



Province of  
British Columbia

Ministry of  
Forests



# FOREST INVENTORY

SECTION	
CHAPTER	
REVISION NO.	DATE

## Growth and Yield

### *Establishment of Permanent Growth Samples in Natural Stands*

1993



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British Columbia

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SECTION	
Growth and Yield/Decay and Volume	
CHAPTER	
Est. of Perm. Growth Samp. in Nat. Stands	
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## Establishment of Permanent Growth Samples in Natural Stands

⇒ Growth plots in natural stands are established to measure the rates of growth, mortality, change in stand structure, and stand development. The data will be used for the development (calibration/validation) of growth and yield models, validation of site index curves, and provide a basis for further scientific studies. Stands are selected for sampling by means of a detailed analysis of previous surveys of the management unit. Growth natural samples should not be established in multi-layered stands except in forest districts in which this type of stand structure is prominent. The standards of measurement for permanent samples are listed in Appendix 1. Established samples must be ecologically classified in accordance with Research Branch specifications.

Since permanent growth samples are cost intensive, their protection is of utmost importance. To ensure their protection, the buffers illustrated in Appendix 31 are recommended.

### Office Preparation and Field Reconnaissance

Obtain the most recent forest cover maps and status maps and note possible areas for sample establishment. Select stands meeting the matrix cell stratification criteria (i.e. geographic area, species, age class, site index class, density class). Then collect the latest air photos which cover those possible areas for sample establishment. A growth sample is assigned a unique sample number. The provincial sample list enumerates samples

consecutively by region and compartment. Do not duplicate numbers within a compartment.

For a list of equipment used in growth and yield natural stands, see Appendix 2.

To attain operational efficiency, carry out a field reconnaissance of the possible areas for sample establishment. Ensure that the stands are relatively free of pests (insect, disease, etc.) and injury (animal damage, windthrow, etc.) and that the portions of the stands containing the plot and buffer are reasonably homogeneous (variation less than 25%) in species composition, aspect, density, age, and top height (site). Discard unsuitable areas, examples of which in even-aged forests are:

- Stands containing more than forty veterans per hectare.
- Stands which are too small to accommodate the plot and buffer.
- Stands which may be too old for at least two remeasurements.

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

- Stands too small to accommodate a sample and buffer.
- Stands in which site and species composition vary extremely.

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



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## 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 of senior personnel 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.

## Sample Location and Marking

### Location and Access Description

For the benefit of future remeasurement crews, describe in detail the access to, and the location of the sample. 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 (for example, bridge crossing or main road junction) and from there note distances to road junctions, creek crossings, or to other prominent features en route to the tie point. Describe the species, diameter and location of the tie tree.

### Tie Point

- ⇒ As growth samples will be remeasured every ten 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 and paint both sides of the tie tree

in the direction of the tie line. Above the blazes and paint, nail aluminum growth plot markers (see Appendix 3) and on them inscribe the sample type (G), sample number, plot number (always 1), region number, compartment number, bearing and distance to the first plot, and the date of sample establishment. The aluminum marker is designed for use in all of the growth and yield programs. A "G" in the sample type section identifies a natural stands sample. 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, two blazes and paint, mark the tie tree with two strands of plastic flagging tape, one above and one below the aluminum markers.

To aid future measurement crews, prepare a sketch (to be attached to the sample sheets) showing the tie point, the sample location, and other significant topographic features.

### Tie Line

- ⇒ From the tie point, the tie line is run to the plot centre with a hand compass, clinometer (Suunto), and measuring tape. Locate (on a set bearing) the boundary of the plot a minimum distance of 20 metres or the equivalent distance of the top height of the stand (whichever is greater) from the tie point or edge of the matrix cell type represented by the plot. Follow the bearing set on the hand compass for the required distance. Measure slope with the clinometer and make the required correction for horizontal distance. Mark each side of trees along the tie line with blazes or good quality tree marking paint. In addition, flag the tie line often enough to be readily followed.



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## Plot Centre

When the required distance has been chained, mark the plot centre with a tubular aluminum stake. Drive the stake into the ground for at least half of its length and build a cairn 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 the bearing, slope, and distance from the plot centre stake to each tree. This information will aid future remeasurement crews in relocating the position of a centre stake that has been pulled out. Mark a large living tree close to the aluminum plot centre stake as the plot centre tree. Nail two aluminum growth plot markers to the plot centre tree approximately two metres above the ground. Inscribe the top section of each aluminum growth plot marker (see Appendix 3) with the sample type (G), the sample number and the plot (1) number.

Record, on the bottom section of the aluminum marker, the region number, the compartment number and the date of sample establishment. If the plot centre is also the tie point for the next sample, then 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.

## Plot Establishment

### Plot Shape and Size

- ⇒ A growth sample in a natural stand consists of one single circular plot.
- ⇒ The plot radius is measured from the plot centre stake and all trees of measurable size inside the plot are tagged. To accommodate the density of different stands being sampled, variation in plot size is permitted. The

objective of the sampling design is to obtain a minimum of 90 living commercial and non-commercial trees that are 4.0 cm + d.b.h. in a sample, which is one plot. In those forest districts in which samples are established in multi-layered stands, the plot size is selected based on the primary layer.

- ⇒ The basic plot size is 0.08 ha with a radius of 15.96 m. In open stands, increase the plot size to 0.09 ha with a radius of 16.93 m or to a maximum of 0.1 ha with a radius of 17.84 m. In dense stands, decrease the plot size to 0.07 ha with a radius of 14.93 m, to 0.06 ha with a radius of 13.82 m, or to 0.05 ha with a radius of 12.62 m, or to 0.04 ha with a radius of 11.28 m. Only these variations in plot size are permitted.
- ⇒ In very dense young stands, there may be few, if any, trees 4.0 cm d.b.h. and greater. If the maximum plot size is used, the result would be numerous ingrowth trees (4.0 cm d.b.h. or greater) in the future. For these stands, use the plot sizes 0.04 ha or 0.05 ha and ignore the minimum tree requirement. However, the sub-plot size must be increased by an amount sufficient to obtain a total of 110 trees for the plot and sub-plot together (see the *Sub-Plot Shape and Size* section of this chapter). As a guide, stands less than 41 years of age with a density of 10,000 stems per hectare or greater, use the 0.04 ha plot size. For stands less than 41 years old with a density between 3,000 and 10,000 stems per hectare, use a 0.05-hectare plot size.

