

CHAPTER EIGHT  
GROWTH AND YIELD  
NATURAL STANDS

SECTION 8.12

REMEASUREMENT OF PERMANENT GROWTH

SAMPLES IN NATURAL STANDS

1989

## REMEASUREMENT OF PERMANENT GROWTH SAMPLES IN NATURAL STANDS

TABLE OF CONTENTS

	<u>Page</u>
8.121	Office Preparation .....
8.122	Field Training .....
8.123	Relocation of the Sample and its Centre .....
8.1231	Access Notes and Tie Point .....
8.1232	Tie Line .....
8.1233	Centre Tree .....
8.1234	Centre Tree Markers .....
8.1235	Plot Centre Stake .....
8.124	Remeasurement of the Plot and Establishment of the Sub-plot ..
8.1241	Tree Tagging .....
8.1242	D.B.H. Measurement .....
8.1243	Tree Class and Decay Indicators .....
8.1244	Tree Classification .....
8.1245	Crown Class and Live-crown Length .....
8.1246	Ingrowth .....
8.1247	Sub-plot Establishment and Tree Count .....
8.1248	Stand Structure .....
8.1249	Sample Trees .....
8.124.10.	Crown Closure .....
8.124.11.	Growth Sample Record Sheet (F.S. 820) .....
8.125	Stem Mapping .....
8.126	Quality Control .....
8.1261	Office Checking of Samples .....
8.1262	Plot Inspection Procedures .....
8.127	Damage to the Sample .....
8.128	Return of Growth Sample Record Sheets (F.S. 820) .....

## REMEASUREMENT OF PERMANENT GROWTH SAMPLES IN NATURAL STANDS

LIST OF FIGURESPage

8-1	Sample tree selection in a single-layered, simple stand .....
8-2	Sample tree selection in a single-layered, complex stand .....
8-13	D.b.h. and the point of germination
8-14	Tagging and height measurement of abnormal trees less than 2.0 cm d.b.h.
8-15	Blind conk and sound knot
8-16	Point of germination
8-17	Closed scars
8-18	Open scars
8-19	Cankers caused by fungi
8-20	Scars caused by rock slides and falling rocks
8-21	Types of fork and crook
8-22	Frost crack on standing trees
8-23	Trunk infections of mistletoe
8-24	Branch infections of mistletoe
8-25	Rotten branches
8-26	Flutes
8-27	Candelabra branches
8-28	Branch fans
8-29	Black knots
8-30	Burls and galls
8-31	Sweep
8-32	Exposed roots
8-33	Sapsucker holes and scarring by woodpeckers
8-34	Crown classes
8-35	Crown class for trees in a multi-layered stand
8-36	Profile of a single-layered, simple stand
8-37	Profile of a single-layered, complex stand
8-38	Profile of a multi-layered stand with two simple layers
8-39	A 260-year old layer of Douglas-fir with a 105-year old layer of lodgepole pine
8-40	A 40-year old stand of white spruce with an 80-year old overstorey of trembling aspen

## REMEASUREMENT OF PERMANENT GROWTH SAMPLES IN NATURAL STANDS

LIST OF TABLESPage

8-1	Metric d.b.h. classes and limits .....
8-2	Imperial d.b.h. classes and limits .....

LIST OF APPENDICES

8-1	Standards of measurement for permanent samples
8-5	D.b.h. and the point of germination
8-6	Measurement and classification of abnormal trees and of trees with forks and broken tops
8-7	Growth sample record sheet for natural stands (F.S. 820)
8-8	Decay indicator position codes
8-9	Pathological classification of trees
8-10	Crown class
8-11	Stand structure
8-12	Equipment list for stem mapping
8-13	Isogonic and isoporonic chart (1980)
8-14	Species symbols
8-15	Plot inspection report (F.S. 822(1)) for natural stands
8-16	Weighted error rating table and the basis for the acceptance or rejection of a plot
8-17	Equipment list for remeasurement of permanent samples in natural stands
8-18	Tie point and plot centre aluminum growth plot marker for single plot samples
8-19	Plot and sub-plot radii slope allowance for natural stands sample remeasurement
8-31	Recommended buffers for permanent growth samples

## SECTION 8.1

### NATURAL STANDS

#### 8.12 REMEASUREMENT OF PERMANENT GROWTH SAMPLES IN NATURAL STANDS

Growth plots in natural stands are remeasured periodically (5 to 10-year periods) whenever the unit in which they are located is reinventoried or when the remeasurement can be coordinated with other field activities of the Forest District or Region. As the original intention of the growth and yield program was for a 10-year remeasurement period, this period should be maintained whenever possible. A list of growth plots with their establishment and remeasurement dates and map locations by management units (P.S.Y.U. and T.S.A.) is regularly circulated to the regions so that remeasurement can be planned years in advance. The standards of measurement for permanent samples are listed in Appendix 8-1. If not already done, all samples due for remeasurement 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 8-31 are recommended.

#### 8.121 Office Preparation

Before field work, prepare and collect:

- A. Copies of the original field record sheets - with room to record the new measurements.
- B. Maps for navigation, (e.g. 1:250 000 contour maps) and photo copies of parts of forest cover maps (approximate scale 1:20 000) showing plot locations in detail.
- C. Photos showing original tie points, either those used at the time of establishment or preferably the latest photos on which tie points and plot locations have been replotted.
- D. Equipment: see Appendix 8-17

#### 8.122 Field Training

All personnel involved in remeasurement must attend a short training course to familiarize them with field procedures. Crews should then begin to work under direct supervision of senior personnel for a period of time sufficient to gain a full understanding of the different phases of the work and to attain reasonable efficiency in the collection of field measurements.

#### 8.123 Relocation of the Sample and its Centre

The notes on location and access usually begin with a description of an easily identifiable point the location of which will likely remain unchanged. Follow the access notes to the tie point and correct them when necessary.

