected plot radius from the plot centre stake. On level terrain, hold the tape horizontally. On sloping terrain, hold the tape parallel to the slope, measure the slope with the Suunto percent scale, and apply the appropriate slope correction to the radius (see Appendix 8-4). Measure the plot radius at a minimum of eight locations while playing out the plot string to mark the circumference. Check trees close to the circumference with the plot tape. Line trees are those on the circumference and are included in the plot when at least half of their base is inside the plot.

8.1243 Division of the Plot into Segments

To simplify tree numbering and to reduce the number of tagging errors, each plot is divided into segments. The number of segments required depend on the density of the stems within the plot. Eight segments are usually sufficient but twelve or even sixteen may be required in dense stands. To lay out the segments, follow this procedure:

A. Set the hand compass to north (0°A) and from plot centre proceed along this bearing to the perimeter of the plot while playing out the plot string.

B. Repeat this procedure in a clockwise direction with the hand compass set at 45° intervals (i.e., 45°, 90°, 135°, 180°, etc.) for 8 segments, at 30° intervals for 12 segments, or at 22.5° intervals for 16 segments. When the plot is divided into segments, the string radiates from the centre stake as do the spokes from the hub of a wheel. Segment number 1 is always the first segment clockwise from the north bearing.

8.1244 Tree Tagging

Having divided the plot into segments, tag all living trees with a d.b.h. of 7.5 cm or larger with round, blue, plastic tags. These tags come embossed with white numbers in sets of
1 to 300. Do not duplicate tag numbers on any one plot. To have more than 300 living stems tagged on one plot is unlikely since plot size is selected according to stand density.

In segment 1, all tags must face plot centre. Begin tagging in segment 1 near the plot centre and continue by passing back and forth across the pie-shaped segment. The last pass near the circumference of the plot is always made in the direction of segment 2 so that the last tree tagged is segment 1 is as near to the first tree tagged in segment 2 as possible.

In segment 2 all tags must face the circumference. Start tagging in segment 2 near the circumference and as close to the last tree tagged in segment 1 and continue by passing back and forth across the segment so that the last tree tagged in the segment is close to plot centre.

Repeat the procedures used for segment 1 and 2 for the remaining segments. Remember that tags in odd numbered segments face plot centre while those in even numbered segments face the circumference.

Tags are fastened to the trees at breast height (1.3 m above germination point) with 5 cm aluminum nails. Angle the nail slightly upward so that the tag hangs away from the tree and drive it in just enough to hold the tag securely and yet allow for radial growth. Use a d.b.h. stick 1.3 m in length to locate tagging height (a hair broom handle on the property list is the length). Raise or lower tagging height only when abnormal swelling occurs at breast height but record the actual tag height on the tally sheet. Special rules govern the tagging of forked trees:

A. If the fork occurs at or above 1.3 m, tag the stem as a single tree provided it has a d.b.h. of at least 7.5 cm.

B. If the fork occurs below 1.3 m, and two or more stems of the fork are 7.5 cm or greater in d.b.h., tag each stem separately using consecutive numbers. When the diameters are recorded on the tally sheet, bracket the numbers of the stems making up the fork.

C. If the fork occurs below 1.3 m, and only one of the stems is 7.5 cm or greater, tag it as a single tree.

8.125 Sub-plot Establishment

To have some representation from trees below the tagging limit (i.e., trees less than 7.5 cm d.b.h.) a sub-plot is established within each of the tree plots in the sample. The minimum number of trees required in all three sub-plots is 30.

8.1251 Sub-plot Shape and Size

Each of the three sub-plots is also fixed radius and circular and its size is dependent on density. The total number of small trees (i.e. less than 7.5 cm d.b.h.) required in a sub-sample (i.e. sub-plots) is 30. For a list of sub-plot sizes and sub-plot radii, see Appendix 8-5.
Note: When it was not possible to obtain the 70 trees (7.5 cm d.b.h. and greater) in the maximum size for the plot (see Section 8.1241), then increase the size of the sub-plot by an amount sufficient to obtain a total of 100 trees for the plot and sub-plot together.

8.1253 Division of the Sub-plot into Segments

Segments were laid out when the three plots were established. For the sub-plots, use the same segment divisions.

8.1254 Tree Tagging

Tag all living trees (within the three sub-plots) between 2.0 cm and 7.4 cm d.b.h. with nails as described in Section 8.1244. In addition, tag all living trees 0.3 m in height but less than 2.0 cm d.b.h. but, for these trees, wire the blue plastic tag onto a branch. The procedure for tagging is the same as that described in Section 8.1244. Special rules govern the tagging of forked trees within the sub-plots:

A. If the fork occurs at or above 1.3 m, tag the stem as a single tree.
B. If the fork occurs below 1.3 m, tag each fork as a tree provided each is 0.3 m or greater in height.