### 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



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parallel to the slope, measure the slope with the Suunto using the percent scale, and apply a slope correction to the radius (see Appendix 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.

## Division of the Plot into Sectors

- ⇒ To simplify tree numbering and aid in the selection of **top height trees**, each plot is divided into sectors, the number of which is dependent on plot size. The number of sectors is six to ten (0.01 ha each) for plot sizes 0.06 to 0.1 ha, respectively. However, for plot sizes 0.04 and 0.05 ha the number of sectors is eight and ten (0.005 ha each), respectively. In these cases, pairs of sectors are combined for the selection of each top height tree.
- ⇒ Sector 1 is always the first sector clockwise from north.

## Dead Tree Tally

Tally by species and 5 cm diameter classes all standing dead trees (at least 3 metres in height) within the plot and record them in card type 9 of the field record sheet. Record trees 2.6 cm d.b.h. to 7.5 cm d.b.h. in the 5 cm class, trees 7.6 cm d.b.h. to 12.5 cm d.b.h. in the 10 cm class, etc.

## Tree Tagging in the Plot

Having divided the plot into sectors, tag all living trees of commercial and non-commercial species with a d.b.h. of 4.0 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 (including the sub-plot). To have more than 300 living stems tagged on one plot is unlikely because plot size is selected according to stand density.

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

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

Repeat the procedures used for sector 1 and 2 alternately for the remaining sectors.

Remember that tags in odd numbered sectors face plot centre while those in even numbered sectors face the circumference.

- ⇒ Tags are fastened to the trees at breast height (1.3 m above the base of the tree on the uphill side) with 6-centimetre aluminum nails (see Appendix 5). Drive 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 1.3 metre long d.b.h. stick to locate tagging height. Raise or lower the tagging height by up to 5.0 cm to avoid abnormal swellings or branch whorls but record the actual tag height on the tally sheet.

Special rules govern the tagging of forked trees:

- If the fork occurs at or above 1.3 m, tag the stem as a single tree provided it has a d.b.h.



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of at least 4.0 cm.

- If the fork occurs below 1.3 m, and two or more stems of the fork are 4.0 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(s).
  - If the fork occurs below 1.3 m, and only one of the stems is 4.0 cm or greater, tag it as a single tree.
- ⇒ To more accurately measure the diameter of trees that have grown together (e.g., trees forked near breast height) or will have grown together by the next measurement, place a second nail at the halfway point around the tree from the nail holding the tree tag (1/2 wrap nails). Note this in the remarks column.
- ⇒ Now and then unusual live trees are found within the plot and sub-plot (e.g., tree of taggable size growing on a tall stump too high to climb). Good judgment must be exercised in dealing with these odd situations. The above example should be treated in the following manner:
- Assign a tree number to the tree and attach the tag to the stump.
  - Estimate the diameter of the tree, record the diameter in the d.b.h. area of the field sheet, and note in the remarks columns of the field sheet, that the diameter was estimated.
  - Record the decay indicators on the tree and stem map the tree location.

## Sub-plot Establishment

- ⇒ To have some representation from trees below the tagging limit, that is, trees less than 4.0 cm d.b.h., a sub-plot is established within the plot. The objective is to obtain a minimum of 20

trees that are less than 4.0 cm d.b.h. but are at least 0.3 m in height.

## Sub-plot Shape and Size

- ⇒ A growth sub-sample also consists of one single circular sub-plot and its size (minimum accepted is 0.002 ha or 2.52 m in radius) is dependent on density. Choose the sub-plot size and, using the procedure described in the *Plot Radius and Circumference* section of this chapter, mark the sub-plot circumference with string. For a list of sub-plot circumference with string. For a list of sub-plot sizes and sub-plot radii, see Appendix 4.

**Note:** In young stands, when it is impossible to obtain the 90 trees (4.0 cm d.b.h. and greater) within the plot area selected using the criteria in the *Plot Shape and Size* section of this chapter, then increase the size of the sub-plot to obtain a total of 110 trees for the plot and sub-plot together. For example, if a plot has only 34 trees 4.0 cm d.b.h. or greater, then the sub-plot must be large enough to include 76 trees less than 4.0 cm d.b.h. but at least 0.3 m in height.

## Division of the Sub-plot into Sectors

Sectors were laid out when the main plot was established. For the sub-plot, use the same sector divisions.

## Tree Tagging in the Sub-plot

Tag with nails all living trees of commercial species that are at least 2.0 cm d.b.h. but less than 4.0 cm d.b.h. using the techniques and procedures described in the *Plot Establishment - Tree Tagging* section of this chapter.

If the major component of the stand (i.e. 50% of the volume or 25% of the total stems in the



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stand) is in trees greater than or equal to 2.0 cm d.b.h., tag only trees within the sub-plot that are 2.0 cm d.b.h. and greater. Count in a dot tally, the remaining commercial species trees within the sub-plot that are less than 2.0 cm d.b.h., derive their metric d.b.h. classes (i.e. either d.b.h. class 0 or 1) at 1.3 m (see Table 1), and record them on the tree count section of the field record sheet (see Appendix 7).

If the major component of the stand is in trees less than 2.0 cm d.b.h., the tagging limit for trees within the sub-plot must be lowered to include trees greater than 1.3 metres. For trees of commercial species greater than 1.3 metres but less than 2.0 cm d.b.h., wire their tags onto a branch (if large enough) or onto the main stem (ensuring that space sufficient for future growth is left), measure their height (instead of diameter) to the nearest decimetre, and record them in the small tree height section of the field sheet. Record (as d.b.h. class 0) the remaining commercial species trees within the sub-plot (0.3 m to 1.3 m in height) in a metric dot tally on the tree count section of the field record sheet (see Appendix 7).