The reference or tie point generally is a prominent topographic feature distinguishable on the photos and on the ground, such as a road junction, a bend in a road, a creek junction or a bridge. The tie tree is a blazed tree located near this reference point. Usually, aluminum growth plot markers are attached by nails to the tree, and strands of plastic red flagging tape are still noticeable on or near the tree. The location of this tree is described in the access notes of the growth sample record sheet (F.S. 820). On the aluminum marker of this tree (see Appendix 8-18), pertinent plot information is recorded such as: region number, compartment number, growth plot number, bearing and distance to the plot centre, and date of plot establishment.

Usually, it is not difficult to locate the original tie point, but sometimes it is impossible owing to disturbances and changes since its establishment. When the location of the tie point becomes difficult, select a new, convenient one recognizable on the photos and on the ground and, from the map, measure and record the new bearing and distance to plot centre. Blaze both sides of the tie tree in the direction of the tie line. Above the blazes, nail two aluminum growth plot markers and on them inscribe the pertinent information (see Appendix 8-18).

Note: "Date" on the marker always refers to the original date of plot establishment.

Flag the tie tree with two strands of red flagging tape, one above and one below the markers.

Each aluminum marker is divided into two sections. When used as a tie point marker, complete only the bottom section and, when used as a plot-centre marker, complete the top section.

From the tie point, the tie line is run with a hand compass, clinometer and chain (or measuring tape). When rerunning the original tie line it is sufficient to renew only the blazes and tape markings at approximately 10-metre intervals. If a new tie point is established, run a new tie line. Follow the bearing set on the hand compass, and mark the distance on the ground every 40 metres. On sloping terrain, make an allowance for slope, which is measured with a clinometer (Suunto), and correct the distance travelled by adding the appropriate correction marked on the chain (or measuring tape). Over broken terrain it may be necessary to correct distance for slope every 20 metres.

8.1233 Centre Tree

Each established plot has a centre tree marked with aluminum growth plot markers and strands of flagging tape usually secured about two metres above ground to avoid interference with measurements of d.b.h. If this tree is missing, either through natural mortality or through man's activity, select another centre tree near the plot centre and mark it properly.

8.1234 Centre Tree Markers

It is usual to find missing or illegible plot centre tree markers; replace them at the time of remeasurement. They are identical to those used in tie-tree marking (see Appendix 8-18) but complete only the top sections and on them inscribe growth plot number, region number, compartment number, and date of plot establishment.

Very often the plot centre also serves as a tie point for the next plot on the tie line, in which case, both sections of the marker are filled out. Because this is a measured tree on the plot, do not blaze it.

8.1235 Plot Centre Stake

Plot centre is marked by a tubular aluminum stake either driven into the ground or supported by a cairn on rocky ground. The stake can usually be identified by the flagging tape on it. If the plot centre stake is missing, pulled out but laying on the ground, or bent but still in the original location, replace it with a new one. To replace a bent stake is not difficult as the original hole is preserved. With some investigation, it may be possible to locate the original location of a stake found laying on the ground. However, if the stake is missing, it is a difficult, time consuming but necessary task to relocate the plot centre.

If the plot centre stake is missing, it is preferable first to tally the original trees on the plot. Some tags may be down or missing, so replace them before relocating the centre stake.

Secondly, determine the approximate centre by observing the layout of the sectors (see Appendix 8-7).

Thirdly, find trees close to the plot perimeter and measure the plot radius from these trees until the approximate plot centre is determined with reasonable certainty. This procedure is particularly important where the plot boundary goes through a clump of trees.

To prevent future problems with the location of plot centre, build a cairn around all plot centre stakes; measure the bearing and slope distance from plot centre to the centre of each of the three trees near the plot stake; and record the tree numbers, bearings, and slope distances in the stem map column of the growth sample record sheet. On the back of the growth sample record sheet on the section titled "Notes", record the year of measurement and whether the stake was in place or missing.

## 8.124 Remeasurement of the Plot and Establishment of the Sub-plot

Accurate, conscientious work is required when comparing obtained measurements with previous measurements and when rechecking measurements that appear to be out of the expected range, that is, ones showing a very large increase compared with those showing little or no increase. Place a check mark beside double-checked data on the growth sample record sheet. Correct errors in species identification and note them in the remarks column: for example, "Tree no. 60 is a Hw not a Fd".

## 8.1241 Tree Tagging

After one base-year measurement of diameter at 1.30 m and 1.37 m above the germination point, all future remeasurements will be at 1.30 m.

At the time of plot establishment, all living trees 9.1 cm and greater in diameter at breast height (4.5' = 1.37 m) were tagged with round blue plastic tags in sets numbered 1 to 300. All missing tree tags at the time of remeasurement must be replaced. For this purpose, use one of two methods (the first being the preferred one). Only one method is to be used within a Forest Region, and use it for all applicable sections of this chapter.

### Method 1

Use the embosser to inscribe the tree number on the aluminum tape and nail this tape to the tree at 1.37 m height; if possible, use the original nail hole. Drive a second nail into each previously tagged tree at a point 0.07 m below the original nail.

### Method 2

Use the embosser to inscribe the tree number on the aluminum tape and nail this tape to the tree at 1.3 m height. Note on the sample record form that method 2 was used.

For both methods, record "new tag" in the remarks column for that tree if a tree tag and nail are missing. Tag the trees by sectors as indicated in the sector diagram on the reverse side of the growth sample record sheet.

For all originally tagged living trees without missing tags, either drive a second nail into each tree at a point 0.07 m below the original nail (if method 1 was selected), or first mark the point at 1.37 m and then move the nail and tag and place them at 1.3 m (if method 2 was selected).

During the first measurement, tagging began in sector 1 and continued in a zig-zagging pattern that began at plot centre and went back and forth toward the circumference with tags facing the plot centre. Once all taggable trees in sector 1 were numbered, the procedure was repeated in sector 2, only this time tagging began at the circumference instead of at plot centre with the tags facing the circumference. The procedures for tagging sectors 1 and 2 were repeated alternately for all remaining sectors of the plot.

For subsequent remeasurements, repeat this same procedure while looking for the next tree. On the back of the growth sample record sheet on the section titled "Notes", record the percentage of tags missing at the time of remeasurement.