8.126 Tree Measurements and Miscellaneous Remarks

8.1261 Tree Description

For each tagged tree, record the following measurements or observations in the appropriate columns of the growth sample record sheet (see Appendix 8-6): tree number, species, segment number, d.b.h. or small tree height, tree class, pathological indicators for trees 2.0 cm and greater, and crown class.

8.1262 D.B.H. or Small Tree Height Measurement

Diameter at breast height is measured to the nearest millimetre for all tagged trees 2.0 cm d.b.h. and greater in the sample. Measure the diameter just above the nail and take great care to make sure that the diameter tape is perpendicular to the bole of the tree and is pulled tight. The smallest possible diameter that can be measured at the nail is the correct one. For tagged trees less than 2.0 cm d.b.h., a total height (small tree height) measurement is taken instead of a diameter measurement. Measure the small tree height from the germination point to the tip of the terminal bud. Call and record the tree number and the tree species before the diameter or small tree height measurement.

8.1263 Tree Class

Each tagged tree is classed as either tree class 1 (residual), tree class 2 (suspect), or tree class 5 (veteran):

Tree Class 1 Residual - none of the pathological indicators is present on the tree.
Tree Class 2  Suspect - one or a combination of several pathological indicators is present on the tree. Each of the pathological indicators must be recorded on the field sheet under "Path Remarks" giving their occurrence as in the lower, middle, and/or upper third of the total height of the tree. The relevant pathological code number is determined from the pathological code table (see Appendix 8 - 7). The following examples will illustrate the relation between "Path. Code" and "Path. Remarks".

1. A suspect tree has scars in the lower and middle third, and a fork in the middle third.
   In the "Path. Remarks" section under "Sc", enter 4, and under "FK-Ck" enter 2.

2. A suspect tree has a dead top, conks in the lower third, and a crook in the middle third.
   In the "Path. Remarks" section under "D.BT", enter 3; under "C" enter 1; and under "FK-Ck", enter 2.

Tree Class 5  Veteran Tree - trees in this class are in a distinctly older age class than the main stand being sampled. It is essential that the increment borer be used to determine the ages of trees that appear to be veterans. If a tree proves to be at least 30 years older than the oldest bored tree of the main stand, it will be recorded as a veteran. This does not apply to multi-layered or complex-layered stands. In these stands a tree will be called a veteran (Tree Class 5) if it is at least 100 years older than the oldest sample trees of the main stand. These trees are easily recognizable and are remnants of much older stands. Growth samples established in multi-layered or complex-layered stands will rarely have tree class 5 trees. Pathological remarks for veteran trees are recorded the same way as for other trees.

8.1264  Pathological Indicators (Suspect Characters)

The eight suspect characters are:

- **C** Conks - in immature stands, their occurrence is mainly on deciduous trees.
- **BC** Blind Conks - these very seldom occur on immature trees.
- **SC** Scars - these can be old or recent scars, and may be open or grown over.
- **Fk/Ck** Fork or Crook - this indicator group includes multiple leaders.
- **FC** Frost Crack - this indicator may resemble a scar but it always follows the grain.
M Dwarf Mistletoe - it can occur on the trunk or on branches.

R Br Rotten Branches - to be called, these must have a minimum diameter of 10 cm and will only be found on veteran trees.

D/BT Dead or Broken Top - it may be old or recent and includes a broken leader.

A tree can only be properly classified when it is viewed from all sides. Since most defects in the upper portion of a tree are not visible to an observer standing at the base of the tree, it is important that the recorder move around until each tree crown being classified is clearly visible to him. The person measuring d.b.h. should move far enough away from the tree to be able to classify the lower third of the stem, while the recorder is responsible for classifying the remaining two thirds of the tree.

8.1265 Crown Class

Crown class refers to the position that each tagged tree occupies in the crown canopy: dominant, codominant, intermediate, and overtopped for which the respective crown classes are 1, 2, 3 and 4.

Record the crown class in the appropriate column of the growth sample record sheet as follows:

A. Crown class 1 (dominant)

Dominant trees have crowns extending above the general (main part) level of the crown canopy. The diameter of a dominant tree is usually larger than that of the average tree in the stand.

B. Crown class 2 (codominant)

Codominant trees have crowns that form the general level of the crown canopy.