**Table 1**

Metric d.b.h. classes and limits

D.B.H. Class	Limits
0	0.3 m to 1.3 m in height
1	0.0 cm to 1.9 cm in d.b.h.

Use the same procedure for tagging sub-plot trees as described in the *Plot Establishment - Tree Tagging* section of this chapter. Special rules govern the tagging of forked trees that are at least 2.0 cm d.b.h. but less than 4.0 cm d.b.h. within the sub-plots:

- If the fork occurs at or above 1.3 m, tag the

stem as a single tree.

- If the fork occurs below 1.3 m, tag each fork as a tree provided each is 2.0 cm d.b.h. and greater.

Give special attention to the method of tagging or counting forked trees less than 2.0 cm d.b.h. To avoid tagging or counting numerous leaders of trees that have been severely browsed, for example, tag as a tree only the tallest leader. This rule, however, only applies if the main leader is less than 2.0 cm d.b.h. See Appendix 6 for a further explanation.

## Tree Measurements and Miscellaneous Remarks

### Tree Description

- ⇒ For each tagged tree, record these measurements or observations in the relevant columns of the field sheet (F.S. 820, see Appendix 7): measurement number, tree number, species, sector number, d.b.h. or small tree height, tree class, decay indicators for trees 2.0 cm d.b.h. and greater, crown class and live-crown length.

### 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 make sure that the diameter tape is perpendicular to the bole of the tree and it is pulled tight (see Appendix 5). The smallest possible diameter measurement that can be obtained 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



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from the base of the tree on the uphill side to the tip of the terminal bud (see Appendix 6). For small trees with drooping leaders, such as cedar and hemlock, measure the height to the highest point of the droop.

- ⇒ Special rules apply to the measurement of the height of abnormal trees within the sub-plot that are less than 2.0 cm d.b.h. (see Appendix 6)

## 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

Record tree class 1 if none of the decay indicators is present on the tree. Also record tree class 1 for tagged trees less than 2.0 cm d.b.h. since an assessment of decay indicators is not made for tagged trees in this category.

### Tree Class 2: Suspect

Record tree class 2 if one or a combination of several decay indicators is present on the tree. Each of the decay indicators including a dead or broken top must be recorded on the field sheet under "Path Remarks" giving its occurrence in the lower, middle, and/or upper third of the total height of the tree. The decay indicator position codes are listed in Appendix 8. These examples illustrate the relationship between the decay indicator and its position code:

- A suspect tree has scars in the lower and middle third, and a fork in the middle third. In the pathological remarks section under "SCAR" enter 4, and under "FK/CK" enter 2.
- A suspect tree has a dead top, conks in the lower third, and a crook in the middle third. In the pathological remarks section under

"D/B T," enter 3; under "CONK" enter 1; and under "FK/CK," enter 2.

- ⇒ Note: Do not record decay indicators in the path section for tagged trees less than 2.0 cm d.b.h., but only note them in the remarks column. Record tagged trees less than 2.0 cm d.b.h. as tree class 1.

### Tree Class 5: Veteran Tree

- ⇒ Tree class 5 trees are in a distinctly older age class than that of the main stand being sampled. Use an increment borer to determine the age of trees that appear to be veterans.
- ⇒ For a veteran component to be recognized, the veterans must have an estimated crown closure of less than 6% for the sample. Veterans are not recognized in stands 121 years or older except in lodgepole pine stands which may have a veteran component of Douglas-fir or larch.
- ⇒ In single-layered stands, record tree class 5 if a tree proves to be at least 40 years older than the mean age of the main stand.
- ⇒ A veteran is not always an old tree: for example, a 20-year old stand could have 70-year old veterans which are remnants of a stand destroyed by fire.
- ⇒ In complex-layered stands, a tree is called a veteran (tree class 5) only when the tree is:
  - A remnant of a much older stand.
  - At least 100 years older than the mean age of the main stand.
  - Of a much larger diameter than those of the trees in the main stand. This criterion is necessary because of the subjectivity in determining what constitutes the main stand owing to the wide range of ages possible in it.
- ⇒ Growth samples established in complex-layered



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stands rarely contain trees belonging to tree class 5. Record decay indicators for veteran trees in the same way as for other trees.

## Decay Indicators, Pest and Injury Codes

### Decay Indicators

⇒ The eight indicators of decay (pathological remarks) defined and illustrated in Appendix 9 are:

*Conk* - usually occurs in immature deciduous stands.

*Blind Conk* - very seldom occurs on immature trees.

*Scar* - must be weathered and may be grown over or open.

*Fork or Crook* - includes multiple leaders.

*Frost Crack* - may resemble a scar but always follows the grain.

*Mistletoe* - can occur on the trunk or on branches. Record a branch swelling that extends to the trunk of the tree as mistletoe. Because mistletoe may be a growth inhibitor, record (in the remarks column) its presence on swollen limbs even if at some distance from the trunk.

*Rotten Branch* - must have a minimum diameter of 10 cm and in immature stands should only be present on veteran trees.

*Dead or Broken Top* - includes a broken or dead leader (see Appendix 6).

⇒ The following abnormalities are not indicators of decay and are illustrated in Appendix 9: butt rot, flute, candelabra branch, branch fan, black knot, burl and gall, sweep, exposed root, spiral grain, dry side, sapsucker hole, and insect boring. Record their occurrence in the remarks section of the field sheet.

A tree can only be properly classified when it is viewed from all sides. Because 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; whereas the recorder is responsible for classifying the upper two-thirds of the tree.

### Pest and Injury Codes

To quantify the effects of insect, disease and injury on tree growth, the Growth and Yield Section has been requested to collect insect, disease and injury data during the establishment of permanent growth samples.