## 8.1242 D.B.H. Measurement

Measure the diameters at 1.3 m and 1.37 m above the nail for all numbered living trees and record them to the nearest millimetre (see Appendix 8-5). If a number is missing or out of sequence, renumber the tree as described in Section 8.1241.

Note 1: When remeasuring diameter, readjust the nail holding the number. Pull it out enough to allow for tree growth until the next remeasurement.

Note 2: Measure the diameters at 1.3 m and 1.37 m above the nail for all previously numbered living trees that are now dead. Assign the same diameter as for the previous measurement if the dead tree cannot be found. In addition, for a tree class 6 tree, measure the stump height and diameter, determine whether the stump is old (10 years plus since cutting) or new (less than 10 years since cutting) and record this information in columns 46 to 52 of the field record sheet.

## 8.1243 Tree Class and Decay Indicators

## A. Tree Class

Each tagged tree is classed as either tree class 1 (residual), tree class 2 (suspect), tree class 4 (dead), or tree class 5 (veteran), or tree class 6 (dead, cutdown):

Tree Class 1      Residual

Record tree class 1 if the tree is alive and none of the decay indicators is present on the tree.

Tree Class 2      Suspect

Record tree class 2 if the tree is alive but not a veteran (see tree class 5), and if one or a combination of several decay indicators is present on the tree.

Tree Class 4      Dead

Record tree class 4 if the tree is dead (standing or downed). If the tree has been cut down, classify it as tree class 6 to distinguish it from one that has died through natural competition and record "cut down" in the remarks section. If it can be determined that the tree died as a result of an insect or disease, record tree class 4 and, in addition, record the primary insect or disease responsible for the death of the tree (see Section 8.1244).

Tree Class 5      Veteran Tree

Record tree class 5 if a tree proves to be at least 30 years older than the oldest borer tree of the main stand. In addition, record a V in the layer column of the growth sample record sheet (F.S. 820). Veterans belong to a distinctly older age class than that of the main stand being sampled. In growth sampling it is important that these trees be properly classified, and it is essential that the increment borer be used to determine ages of trees that appear to be veterans.

A veteran is not always an old tree: for example, a 20-year old stand could have 60-year old veterans which are remnants of a stand destroyed by fire. For a veteran component to be recognized, the veterans must have an estimated crown closure of less than six percent for a 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 complex-layered stands, a tree is called a veteran (tree class 5) when the tree is:

1. A remnant of a much older stand.
2. At least 100 years older than the oldest samples trees of the main stand.
3. 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.

Tree Class 6      Dead, Cut Down

Record tree class 6 if the tree is dead as a result of being cut down. In addition, record "cut down" in the remarks section.

## B. Decay Indicators

The eight indicators of decay (pathological remarks) are defined and illustrated in Appendix 8-9 and are:

- |               |   |
|---------------|---|
| Conk          | - In immature stands, it usually occurs on deciduous trees. |
| Blind Conk    | - It very seldom occurs on immature trees.                  |
| Scar          | - It must be weathered and may be grown over or open.       |
| Fork or Crook | - It includes multiple leaders.                             |

- Frost Crack - It may resemble a scar but it always follows the grain.
- Mistletoe - It can occur on the trunk and on branches. Record a branch swelling that extends to the trunk of the tree as mistletoe. Because mistletoe may be an inhibitor of growth, also record it if present on swollen limbs even if at some distance from the trunk, but only in the remarks column.
- Rotten Branch - It must have a minimum diameter of 10 cm and in immature stands should only be present on veterans.
- Dead or Broken Top - It includes a broken or dead leader (see Appendix 8-6).

These abnormalities are not indicators of decay and are illustrated in Appendix 8-9: 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 growth sample record sheet.

#### 8.1244 Tree Classification

##### Decay Indicators

Record each of the decay indicators (including dead or broken top) in the pathological remarks section of the growth plot record sheet as occurring in the lower, middle and/or upper third of the total height of the tree by entering the numerical decay indicator position codes (see Appendix 8-8). These examples illustrate the relationship between the decay indicator and its position code:

- A. Suppose that 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.
- B. Suppose that 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.
- C. Suppose that a suspect tree has a fork in the middle third, a large scar extending the whole length of the tree, and the leader from the tallest fork is broken. In the pathological remarks section under "FK/CK", enter 2; under "SCAR", enter 7; and under "D/B T", enter 3.

For veterans (tree class 5), record decay indicators in the same way as for other trees.

To classify a tree properly, it has to be viewed from all sides. As most defects in the upper portion of a tree are not visible to an observer standing at its base, it is important that the recorder station himself so that the crown of each tree being classified is clearly visible to him. The person measuring d.b.h. should move away from the tree far enough to be able to classify the whole lower third of the stem, while the recorder moves around the tree to classify the upper two thirds.

### 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 remeasurement of permanent growth samples.

For each tree affected, record the pest or injury code listed below in the remarks columns (col. 65-68) 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 percent. This would be recorded as ID\_3 in the remarks column.

In addition to recording the primary pest or injury for each tree affected, make a general assessment of the primary pest or injury for the total sample and record it in the sample header section of the field sheet. If known, also record the year of attack.

### PEST AND INJURY CODES

#### Acceptable Codes

#### Description

#### A Animal damage

AB	bear
AC	cattle
AD	deer
AE	elk
AH	hare or rabbit
AM	moose
AP	porcupine
AS	squirrel

Acceptable CodesDescription

## A Animal damage (cont.)

AV	vole
AX	birds
AZ	beaver

## D Diseases

DA	Foliage Diseases
DD	Stem Rot (internal decay only)
DDA	armillaria
DDC	laminated, cedar strain
DDI	tomentosus root rot
DDL	laminated
DDN	annosus
DDS	schweinitzii butt rot
DF	Brooming (non-mistletoe)
DL	Leader and Branch Dieback
DLS	<u>Sclerophoma pithyophila</u>
DM	Dwarf Mistletoe <sup>1</sup>
DMF	Douglas-fir dwarf mistletoe
DMH	hemlock dwarf mistletoe
DML	larch dwarf mistletoe
DMP	lodgepole pine dwarf mistletoe
DP	Bark Disease (superficial)
DR	Root Disease
DRA	armillaria root disease
DRB	black stain root disease
DRC	laminated root rot, cedar strain
DRL	laminated root rot
DRN	annosus root rot
DRR	rhizina root disease
DRT	tomentosus root rot

Note - these remarks pertain to sample sheets which have an eight code pathological remarks section.