C. Crown class 3 (intermediate)

Intermediate trees have crowns below, but still extending into, the general level of the crown canopy.

D. Crown class 4 (overtopped)

Overtopped trees have crowns below the general level of the crown canopy.

8.1266 Small Tree Count

The small tree count is a simple dot count, for each of the three plots, of all living stems greater than 0.5 m in height but less than 7.5 cm d.b.h. Make a stem count by d.b.h. class, species, and segment. Use the simple dot count method of tallying and an aluminum diameter gauge to assess the d.b.h. class. Record the small tree count on the reverse side of the growth sample record sheet (see Appendix 8 - 6) for a list of d.b.h. classes by d.b.h. limits, refer to Table 8 - 2.
Table 8-2

Metric Unit DBH Classes and Limits

<table>
<thead>
<tr>
<th>D.B.H. Class</th>
<th>D.B.H. Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0 - 1.9 cm</td>
</tr>
<tr>
<td>2</td>
<td>2.0 - 3.9 cm</td>
</tr>
<tr>
<td>3</td>
<td>4.0 - 5.9 cm</td>
</tr>
<tr>
<td>4</td>
<td>6.0 - 7.9 cm</td>
</tr>
</tbody>
</table>

Note: Record all trees between 0.3 m and 1.5 m in height as d.b.h. class 0.

8.1267 Sample Trees for Age

In even-aged stands (pure and mixed) average age is determined by boring ten dominant and/or codominant trees of the leading major species on the sample, i.e., ten trees selected from the three plots. But in mixed stands take one additional age for each major species to determine if each species is in the same age class. If the second major species belongs to a different age class then take 10 ages for it. The age of the second major species is not included in the calculation of average sample age, but the presence and the age of it are noted in the stand description, and main stand age is still calculated from the 10 ages of the leading major species.

Trees which appear to be veterans must be bored for age to determine if they are veterans. Veteran trees are not used in the calculation of the main stand age.

For multi- and complex-layered stands, average age is calculated by averaging the ages obtained from sample trees representative of the layers. For samples in multi-layered stands, take an equal number of sample tree ages for the leading species from each layer (10 in total). For samples in complex-layered stands, take sample tree ages of trees representative of the range in tree heights for the leading species (10 in total). For each additional major species in multi- and complex-layered samples, take one age in addition to the 10 ages for the leading species.

Whenever possible bore trees selected for age at 0.3 m above the germination point. Half the cores taken must include the pith. If the pith is missed by more than an estimated 3 years on trees under 100 years old, or by 5 years on trees over 100 years old, then re-bore the tree. Count ages in the field and record them in the appropriate space on the field sheet. Then, put the accepted cores in plastic straws, which must be properly labelled with Region number (Re#), Compartment number (Co#), Sample number (Ga#), Plot number, tree number, species, counted age, and boring height. Collect these straws and return them to Inventory Branch for further analysis.
Since trees are bored for age at a point above germination point, a correction must be made to obtain total age. Calculate the average age and average height of the 10 sample trees selected from the leading major species. From the appropriate species site curve in the field handbook establish a temporary site class based on the average age and average height of the sample trees. Using the pertinent species correction table from the field handbook, select the appropriate age correction factor based on boring height and temporary site class. Then add this age correction factor to the boring age to give total average age. Using this total average age, check the site curve again to make sure that the site class has not changed owing to the addition of the age correction factor. If the site class has changed, select the appropriate age correction and repeat the procedure.

8.1268 Sample Trees for Height

All trees measured for age must be measured for height. Local height-diameter curves are constructed from growth sample data before samples are compiled. To construct reliable curves, we therefore need a good number of heights.

Fourteen heights are required for each major species in the sample (i.e. on the three plots), of which 10 are to be taken from the dominant and codominant class using ratio of 2 codominants to 1 dominant, while the remaining 4 are to be taken from the intermediate and over-topped crown classes in order to cover the full range of stand diameters. For minor species (less than 20% by volume) take 4 heights, and for scattered species take 1 height. If veteran trees are present on the sample, take at least one height for each species. When possible, select residual sample trees for height measurements (Tree Class 1), otherwise select trees that do not have suspect characters occurring in the upper third of the tree. For each height measurement it is essential that the tree top and bottom be clearly visible and that the reading on the Suunto percent scale not exceed 90%. The bottom reading may be taken on a hard hat held at the tree tag height in which case the correction is 1.3 m.