For each tree affected, record the primary pest or injury code (see Appendix 30) in columns 61 to 64 of the field record sheet. Identify (if possible) the pest species and, if the observer is suitably trained, assess the severity of pest attack (for pests listed within the table) using the rating system identified in the Quantification of Damage section of the Pest and Injury Codes Table. For other pests, consult an appropriate specialist for a rating system. If the observer is not suitably trained, assess the severity of pest attack using the following subjective assessment codes: L = Low, M = Moderate, S = Severe, and P = Past attacks.

If the observer is not able to identify the insect or disease species, a shorter incomplete label is still useful. For example, an observer may identify a defoliating insect and assess the percent defoliation for the tree as 30%. This would be recorded as ID\_\_3 in columns 61 to 64.

In addition to recording the primary insect,



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disease or injury for each tree affected, make a general assessment of the primary insect, disease, or injury for the total sample and record it in the sample header section (stand disturbance columns 57 to 67 of card type 1) of the field sheet. If known, also record the year of attack.

## Crown Class and Live-crown Length

### Crown Class

Crown class refers to the position of the crown of a tree relative to all other trees within the general plot area (not the whole stand). Each tagged tree classed as tree class 1, 2 or 5 is assigned a crown class code. The six crown classes are dominant, codominant, intermediate, suppressed, veteran, and understory, and their respective crown class codes are 1, 2, 3, 4, 5, 6 (see Appendix 10).

Record the crown class in column 39 of the field sheet (F.S. 820).

**Note:** Crown class 6 should be used sparingly (i.e., do not confuse it with crown class 4) since it is only intended for use in older stands (60 years+) in which the understory trees (usually shade tolerant) are clearly of a much younger age than the main stand.

### Live-crown Length

Live-crown length is the length from the top (if alive) of the tree or from the top of the live portion (if top dead) to the base of the lowest contiguous live crown as a percentage of the total tree height. When determining the base of the lowest contiguous live crown, do not consider forks originating below breast height or epicormic branches. As the tops of defoliated trees may appear dead at the time of live crown assessment, care must be taken so that the live crown length is not underestimated.

Assign to each live tagged tree a live-crown length estimated to the nearest 10%. Record live-crown length (as 1 for 10%, 2 for 20%, etc.) in column 66 of the field sheet (F.S. 820).

## Stand Structure

Stand structure is the physical arrangement or pattern of organization of the stand. Stand structure is described and classified according to recognizable differences in age and in height.

The stand structures recognized are:

### A. Single layer

1. Simple structure (even age, even height)
  - a) Without veterans
  - b) With veterans
2. Complex structure (uneven age, uneven height)
  - a) Without veterans
  - b) With veterans

### B. Multi-layer: (A multi-layered stand has two distinct layers)

1. Layer 1 (top layer)
2. Layer 2 (bottom layer)

For further details on stand structure, see Appendix 11.

For each tagged tree, identify the layer to which it belongs. For single-layered stands, leave the layer column (65) blank (including veterans) as 1 is assumed for trees in the main stand and tree class 5 identifies the veteran layer. For multi-layered stands, record the layer code for each tagged tree in column 65: codes 1 and 2 for layer 1 and layer 2, respectively.



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## Sample Trees

### ⇒ Sample Trees for Height

Local height-diameter curves are constructed from growth sample data before samples are compiled. To construct reliable curves, a substantial number of heights are needed for each species. The number is dependent on the stand composition, which ultimately is based on gross volume. In the field, use the calculated basal area for stand composition if possible; otherwise, the 50% rule (see Appendix 44) is acceptable. For a single layered stand or for each layer (1 and 2) in a multi-layered stand, select height sample trees for each sample as follows:

### ⇒ A. For each major species (20% or greater by composition) select the following:

#### 1. Top Height Trees

Select the required number of top height trees to a maximum of ten. Top height is the average height of a sample of suitable (i.e. largest diameter, living tree free of major defects with a crown class of 1 or 2) trees, each selected from a non-empty (i.e. plot with a suitable tree) 0.01 hectare plot/sector. For example, on a 0.01 ha sample, ten top height trees (if suitable) would be measured (i.e. the largest d.b.h. tree from each top height sector). In the same way, four top height trees would be measured in a 0.04 ha sample using the modified top height sectors described in *Division of the Plot into Sectors*.

#### 2. Remaining Range

Select an additional 15 trees distributed evenly throughout the remaining range of d.b.h. down to 2.0 cm.

- ⇒ B. For each minor species (10 to 19% by composition) and scattered species (less than 10% by composition), select 15 height sample trees (if present and suitable). Distribute them evenly throughout the d.b.h. range down to 2.0 cm.
- ⇒ C. For the Veteran layer, select for height measurement one sample tree from each species present. Estimate the height of all the other veterans and record it in the small tree or Vet height section (columns 27 to 29 of card type 3) and write "estimated" in the remarks column.

Whenever possible, select residual trees (tree class 1) for height measurements, otherwise select trees that do not have major suspect characteristics such as a major fork which affects the true height or a major scar at breast height which affects its true diameter.

Do not use trees with estimated diameters and trees with leans or sweeps greater than five degrees.

For good height measurements, the top and the bottom of the tree must be clearly visible and the reading of the Suunto percent scale should not exceed 90%. The bottom reading should be taken at the tree tab height for the correction of 1.3 metres.

In some areas it may not be possible to meet the height requirements if only "suitable" sample trees are taken. In this situation take the best of the "poor" height trees to try and meet the requirements unless the individual tree height is at least 10% shorter than it would be without the defect (e.g., lean, fork, broken top, etc.) Make a note of the amount (in metres) that the top height has been underestimated due to using less suitable top height trees.



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- ⇒ To ensure accurate and consistent measurements of suppressed trees with flattened tops (common with hemlock), sight on the highest point of the top and keep the top reading as low as possible (less than 60%). Even though lateral branches are often higher than the tiny (not very visible) leader of suppressed cedar trees, ensure that the top reading is taken on the tiny leader and not on the lateral branch that may be higher.