1. Differs from mistletoe, under path remarks, in that this code includes both branch and stem infections.

Acceptable CodesDescription

DS	Stem Diseases (external cankers and rust)
DSA	atropellis canker (lodgepole pine)
DSB	white pine blister rust
DSC	lodgepole pine, comandra blister rust
DSG	western gall rust
DSS	lodgepole pine, stalactiform blister rust
I	Insects
IA	Aphids
IAB	balsam woolly aphid
IAC	<u>Cinara</u> spp.
IAG	cooley spruce gall adelgid
IAS	spruce aphid ( <u>Elatobium abietinum</u> )
IB	Bark Beetles
IBB	<u>Dryocoetes</u> (western balsam bark beetle)
IBD	Douglas-fir beetle
IBI	Ips spp.
IBM	mountain pine beetle
IBS	spruce beetle
ID	Defoliators
IDA	black army cutworm
IDB	2-year-cycle budworm ( <u>biennis</u> )
IDC	larch casebearer
IDE	spruce budworm ( <u>fumiferana</u> )
IDF	forest tent caterpillar
IDG	greenstriped forest looper
IDH	western blackheaded budworm
IDL	western hemlock looper
IDM	gypsy moth
IDS	conifer sawfly
IDT	Douglas-fir tussock moth
IDV	variegated cutworm
IDW	western spruce budworm
IDZ	western false hemlock looper
IS	Shoot Insects
ISB	western cedar borer
ISE	European pine shoot moth
ISP	<u>Petrova</u> spp.

Acceptable CodesDescription

IW	Weevils
IWC	<u>Steremnius carinatus</u>
IWM	<u>Magdalis</u> spp.
IWP	lodgpole terminal weevil
IWS	white pine weevil (on spruce)
IWW	Warren's rootcollar weevil
M	Mite damage
N	Non-biological (Abiotic) injuries
NB	fire
ND	drought
NF	flooding
NG	frost <sup>2</sup>
NH	hail
NK	fumekill
NR	redbelt
NS	slide
NW	windthrow
NY	snow or ice
NZ	sunscald
T	Treatment Injuries
TC	chemical
TL	logging <sup>3</sup>
TP	planting
TR	pruning
TT	thinning or spacing
V	Vegetative Injuries

Note - these remarks pertain to sample sheets which have an eight code pathological remarks section.

- Differs from frost cracks, under path remarks, in that this code includes both recent and old damage.
- Differs from scars, under path remarks, in that it includes both recent and old damage.

## QUANTIFICATION OF DAMAGE

INTENSITY - a rating for an individual tree based on its severity of pest attack. The exception is mountain pine beetle and its rating is based on the time elapsed since attack. Some of the codes that have been adopted are listed below. Further elaboration of the categories is required. Suitable training should be provided prior to rating intensity on individual trees otherwise use the subjective assessment below.

<u>PEST</u>	<u>CODE</u>	<u>EXPLANATION</u>
defoliator	1-0	percentage defoliation of foliage
dwarf mistletoe	1-6	Hawksworth 6-point scale
mountain pine beetle	G,R,Y	G-green (0-1 yrs), R-red (1-2 yrs), Y-grey and old attacks (2-3+ yrs.)
western gall rust	1-3	1-branch galls only, 2-stem galls only, 3-branch and stem galls
white pine weevil	1-0	number of years of attack (1-9, except 0 which equals 10 yrs. of attack) in the last 10 years e.g.

For other pests either consult an appropriate specialist for a rating system or use a subjective assessment of intensity for example; L-Low, M-Moderate, S=Severe, and P=Past Attacks. This subjective assessment will provide both a rough indication of intensity and identify possible pest entries requiring future action.

INCIDENCE - is the percentage of trees infected or infested over the total number of trees in the plot.

Two exceptions exist:

- 1) root disease information acquired from line-intersect surveys. In this case incidence is defined as the percentage of ground area occupied by infection centers over the total survey length. Each infection center is measured as the distance between the two adjacent nonsymptomatic trees on each side of the symptomatic trees.
- 2) Non-biological or treatment injuries that result in the removal of trees. Plot summaries may consist of percent area comparisons of impacted versus unaffected areas.

PERCENTAGE CODE RATINGS -

proposed for the above are 1(0-10%), 2(11-20%), 3(21-30%), ...  
0(91-100%)

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 four crown classes are dominant, codominant, intermediate, and overtopped and their respective crown class codes are 1, 2, 3 and 4 (see Appendix 8-10).

Record the crown class in column 36 of the growth sample record sheet (F.S. 820).

Live-crown Length

Live-crown length is the length from the top of the tree to where the major living branch nearest to the ground enters the bole of the tree. When finding the first major living branch, do not consider forks originating below breast height or epicormic branches. The live-crown length is recorded as a percentage of the total tree height.

Assign to each live tagged tree a live-crown length estimated to the nearest 10 percent. Record live-crown length in columns 62 to 64 of the growth sample record sheet (F.S. 820).

## 8.1246 Ingrowth

Ingrowth refers to trees that were below the tagging limit in diameter at the last measurement and are now 7.5 cm d.b.h. and greater at 1.3 metres above the germination point. When all previously numbered trees have been remeasured, tag all living trees that are now 7.5 cm d.b.h. and greater by consecutive number for the plot.

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(s).
- 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.

For tagging ingrowth trees, select method 1 if method 1 was used previously (see Section 8.1241) or method 2 if that one was used:

Method 1

Nail the tag to the tree 1.37 m above the germination point. Drive a second nail into each tree 0.07 m below the first nail, that is, 1.3 m above the germination point.

Method 2

Nail the tag to the tree 1.3 m above the germination point.