8.1269 Crown Closure

Crown closure is defined as the percent of area occupied by the canopy, through vertical projection, of the trees equal to or greater than the minimum size specified for the inventory. Estimate crown closure of the main stand, i.e., the percent of the sky covered by the tree crowns, to the nearest percent for each plot and record it in the appropriate column of the growth sample record sheet. In multi-layered stands assess the crown closure separately for each layer.

8.126.10 Topography and Main Ground Cover

Make a brief description of landform, slope, surface conditions, soil type and soil texture. Record minor vegetation in order of occurrence by botanical or common name.
8.126.11. Stump Measurements

For each stump found on growth plots established in selectively logged stands, measure and record by segment: the stump tree-number (900-999), species, height, diameter, and the tree number of the closest tagged tree.

Note: stump tree-numbers range from 900-999 and are assigned to stumps, but tags are not affixed to them.

8.127 Stem Mapping

For use in distance-dependent growth modelling studies, 10% of the growth samples established in natural stands are stem mapped. To establish the location of trees on these circular plots, measure and record on the stem mapping section of the growth sample record sheet, the bearing and distance from a point, usually to each tagged tree. For a list of equipment needed for stem mapping, see Appendix 8-8. To stem map growth samples, follow this procedure:

A. Set up the staff compass directly over the aluminum plot centre stake, and level the instrument.

If a large diameter tree interferes with sightings on a considerable number of trees in the plot, then it is permissible to set up the instrument in an opening close to plot centre, but measure and record the bearing and the horizontal distance from the plot centre stake to this opening.

B. Check for the appropriate magnetic declination, and raise the sighting vanes. In Western Canada, magnetic declination is east of true north. The correct magnetic declination is obtained from an Isogonic Chart (Appendix 8-9).

C. Systematically sight along to each tagged tree on the sample. To avoid sighting on the wrong tree, place the d.b.h. stick, wrapped with flagging tape to make it more visible, in front of the tree being sighted. To avoid false compass readings, keep sources of magnetic interference such as steel tapes, axes, knives, steel datum holder, eye glasses with steel frames, and most metal objects away from the staff compass. To simplify recording and possibly to minimize errors, use a staff compass that has Azimuth bearings, when available.

D. Measure the slope distance between plot centre, i.e. staff compass, and the centre of the tree.

E. Measure the slope with the clinometer (Suunto) using the percent scale.

F. Read the staff compass bearing on the scale at the north end of the compass needle.
G. Record the measurements in the appropriate columns alongside each tree number on the plot sheet.

As with tree tagging, begin stem mapping in segment 1 and continue in a clockwise direction until all the tagged trees are stem mapped.

All stem mapped plots should be photographed with low level (70 mm) photos. To aid the photography crew and to obtain complete coverage of the plot, raise a flag on the tallest tree near the plot centre.

8.128 The Growth Sample Record Sheet
8.1281 The Front of the Growth Sample Record Sheet (Appendix 8-6).
8.12811 Top Section of the Growth Sample Record Sheet:

Region No. - Enter the pertinent provincial inventory reference region number obtained from inventory maps.

Compt. No. - Enter the pertinent provincial inventory reference compartment number from inventory maps.

Compt. Letter - Enter the pertinent provincial inventory reference compartment letter. Only a few areas in B.C. have a compartment number followed by a letter, mainly on the Coast.

Sample No. - Enter the consecutive sample number for the compartment.

Plot No. - Enter the appropriate plot number.

Measurement No. - Enter "0" which is the code for the initial sample measurement.

Plot Size - Enter the plot size in hectares.

Plot Radius - Enter the plot radius in metres.

Sub-plot Size - Enter sub-plot size in hectares.

Sub-plot Radius - Enter sub-plot radius in metres.

Aspect - Enter the plot aspect (e.g. N. SW. etc.).

Slope - Enter the average slope of each plot in percent.

Crown Closure - Enter the crown closure of each plot to the nearest percent.

Maximum Tag Number - Enter the maximum tag number used on the plot.

Date of Measurement - Enter date of plot measurement.

Sample Size - Enter the sample size in hectares (i.e. for all 3 plots together).
Sample per Hectare Factor
- Enter the pertinent factor, which varies with sample size.

Age
- Enter average sample age.

Age Range
- Enter age range for samples established in complex or multi-layered stands.

Height
- Enter average sample height.

Site
- Enter the appropriate site for the sample.

Number of Stems 7.5 cm d.b.h. +
- Enter the total number of stems tagged that are 7.5 cm d.b.h. and greater in all three plots.

Number of Stems Less than 7.5 cm
- Enter the total number of stems that are less than 7.5 cm d.b.h. in all three sub-plots.