- ⇒ **Note:** To ensure that the height measurement is consistently taken from the same location, paint a blue spot at the base of the tree to indicate the direction from which the height measurement was made.

## ⇒ Sample Trees for Age

In signal layer single structure stands (pure and mixed) average age is determined from the ages of the top height trees of the leading major species on the sample. In mixed stands, take one additional age for each major species to determine if each is in the same age class. If the second major belongs to a different age class, and its volume is within 10% of the first, then also take the same number of ages for it. The age of the second major is not included in the calculation of average sample age, but the presence and the age of it are noted in the stand description.

- ⇒ The sample mean age is derived only from the top height trees of the leading species even if some cores have rot. By estimating the rot portion, a total age can be derived and used in the calculation of the mean age.
- ⇒ Trees which appear to be veterans must be bored to confirm that they are in fact vets. Bore the smallest diameter vet per species only as the others can be assumed to be vets also. The ages of the veterans are not used in the

calculation of the main stand age but are used for the vet layer.

- ⇒ In single layer complex structure stands, average age is also determined from the ages of the top height trees of the leading major species; but to show the variation of the stand age, take two additional ages (of the leading major) from the younger portion of the stand. For each additional major, take one age from the top height trees but do not include them in the mean age calculation.
- ⇒ In multi-layered stands select sample trees for age as above for each layer. The top height method for determining site index is more suited to even-aged stands. However, for simplification, select age sample trees for both layers of a multi-layered stand using the top height requirements as above.
- ⇒ Bore trees selected for age at 1.3m (breast height) above the base of the tree on the uphill side. Half the cores taken must include the pith. If the pith is included, record Y in the pith column of the field sheet. If the pith is missed by more than an estimated three years on a tree under 100 years old, or by five years on a tree over 100 years old, then rebore the tree. Count ages in the field and record them on the field sheet. Then measure the radial increment for the last 10 and 20 years (to the nearest millimetre) and record the measurements in the radial increment section of the field sheet. In addition, for samples in stands that have been selectively logged (complex stand structure), put the accepted cores in plastic straws, which must be properly labeled with region number (#R), compartment number (Co#), sample number (G#), plot number, tree number, species, counted age, and boring height. Collect these straws and return them to the Forest Inventory Branch for further analysis.



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⇒ Because trees are bored for age at breast height, to obtain total age, a correction must be made for each tree. From the appropriate species site table in the *Field Handbook*, determine a site index for each tree based on the breast height age and the height of each sample tree measured for both age and height. Select the age correction (i.e. years to breast height) for each tree based on the site index of each tree. If any sample tree has rot, count the rings on the portion of core that is sound, estimate the number of years in the rotten portion, add the number of years in the sound portion to the number of years in the rotten portion and record the total breast height age in the boring age section (columns 46 to 48 of card type 4) of the field record sheet. Record R for rot in column 56 of the field record sheet (card type 4).

**Note:** If it is not possible to bore a small tree (i.e. tree less than 5.0 cm d.b.h.) for age without damaging it, select an outside-plot tree and bore it. Assign tree numbers 980 to 999 to outside-plot trees. Paint a blue spot on each tree at breast height and reference the tree by including a diagram (in the remarks section of card type 4) showing the plot and the approximate location of the tree.

## Crown Closure and Slope Position

### Crown Closure

Crown closure is the percentage of ground area covered by the vertically projected tree crowns. Estimate crown closure for each plot by layer to the nearest 10% and record it in the crown closure column of the field sheet. Record crown closure for the veteran component to the nearest percent. Crown closure for the veteran component in the sample must be less than 6% or it must be classified as a separate layer.

## Slope Position

⇒ Slope position is the relative position of the sample within a catchment (water) area. The recognized slope position categories (see Figure 1) are Crest, Upper, Mid, Lower, Toe, Flat (level) and Depression. Record the slope position below the slope (%) columns as C, U, M, L, T, F and D respectively.

## Stump Measurements

⇒ For each stump of commercial species, with a diameter of 12.5 cm or greater, found on growth plots established in selectively logged stands, measure and record by sector: stump number (900-979 assigned but not affixed to them), species, height, diameter, new or old (under 10 years since cutting or over respectively) and tree number of the closest tagged tree.

## Stem Mapping

For use in distance-dependent growth modeling studies, 10% of the growth samples established in natural stands are stem mapped. The Forest Inventory Branch designates the stratum (type group, site, age class) and the number of samples to be stem mapped. To establish the location of trees on these circular plots, measure and record on the stem mapping



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section of the field sheet, the bearing and distance from a point, usually plot centre, to each tagged tree. For a list of equipment needed for stem mapping, see Appendix 12.

To stem map growth samples, follow this procedure:

- Set up the staff compass directly over the aluminum plot centre stake, and level the instrument. Record 1 in column 15 (card type 6) on the back of the field sheet (F.S. 820).

If a tree of large diameter interferes with sightings on a considerable number of trees in the plot, then set up the instrument in an opening close to plot centre, but measure and record the bearing and the distance from the instrument to the plot centre. Record these measurements on the back of the Field sheet in columns 16 to 23 (card type 6); also record 2 in column 15.

- Adjust the staff compass for magnetic declination, and raise the sighting vanes. In Western Canada, magnetic declination is east of true north. Obtain the correct magnetic declination from an isogonic chart (see Appendix 13).
- 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 holders, 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.

- Measure the slope distance between plot centre (staff compass) and the centre of the tree.
- Measure the slope with the clinometer (Suunto) using the percent scale.
- Read the staff compass bearing on the scale at the north end of the compass needle.
- Record the measurements in the respective columns alongside each tree number on the plot sheet.

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

All stem-mapped plots should be photographed on 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. Record the tree number of the flagged tree in the section titled "Notes" on the field sheet (F.S. 820).