For these ingrowth trees, regardless of the method of tagging, record measurement number, tree number, species, sector, measured diameters at 1.3 m and at 1.37 m to the nearest millimetre, tree class, decay indicators, crown class, live-crown length, pest or injury code (if applicable) and the tree number of the closest previously numbered living tree. In addition, for each ingrowth tree, within the sub-plot, record 2 in the sub-plot tree column. For plots in dense stands, it is advisable to string the plot circumference beforehand.

## 8.1247 Sub-plot Establishment and Tree Count

To have some representation from trees below the tagging limit, that is, trees less than 7.5 cm d.b.h., a sub-plot is established for each sample. The objective is to obtain a total of 30 trees (minimum number accepted is 20) in each sub-sample that are less than 7.5 cm d.b.h. but are at least 0.3 m in height. The sub-sample size is dependent on density. For a list of sub-plot radii, see Appendix 8-19. Choose the sub-plot size and mark the sub-plot circumference with string.

Within the sub-plot, tag all living trees 2.0 cm d.b.h. and greater but less than 7.5 cm d.b.h. (diameter assessed at 1.3 m above the germination point).

If the major component of the 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 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 8-1), and record them on the tree count section of the field record sheet (see Appendix 8-7). In addition, record (on the imperial units section of the tree count form) as imperial d.b.h. class one (see Table 8-2) trees less than 2.0 cm d.b.h. but at least 1.5 cm d.b.h. at 1.37 metres.

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 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 growth sample record sheet. In addition, record as imperial d.b.h. class one on the tree count section of the growth sample record sheet, trees less than 2.0 cm d.b.h. but at least 1.5 cm d.b.h. at 1.37 metres. Record (as d.b.h. class 0) the remaining trees within the sub-plot (0.3 m to 1.3 m in height) in a metric dot tally.

For tagging these sub-plot trees, use the same method of tagging as previously selected:

Method 1

Nail the tag to the tree 1.37 m above the germination point. Drive a second nail into each tree 0.07 m below the first nail, that is, 1.3 m above the germination point.

Method 2

Nail the tag to the tree 1.3 m above the germination point.

Special rules govern the tagging of forked trees that are at least 2.0 cm d.b.h. but less than 7.5 cm d.b.h. within the sub-plot:

- 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 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 (see Appendix 8-6).

For each tagged tree in the sub-plot, record these measurements or observations in the appropriate columns of the growth sample record sheet: measurement number, tree number, species, sector number, d.b.h. (at 1.3 m and 1.37 m) or small tree height, tree class, decay indicators for trees 2.0 cm d.b.h. and greater, crown class, live-crown length, a "1" in the sub-plot tree column, pest or injury code (if applicable) and the number of the closest previously tagged living tree. For tagged trees less than 2.0 cm d.b.h., measure and record their tree height to the nearest decimetre instead of diameter. In addition, for trees less than 2.0 cm d.b.h. but at least 1.5 cm d.b.h. at 1.37 m, measure and record their diameter at 1.37 m on the left-hand margin of the growth sample record sheet (see Appendix 8-7). Measure the small-tree height from the germination point to the tip of the terminal bud. For small trees with drooping leaders, such as cedar and hemlock, measure the height to the highest point of the droop. Do not record decay indicators for trees less than 2.0 cm d.b.h. in columns 28 to 35 but note them in the remarks section.

Now and then, unusual live trees are found within the sub-plot. Special rules apply to the measurement of the height of these abnormal trees that are less than 2.0 cm d.b.h. (see Appendix 8-6). The preceding detailed information is summarized in the office during the sample processing stage to make two different tree counts (metric and imperial) that use two different d.b.h. class limits (see Tables 8-1 and 8-2). The tree count is a record of the number of living stems (within the sub-plot) 0.3 m in height and greater but less than 9.1 cm. d.b.h. (assessed at 1.37 m). Always make a stem count by d.b.h. class, by species, and by sector and use the simple dot count method of tallying (see Appendix 8-7).

Table 8-1

## Metric d.b.h. classes and limits

D.B.H. Class	Limits
0	All trees 0.3 m to 1.3 m in height
1	0.0 cm to 1.9 cm
2	2.0 cm to 3.9 cm
3	4.0 cm to 5.9 cm
4	6.0 cm to 7.9 cm
5	8.0 cm to 9.9 cm

For each tree within the sub-plot first derive its imperial d.b.h. class at 1.37 m (see Table 8-2) and secondly the metric d.b.h. class at 1.3 m (see Table 8-1). Include only trees that are at least 0.3 m in height but less than 9.1 cm d.b.h. (at 1.37 m) in the tree count. For example, a tree that is 9.1 cm d.b.h. at 1.37 m and 9.0 cm d.b.h. at 1.3 m would not be included in the tree count. However, a tree that is 9.0 cm d.b.h. at 1.37 m and 9.1 cm d.b.h. at 1.3 m would be included in the tree count and would be recorded as imperial d.b.h. class 3 and metric d.b.h. class 5.

Table 8-2

## Imperial d.b.h. classes and limits

D.B.H. Class	Limits (inches)	Limits (cm)
1	0.6 to 1.5	1.5 to 3.9
2	1.6 to 2.5	4.0 to 6.4
3	2.6 to 3.5	6.5 to 9.0

## 8.1248 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 8-11.

For each tagged tree, identify the layer to which it belongs. For single-layered stands, only record the veteran layer code (V) in column 61 (F.S. 820), if veterans are present; for multi-layered stands, record the layer code for each tagged tree in column 61: codes 1, 2 and V for layer 1, layer 2, and a veteran layer, respectively.

Sample Trees for Age

As a result of changing to top height and breast height age for site determination, breast height ages are required for the top height trees (i.e. a one time measurement).

In even-aged stands (pure and mixed) average age is determined by boring the 100 largest diameter trees per hectare (if suitable for height measurement, see 'Sample Trees for Height' in this section) of the leading major species on the sample (see Figure 8-1). For example, on a 0.1 ha sample size, the ten trees (of the leading species) of largest diameter in the sample would represent the 100 largest diameter trees per hectare whereas the five largest diameter trees (of the leading species) in a 0.05 ha sample size would represent the 100 largest diameter trees per hectare. A major species comprises 20 percent or more of the gross sample volume.