Tree Details Section

Tree No.
- Enter the tag number of the tree being examined.

Species
- Enter the species code of the tree being examined.

Segment
- Enter the segment in which each tagged tree is located.

Small Tree Height
- Enter small tree height to the nearest decimetre for tagged trees (trees 0.3 m in height but less than 2.0 cm d.b.h. at 1.3 m).

D.B.H.
- Enter the diameter at breast height (1.3 m above germination point) of each tagged tree 2.0 cm and greater to the nearest millimetre.

T.C.
- Enter the pertinent tree class code, of which three are recognized: residual (1), suspect (2), and veteran (5).

Pathological Remarks
- Record the pathological indicators present on each tree.

Crown Class
- Record the crown class applicable to each tree.

Stem Mapping
- Record the pertinent stem mapping information for each tree.

Stumps
- Record the stump information required.

Sub-plot Tree
- Record in this column code "1" if the tree is located in the sub-plot.
8.1282 The Back of the Growth Sample Record Sheet (see Appendix 8-6)

Tree Heights - Record sample tree height measurements.
Age Count - Record the ages of sample trees bored.
Topography - Give a brief description of landform slope (e.g. uniform or variable), and surface conditions in the vicinity of the plot.
Main Ground Cover - List minor vegetation in order of occurrence.
Location and Access - Describe in detail the location of the sample and the access to it.

8.1299 Quality Control, Sample Mapping, and Return of Field Sheets

To ensure that crews continue to work efficiently, and that they follow and understand the application of recommended procedures, regular inspections must be carried out on each crew. Inspect at least 10% of all samples established, and where the inspection shows that a growth sample has been poorly done, the original crew will be required to re-do it.

In addition to sample inspections, make spot checks as the work progresses to be sure that tie points have been properly marked and that tie lines have been run on the designated bearings. So that their performance can be observed, occasionally visit each crew on the sample. After sample inspection, correct all errors greater than the allowable standard on the field sheet.

8.1291 Inspection Items

A. Plot radii

Check a minimum of three plot radii per plot. If it is discovered that any tagged tree is actually an out-of-plot tree, or vice versa, then check each line tree to determine whether or not any other errors have been made in the stringing of plot circumference.

B. DBH, Tree Class and Pathological Remarks

Check at least six of the larger diameter trees in the sample (3 plots) for d.b.h. and for classification.

C. Tree Tag Height

Check the tag height of at least six trees in the sample to verify that breast height has been located at 1.3 m above germination point. At the same time check to make sure that the nails are driven in to the trees securely and at a slight angle so that the tag hangs away from the tree.
D. Sample tree Ages and Heights

Check a minimum of three trees per sample (1 per plot) for age and for height.

E. Crown Closure, Topography and Main Ground Cover

Verify that the recordings for crown closure, topography, and for main ground cover are correct.

F. Plot Centre Stake and Tree

Check that the information inscribed on the aluminum markers nailed to the plot centre tree is legible and correct and that the centre tree is marked with two strands of red plastic tape (one strand above and the other below the aluminum markers). A cairn must have also been built around the plot centre stake.

G. Stem Mapping

For samples that were stem mapped, check a minimum of six trees per sample for bearing, distance and percent slope.

8.1292 Allowable Errors of the Measured Data

A. Growth sample tie points will be exactly located on maps and photographs to correspond with the ground location.

B. Compass bearings will be accurate to ± 1 degree.

C. Distance between two ground points (e.g. tie point and first plot) will be accurate to ± 1% of true horizontal distance.

D. No error is permitted on plot radius. Check every line tree to determine whether it is inside or outside of the plot.

E. Breast height will be within ± 5 cm of actual breast height (1.3 m) from the point of germination.

F. Diameter at breast height will be within ± 1% of the true diameter.

G. Ground measurement of tree heights will be correct to ± 2% of actual tree height.

H. Age counted from a core that includes the pith of the tree will be correct to within ± 2% of the actual age of the tree at boring height.

I. Crown closure will be within ± 10% of the true crown closure.

8.1293 Sample Mapping

Having established the samples, plot them on the forest cover maps at the appropriate district office. Send copies of the maps showing the location of all the samples to the regional office and to the Inventory Branch.
Return of Field Sheets

To make sure that all the necessary data have been collected and that errors in the data are minimal or non-existent, check all the samples in the office before sending them to Victoria. Correct errors and omissions while the field sheets are still in the field. When satisfied that the field sheets are complete and without visible errors, send them to the Growth Monitoring Section, Inventory Branch, Victoria.