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## Growth Sample Field Sheet (F.S. 820)

Column	Item	Instruction
<b>Front of the Growth Sample Field Sheet (see Appendix 7).</b>		
<i>Card Type 1 - Sample Data</i>		
1 to 2	Region No.	Enter the provincial inventory reference region number obtained from inventory maps.
3 to 5	Compt. No.	Enter the provincial inventory reference compartment number obtained from inventory maps.
6	Compt. Letter	Enter the provincial inventory reference compartment letter. Only a few areas in B.C. have a compartment number followed by a letter, and they are mainly on the Coast. If the compartment letter does not exist, leave blank.
7 to 9	Sample No.	Enter the consecutive sample number for the compartment.
10	Sample Type	Enter G.
11	Plot No.	Enter the plot number (1).
12	No. of Plots in Sample	Enter 1.
13	Card Type	Card type 1 is entered.
14	Measurement No.	Enter 0, which is the code for the initial sample measurement.
15	Agency	Enter I for Company sample or leave blank if Ministry sample.
16	St. Str. Code	Enter 1 for simple stand structure, 2 for complex stand structure, and 3 for multi-layer.
17	Primary Layer	Enter Primary Layer (1 or 2) if multi-layer stand structure.
18 to 30	Ecosystem	Enter the ecosystem if ecologically classified.
31 to 33	Mean Age (Layer 1)	Enter the mean age for Layer 1.
34 to 36	Mean Age (Layer 2)	Enter the mean age for Layer 2 if applicable.
37 to 39	Mean Age (Layer V)	Enter the mean age for the veteran component. If Layer V does not exist, leave blank.
40 to 45	Age Range	Enter age range (youngest and oldest age) for samples established in complex-layered stands.



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- |          |                                |  |
|----------|--------------------------------|--|
| 46       | Sel. Logged                    | Enter S if the sample is in a stand that has been selectively logged.  |
| 47       | Stem Map                       | If the sample is not stem mapped, enter N; if it is stem mapped, enter Y.                                    |
| 48 to 50 | Top Height (Layer 1)           | Enter the top height for Layer 1.  |
| 51 to 53 | Top Height (Layer 2)           | Enter the top height for Layer 2 if applicable.  |
| 54 to 56 | Top Height (Layer V)           | Enter the top height for Layer V if applicable.  |
| 57 to 60 | Complete Disturbance           | Record the complete disturbance type and year.   |
| 61 to 67 | Partial Disturbance            | Record the partial disturbance type, species, year, and degree.  |
| 13       | <i>Card Type 2 - Plot Data</i> |  |
| 14       | Measurement No.                | Enter 0 which is the code for the initial sample measurement.  |
| 15       | F.I.Z.                         | Enter the Forest Inventory Zone.   |
| 16 to 19 | Plot Size                      | Enter the plot size.   |
| 20 to 23 | Plot Radius                    | Enter the plot radius.   |
| 24 to 27 | Sub-plot Size                  | Enter the sub-plot size.   |
| 28 to 31 | Sub-plot Radius                | Enter the sub-plot radius.   |
| 32 to 34 | Aspect                         | Enter the plot aspect in Azimuth (0 is for flat and 360 is North).   |
| 35 to 37 | Slope                          | Enter the average slope of the plot in percent.  |
|          | Slope Position                 | Record the slope position category (C, U, M, L, T, D, F) of the sample just below the slope percent columns. |
| 38 to 41 | Elevation                      | Enter elevation above sea level.   |
| 42 to 44 | Crown Closure (Layer 1)        | Enter the crown closure of the plot (for layer 1) to the nearest 10%.  |
| 45 to 47 | Crown Closure (Layer 2)        | Enter the crown closure of the plot (for layer 2 if applicable) to the nearest 10%.                          |
| 48       | Crown Closure (Layer V)        | Enter the crown closure of the plot for the veteran component (must not be greater than 5%).                 |



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- 49 Plot Status Enter the status of the plot (**A** = active, **D** = inactive - abandoned, **X** = destroyed, **L** = lost in field, **B** = badly disturbed).
- 50 Stand Origin Enter the stand origin (**C** = coppice, **F** = fill planted, **G** = genetic, **N** = natural, **P** = planted, **R** = residual stand, **S** = seeded).
- 51 to 56 Date of Measurement Enter the date of plot measurement (year-month-day).
- 57 to 64 Map No. Enter the B.C.G.S. map sheet number.
- 65 to 72 Photo No. Enter the B.C. flight number and photo number.
- 73 to 74 Year of Plantation Enter the year in which the stand was planted (silviculturally treated samples only).
- 75 Stock Age Enter the age of the stock planted (silviculturally treated samples only).
- 76 to 77 Tagging Limit Enter the tagging limit (silviculturally treated samples only).
- 78 Tagging Limit Code Enter the tagging limit code (**H** = ht, **D** = diameter) for silviculturally treated samples only.
- 13 *Card Type 3 - Tree Data*
- 14 Measurement No. Enter **0** which is the code for the initial sample measurement.
- 15 to 18 Tree No. Enter the tag number of the tree being examined.
- 19 to 20 Species Enter the commercial or non-commercial species code of the tree being examined. For species codes, see Appendix 14.
- 21 to 22 Sector No. Enter the sector in which each tagged tree is located.
- ⇒ 23 to 26 D.B.H. (1.3 m) Enter the diameter at breast height (1.3 m above the base of the tree on the uphill side) of each tagged tree 2.0 cm d.b.h. and greater to the nearest millimetre.
- ⇒ 27 to 29 Small Tree or Curve Height Enter (if applicable) small tree height to the nearest decimetre for tagged trees (trees greater than 1.3 m in height but less than 2.0 cm d.b.h. at 1.3 m). Also, record the estimated or measured height for veteran trees.