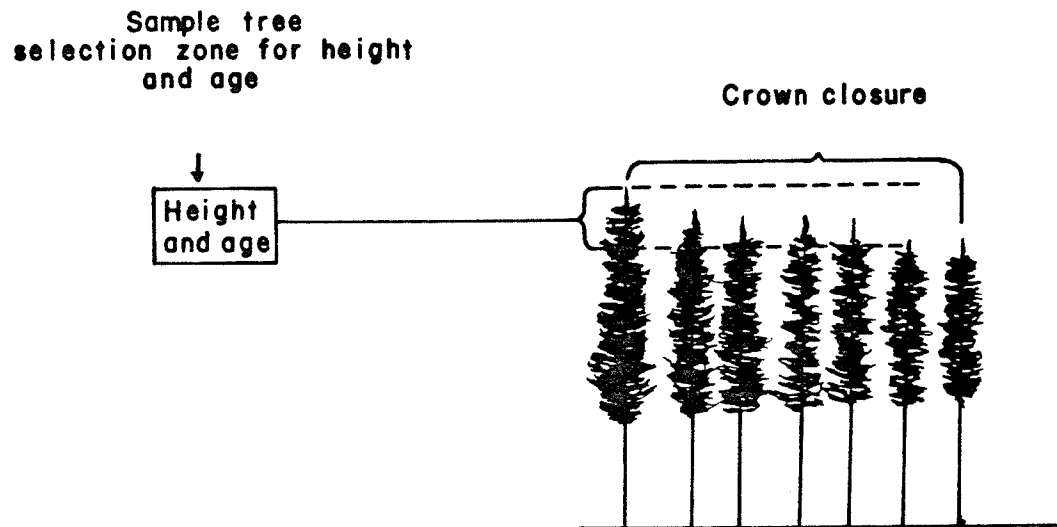


Figure 8-1 Sample tree selection in a single-layered, simple stand

For complex-layered stands, average age is calculated by averaging the tree ages of the 100 largest diameter trees per hectare (if suitable for height measurement, see 'Sample Trees for Height' in this section) of the leading major species (see Figure 8-2). To show the variation in age, take two additional ages (of the leading major species) from the younger portion of the stand. Do not select a tree smaller than 2.0 cm d.b.h.

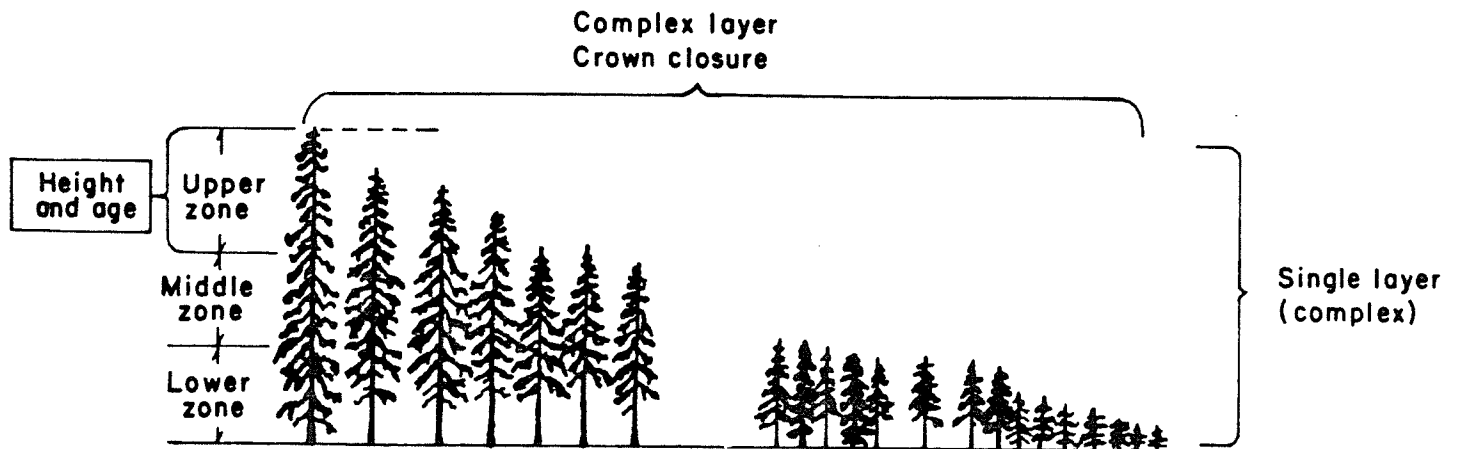


Figure 8-2 Sample tree selection in a single-layered, complex stand

For multi-layered stands select sample trees for age as above for each layer. The top height method for determining size 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 1.3 m (breast height) above the germination point. Half the cores taken must include the pith. If the pith is included, record 1 in the pith column of the growth sample record 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, for

samples established in complex-structure stands, 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 growth sample record sheet.

Because trees are bored for age above the germination point, a correction must be made to obtain total age. Calculate the average boring age of the top height trees and top height (ie. 100 largest diameter trees per hectare) of the leading major species provided that all 10 were successfully bored for age at 1.3 m above the germination point. From the appropriate species site curve in the Field Handbook, establish a temporary site class based on the average age and top height of the sample trees. Using the pertinent species correction table from the Field Handbook, select the relevant age correction factor based on boring height and temporary site class. Then add this age correction factor to the average 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.

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 age in the total age section (columns 53 to 55 of card type 4) of the field record sheet. Record the number of years of rot in columns 46 to 52 of card type 4 (for example "75 years of rot").

Note: If it is not possible to bore a small tree for age without damaging it, select an outside-plot tree and bore it. Assign tree numbers 980 to 999 to outside-plot trees.

#### Sample Trees for Height

All trees within the plot 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 substantial number of heights. In all cases below, the required number of trees to satisfy top height (i.e. 100 largest diameter trees per hectare of the leading species) must be measured. See the "Sample Trees for Age" section of the manual above for further clarification of top height.

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. Major Species (species comprising at least 20% of total volume)

##### 1. Pure Stands (leading species comprises >80% of total volume)

Twenty heights are required for the leading species and are to be selected as follows:

- a) Ten dominants and/or codominants from which the number of sample trees to meet the top height requirement must be measured. Ensure that the remaining trees not required for top height cover the rest of the range of diameters in the codominant crown class.
- b) Five Intermediates including the one of largest diameter (ensure that sample trees are selected to cover the full range of diameters in this crown class).
- c) Five Suppressed including the one having the smallest d.b.h. (down to 2.0 cm d.b.h.). Ensure that sample trees are selected to cover the full range of diameters in this crown class.

Note: When the leading species comprises less than 80 percent of the total volume (e.g. Hemlock 74 percent, Cedar 16 percent, and Spruce 10 percent) treat the leading minor species as if it were a major one. Select sample trees as in A. 2 below.

## 2. Mixed stands

In stands comprising of two major species, select fifteen height sample trees for each major species as follows:

- a) Eight dominants and/or codominants from which the number of sample trees to meet the top height requirement must be measured. Ensure that the remaining trees not required for top height cover the rest of the range of diameters in the codominant crown class.

Note: When eight trees are not adequate to satisfy the top height requirement (e.g. 0.09 ha and 0.1 ha sample sizes), select the additional dominant(s) or codominant(s) to satisfy the top height requirement and reduce the intermediate crown class requirement by one tree and the suppressed crown class also by one tree if necessary.

- b) Four intermediates including the one of largest diameter (ensure that sample trees are selected to cover the full range of diameters in this crown class).
- c) Three suppressed including the one having the smallest d.b.h. (down to 2.0 cm d.b.h.). Ensure that sample trees are selected to cover the full range of diameters in this crown class.

In stands comprising of three or more major species, select sample trees as above for the two leading major species and select 5 height sample trees for each additional major species as follows:

- a) One tree in each existing crown class including the largest and smallest diameter trees.
  - b) Remaining tree(s) in the most frequently occurring crown class(es).
- B. Minor species (comprising 10-19% of total volume)  
Select five height sample trees for each minor species as follows:
- a) One tree in each existing crown class including the largest and smallest (down to 2.0 cm) diameter trees.
  - b) Remaining tree(s) in the most frequently occurring crown class.
- C. Scattered Species (comprising less than 10% of total volume)  
Select one height sample tree for each scattered species from the crown class occupied most frequently by that particular species.

If veteran trees are present within the sample, take at least one height for each species present and estimate, to the nearest metre, the total heights of all other veterans in the sample. Record each estimated or measured height in the curve height column of the growth sample record sheet (F.S. 820).

Remeasure the heights of all previously recorded sample trees, provided that they meet the preceding specifications and are still suitable for height measurement. For each measurement of height, the top and bottom of the tree must be clearly visible and the reading on the Suunto percent scale should not exceed 90 percent. The bottom reading may be taken on a hard hat held at the tree-tag height, for which the correction is 1.3 m.

Unsuitable sample trees have broken tops (broken by wind or snow), forks, crooks, or have died. Replace these trees with ones of the same species and of similar d.b.h. It may also be necessary to take additional sample trees because of changes in species composition. So compare the species composition under the "actual type" column with that at present, and determine the number of additional sample trees required.

Note: 1 Double-check height measurements of trees that decreased or increased excessively since the last measurement.

Note: 2 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.

8.124.10. Crown Closure

Crown closure is the percentage of ground area covered by the vertically projected tree crowns. Estimate crown closure for the plot by layer to the nearest 10 percent, and record this estimate in the crown closure column of the growth sample record sheet (F.S. 820). 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.

8.124.11. Growth Sample Record Sheet (F.S. 820)

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Column	Item	Instruction
<u>Front of the Growth Sample Record Sheet (see Appendix 8-7)</u>		
<u>Card Type 1 - Sample Data</u>		
1 to 2	Region No.	- Entered at establishment.
3 to 5	Compt. No.	- Entered at establishment.
6	Compt. Letter	- Entered at establishment.
7 to 9	Sample No.-	- Entered at establishment.

Column	Item	Instruction
10	Plot No.	- Entered at establishment.
11	Card Type	- Card type 1 is entered.
12	Measurement No.	- Enter 1 for the first remeasurement, 2 for the second, and so on.
13 to 15	Sample Size	- Entered at establishment.
16 to 19	Sample per Hectare Factor	- Entered at establishment.
20 to 23	Sub-sample Size	- Enter the sub-sample size in hectares.
24 to 29	Sub-sample per Hectare Factor	- Enter the factor, which varies with sub-sample size.
30 to 32	Mean Age (Layer 1)	- Enter the mean age for layer 1.
33 to 35	Mean Age (Layer 2)	- Enter the mean age for layer 2 if applicable.
36 to 38	Mean Age (Layer V)	- Enter the mean age for the veteran component. If layer V does not exist, leave blank.
39 to 44	Age Range	- Enter age range (youngest and oldest age) for samples established in complex-layered stands.
45 to 47	Damage to Sample (%)	- Enter damage to the sample, if any.
48	Stem Map	- If the sample is not stem mapped, enter 0; if it is stem mapped, enter 1.
49 to 51	T.S.A. No.	- Enter the T.S.A. number.
52	F.I.Z.	- Enter the forest inventory zone (letters A to L).
53 to 58	Stand Disturbance	- Enter the disturbance type, species, severity and year of attack.

Column	Item	Instruction
59 to 60	Tagging Limit	- Record the tagging limit in cm (silviculturally treated samples only).
11	<u>Card Type 2 - Plot Data</u>	
12	Measurement No.	- Enter 1 for the first remeasurement, 2 for the second remeasurement, and so on.
13 to 15	Plot Size	- Entered at establishment.
16 to 19	Plot Radius	- Entered at establishment.
20 to 23	Sub-plot Size	- Enter the sub-plot size in hectares (see Appendix 8-19).
24 to 27	Sup-plot Radius	- Enter the sub-plot radius in metres (see Appendix 8-19).
28 to 29	Aspect	- Entered at establishment.
30 to 31	Slope	- Entered at establishment.
32 to 35	Elevation	- Entered at establishment.
36 to 38	Crown Closure (Layer 1)	- Enter the crown closure of each plot (for layer 1) to the nearest 10 percent.
39 to 41	Crown Closure (Layer 2) (Layer 2)	- Enter the crown closure of each plot (for layer 2) to the nearest 10 percent.
42 to 44	Crown Closure (Layer V)	- Enter the crown closure of each plot for the veteran component (for three plot samples, the average of all plots in the sample must not be greater than 5%).
45 to 50	Date of Measurement	- Enter the date of plot measurement (year-month-day).
51 to 58	Map No.	- Enter the B.C.G.S. map sheet number.
59 to 66	Photo No.	- Enter the B.C. flight number and photo number.
67 to 68	Plantation Year	- Enter the year in which the stand was planted (silviculturally treated samples only).