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30	Tree Class	Enter the tree class code: residual (1), suspect (2), or veteran (5). For trees less than 2.0 cm d.b.h., always record tree class code 1.
31 to 38	Pathological Remarks	Record decay indicators present on each tree.
39	Crown Class	Record the crown class (1 to 6) of each tree.
40 to 48	Stem Mapping	Record the stem-mapping information for each tree.
49 to 55	Stumps	Record the stump height, diameter, and new or old code (for samples in selectively logged stands only).
⇒ 56 to 59	Near Tree No.	Record the tree number of the closest sequentially numbered living tree to the ingrowth or sub-plot tree being measured.
60	Sub-plot Tree	Record code 1 if the tree is located in the sub-plot and is less than 4.0 cm d.b.h.
61 to 64	Pest	Record the pest code and severity / intensity if injury or pests are present on the tree.
65	Layer	If the stand has more than one layer, enter the layer to which that tree belongs (for single-layered stands, the layer column must be left blank). For veteran trees (tree class 5), also leave blank.
66	Live-crown Length	Enter the length of the live crown expressed as a percentage of the total length of the tree (to the nearest 10%; 1 = 10%, etc.).
67	Missed Tree and Out of Plot	Do not use at establishment.
68	Nat., Plant	Enter P if tree was planted. Leave blank if tree regenerated naturally.
69 to 74	Remarks	Enter pertinent tree information not recorded in preceding columns.



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## Back of the Growth Sample Field Sheet (see Appendix 7)

### Card Type 4 - Sample Tree Data

1 to 12	Plot Identity	Enter the region no., comp. no., letter, sample no., sample type, plot no., no. of plots in sample.
13	Card Type	Card type 4 is entered.
14	Measurement No.	Enter 0 which is the code for the initial sample measurement.
15 to 18	Tree No.	Enter the tree number of the sample tree.
19 to 20	Species	Enter the species of the sample tree.
21 to 23	Top	Enter the top Suunto reading (% scale).
24 to 26	Bottom	Enter the bottom Suunto reading (% scale, + or -).
27 to 29	Total	Enter the total of the top and bottom readings.
30 to 32	Slope Dist.	Enter the slope distance from the tree to the measurer.
33 to 34	Slope %	Enter the slope percent.
35 to 37	Horiz. Dist.	Enter the horizontal distance between the tree and the measurer.
38 to 40	Height	Enter the calculated height.
41 to 42	Height Correction	Enter the height correction (normally 1.3 m).
43 to 45	Total Height	Enter the total height.
46 to 48	Boring Age	Enter the boring age.
49 to 50	Boring Height	Enter the boring height (1.3 m).
51 to 52	Age Correction	Enter the age correction.
53 to 55	Total Age	Enter the total age.
56	Pith	If the pith is included, enter <b>Y</b> , if missed leave blank, and if the core has rot enter <b>R</b> .
57 to 62	Rad. Inc. (mm)	Record the radial increment (to the nearest mm) during the last 10 and 20 years for trees bored for age.
63	Comp. Age	Record <b>A</b> if the tree is to be included in the sample average age calculation.
64	Comp. Ht.	Record <b>H</b> if tree is to be included in top height calculation.
65 to 66	Remarks	Enter pertinent remarks.



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## Card Type 5 - Tree Count Summary Data

13	Card Type	Card type <b>5</b> is entered.
14 to 15	Species	Enter the species symbol (see Appendix 14).
16	Measurement No.	Enter <b>0</b> which is the code for the initial sample measurement.
17 to 19	Dot Tally	Enter the number of trees in d.b.h. class by species (dot tally).
20 to 21	D.B.H. Class 0	Enter the number of trees in d.b.h. Class 0.
22 to 24	Dot Tally	Enter the number of trees in d.b.h. Class 1 by species (dot tally).
25 to 26	D.B.H. Class 1	Enter the number of trees in d.b.h. Class 1.
27 to 29	Total	Enter the total number of trees in d.b.h. Class 0 and 1.
30 to 43	Tree Count	As for columns 16 to 29 for a second measurement.
44 to 57	Tree Count	As for columns 16 to 29 for a third measurement.

## Card Type 6 - Stem Mapping Data

(13 to 23)	Stem Mapping	Record the necessary information for stem-mapped samples.
13	Card Type	Card type <b>6</b> is entered.
14	Measurement No.	Enter <b>0</b> which is the code for the initial sample measurement.
15	Compass at PLT Centre Y = 1 N = 2	If the staff compass was set up at plot centre, record <b>1</b> , and if it was set up elsewhere, record <b>2</b> .
16 to 18	Bearing From Compass to Plot (0 to 360)	If the compass was not set up at plot centre, record the bearing ( <b>0 to 360</b> ) from the compass to the plot centre.
19 to 20	Slope (%)	Only if the compass was not set up at plot centre, record the slope percent from the compass to plot centre. If the slope is zero, record <b>0</b> .
21 to 23	Slope Distance (0.01 m)	If the compass was not set up at plot centre, record the slope distance from the compass to plot centre.
	Sector Diagram	Sketch the layout of the plot sectors for future reference.



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- Location and Access      Describe in detail the location of the sample and the access to it.
- Notes                      Record remarks in this area.
- Meas. No. \_\_\_ by \_\_\_      Record the measurement number and have the measurer sign the sample.
- Dead Tree Tally            Record the dead standing trees by species and 5 cm d.b.h. classes in a dot tally.

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

Refer to Appendix 1 for the standards of measurement, which state the non-sampling error or variation allowed. Sampling crews should emphasize accuracy of measurement and then production.

To ensure that crews continue to work efficiently and 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 may be required to redo 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 on the field sheet all errors greater than the allowable standard .

## Office Checking of Samples

All field sheets must be office checked before sending them to the Growth and Yield section at the Forest Inventory Branch. To office check properly:

- A. Check that all information recorded is legible and dark enough for clear photocopying.
- B. Check that the region number, the compartment number, the compartment letter, the sample number, sample type, plot number, number of plots in sample, and measurement number have been recorded on every page and the tree information is complete, has been recorded in the proper column, and has been correctly justified.
- C. Check that for each plot the bearing and distance from plot centre to three tagged, living trees have been recorded in the stem map columns.
- D. For samples that were stem mapped, check that the required information on the location of the staff compass has been recorded for card type 6.
- E. If the distance measured is the horizontal distance, check that a zero has been recorded in the slope percent column, that is for stem map and height measurement.



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F. Check that the tree class meets these criteria:

*Tree class 1* - Tree has no decay indicators.

*Tree class 2* - Tree has one or more decay indicators.

*Tree class 3* - Not used.

*Tree class 4* - Not used.

*Tree class 5* - Tree is a veteran.

G. Check that the sample trees have been selected in accordance with the specifications in this manual (see the *Sample Trees* section of this chapter).

H. Check height calculations.

I. Check that mean sample total age and sample top height have been calculated correctly and have been recorded on the first sheet of the plot.

J. Check that agency, stand structure code, primary layer (if multi-layered stand), ecosystem (if applicable), stand disturbance (if applicable), the age range (if applicable), the stem map code, the selectively logged code (if applicable), the F.I.Z., the plot and sub-plot sizes and radii, the aspect, the slope, the slope position, the elevation, the crown closure, the plot status, the stand origin, the date of measurement, the map number, and the photo number have been recorded only on the first sheet of each plot.

K. Check that the number of tagged plot and sub-plot trees plus those in the tree count total a minimum of 110 trees.

L. Check that the dead standing trees (if any present) have been recorded correctly.

M. Check that the pages have been numbered properly and the tally person has signed the

sample.

## Plot Inspection Procedures

### Pre-field Inspection

A. Randomly select one plot that has been office checked according to the procedures in the *Office Checking Samples* section of this chapter.

B. Randomly select seven trees from the tree detail section (card type 3) of the field sheet and transcribe their respective measurements onto the top section of the plot inspection report (F.S. 822(1), see Appendix 15).

C. Randomly select five trees for height from the sample tree section (card type 4) of the field sheet and transcribe their height measurements onto the sample tree section of the plot inspection report.

D. Select two trees for age (i.e. two of the five selected for height) from the sample tree section and transcribe the age measurements into the sample tree section of the natural stands plot inspection report.

E. Transcribe the crown closure, aspect, and slope of the plot onto the appropriate section of the plot inspection report.

F. Enter the sample identity (region, compartment, sample, sample type, plot), plot and sub-plot sizes, plot and sub-plot radii, inspection date, original tally crew, and the date of measurement in the section at the top of the plot inspection report.

G. Randomly select (from the tree count summary section) one diameter class for a species to check (in the field) that the dot tally is correct for that class.

H. Randomly select (from the dead tree tally) one diameter class for a species to check (in



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the field) that the dead tree tally is correct for that class.

## Field Inspection

- A. Use the access notes to get to the plot.
- B. Check that the tie point is marked as specified in the *Tie Point* section of this chapter.
- C. Verify that the tie line bearing and distance were run within the allowable standards.
- D. Check that the aluminum plot centre markers are inscribed correctly and the plot centre stake is protected with a cairn.
- E. Check that the bearings and distances from plot centre to three trees are correct.
- F. Check the plot and sub-plot radii each at a minimum of three different locations on the perimeter for trees that should have been included or excluded from the plot or sub-plot. Also, check that trees away from the perimeters, but within the plot and sub-plot that are larger than the tagging limits, were not missed. Flag with a circled asterisk any tree missed or tallied when it should have been included or excluded, respectively.
- G. Check that all sub-plot trees less than 4.0 cm d.b.h. but at least 0.3 m in height were either tagged or counted in the dot tally.
- H. Check that all dead standing trees have been recorded in the dot tally.
- I. Carefully measure all the selected trees recorded on the plot inspection report for:

### 1. *Tree identification*

Check that the genus or species of each tree inspected is correct and place a circled asterisk beside a tree that was incorrectly identified.

### 2. *Tree tag height*

Check the tag height of the seven selected trees to verify that breast height has been located at 1.3 m above the base of the tree on the uphill side. At the same time, make sure that the nails have been securely driven into the trees and the nail with the tag has been driven in at a slight angle so that the tag hangs away from the tree.

### 3. *Diameter and pathological remarks (decay indicators)*

Measure the seven selected trees for d.b.h. and classify them.

### 4. *Sample tree heights*

Measure the five selected trees for height.

### 5. *Stem mapping*

If the sample was stem mapped, check the seven selected trees for bearing, distance, and percent slope.

Also, assess crown closure for the plot. Compare all of the check measurements with the crew's measurements and give the crew the benefit of the doubt on any slight discrepancy.

- J. Check that the results conform to the standards of measurement (see Appendix 1).
- K. Use an asterisk in the margin to indicate that the difference between the two measurements is greater than the allowable error.
- L. Use a circled asterisk in the margin to indicate that the error is greater than two times the allowable error.
- M. Complete the inspection items section of the inspection report.
- N. Rate the quality of the work on the plot



# FOREST INVENTORY

using the system of weighting in Appendix 16.

- O. Record the plot rating and any other comments in the remarks section of the plot inspection report.

### Post Field Inspection

- A. Discuss the results of the plot inspection with the original tally crew.
- B. Make recommendations to the original field crew, when necessary, for improvement of their work.
- C. Change, on the original field sheets, all data flagged with an asterisk or a circled asterisk.

SECTION	
Growth and Yield/Decay and Volume	
CHAPTER	
Est. of Perm. Growth Samp. in Nat. Stands	
REVISION NO.	DATE
1.1	Sept. 1, 1993

### Mapping of Samples

Having established the samples, plot them on the forest cover maps at the Forest District office. Send copies of the maps showing the location of all the samples to the forest region and to the Forest Inventory Branch.

### Return of Field Sheets

Once the field sheets have been office checked and corrected, make good legible photocopies of them before sending the originals to the Growth and Yield Section at the Forest Inventory Branch. Store the photocopies in the forest region for security and reference. Send a covering letter with the originals that lists the samples sent, and keep a duplicate of the covering letter for field office records. Use the registered mail service if sending the package through Canada Post.