Column	Item	Instruction
69	Age of Stock	- Enter the age of the stock planted (silviculturally treated samples only).
11	<u>Card Type 3 - Tree Data</u>	
12	Meas. No.	Enter 1 for the first remeasurement, 2 for the second, and so on.
13 to 15	Tree No.	- Enter the tag number of the tree being examined.
16 to 17	Species	- Enter the commercial species code of the tree being examined. For species codes, see Appendix 8-14.
18 to 19	Sector No.	- Enter the sector in which each tagged tree is located.
20 to 23	D.B.H. (1.3 m)	- Enter the diameter at breast height (1.3 m above germination point) of each tagged tree 2.0 cm d.b.h. and greater to the nearest millimetre.
24 to 26	Small Tree or Curve Height	- Enter 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.
27	Tree Class	- Enter the tree class code: residual (1), suspect (2), dead (4), veteran (5), or dead cut down (6). For trees less than 2.0 cm d.b.h., always record tree class code 1.
28 to 35	Pathological Remarks	- Record decay indicators present on each tree.
36	Crown Class	- Record the crown class of each tree.
37 to 45	Stem Mapping	- Record the stem-mapping information for each tree.

Column	Item	Instruction
46 to 52	Stumps	- Do not use.
53 to 55	Near Tree No.	- Record the tree number of the closest numbered living tree to the ingrowth or sub-plot tree being measured.
56	Sub-plot Tree	- Record code 1 if the tree is located in the sub-plot and is less than 7.5 cm d.b.h. or code 2 if the tree is located in the sub-plot and is greater than or equal to 7.5 cm d.b.h.
57 to 60	D.B.H. (1.37 m)	- Record d.b.h. taken at 1.37 m above the germination point.
61	Layer	- If 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).
62 to 64	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%).
65 to 69	Remarks	- Enter pertinent tree information not recorded in preceding columns. Record the pest or injury code in columns 65 to 68.

Back of the Growth Sample Record Sheet (see Appendix 8-7)

Card Type 4 - Sample Tree Data

1 to 10	Plot Identity	- Entered previously (region no., comp. no., letter, sample no., pith no.).
11	Card Type	- Card type 4 is entered.
12	Meas. No.	- Enter 1 for the first remeasurement, 2 for the second, and so on.
13 to 15	Tree No.	- Enter the tree number of the sample tree.

Column	Item	Instruction
16 to 17	Species	- Enter the species of the sample tree.
18 to 21	D.B.H.	- Enter the d.b.h. (measured at 1.3 m above the germination point) of the sample tree.
22 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.
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 (1)	- If the pith is included, enter 1.
57 to 62	Rad. Inc. (mm)	- Do not use.
	Tree Count	- Record the tree count as a dot tally in this section.

Column	Item	Instruction
<u>Card Type 5 – Tree Count Summary Data</u>		
11	Card Type	- Card type 5 is entered.
12	Measurement No.	- Enter 1 for the first remeasurement, 2 for the second, and so on.
13 to 14	Species	- Enter the species symbol (see Appendix 8-14).
15 to 30	Imperial D.B.H. Classes	- Enter the number of trees in each imperial d.b.h. class by species as well as the total by species.
31 to 58	Metric D.B.H. Classes	- Enter the number of trees in each metric d.b.h. class by species as well as the total by species.
<u>Card Type 6 – Stem Mapping Data</u>		
(11 to 21)	Stem Mapping	- Record the necessary information for stem-mapped samples.
11	Card Type	- Card type 6 entered.
12	Measurement No.	- Enter 1 for the first remeasurement, 2 for the second, and so on.
13	Compass at PLT Centre Y = 1 N = 2	- If the staff compass was set up at plot centre, record 1, and if it was set up elsewhere, record 2.
14 to 16	Bearing From Compass to Plot (0 to 360°)	- If the compass was not set up at plot centre, record the bearing (0 to 360°) from the compass to the plot centre.
17 to 18	Slope (%)	- Only if the compass was not set up at plot centre, record the slope percent from the compass to the plot centre. If the slope is 0, record 0.
19 to 21	Slope Distance (0.01 m)	- If the compass was not set up at plot centre, record the slope distance from the compass to the plot centre.

Column	Item	Instruction
	Sector Diagram	- Sketch the layout of the plot sectors for future reference.
	Topography	- Do not use.
	Main Ground Cover	- Do not use.
	Location and Access	- If access to the sample has changed, describe the revised access.
	Notes	- Record remarks in this area. Note whether the plot centre stake was in or out at remeasurement.
	Meas. No. ___ by___	- Record the measurement number and have the measurer sign the sample.

## 8.125 Stem Mapping

For use in distance-dependent growth modelling studies, ten percent of the growth samples in natural stands are stem mapped. The Inventory Branch designates the growth samples to be 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 plot centre, to each tagged tree. For a list of equipment needed for stem mapping, see Appendix 8-12.

To stem map growth samples:

- A. Set up the staff compass directly over the aluminum plot centre stake, and level the instrument. Record 1 in column 13 (card type 6) on the back of the growth sample record sheet.

If a large diameter tree 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 distance from the instrument to the plot

centre. Record these measurements on the back of the growth sample record sheet in columns 14 to 22 (card type 6), and also record 2 in column 13.

- B. 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 8-13).
- C. Systematically sight along to each tagged tree on the sample.
 

To avoid sighting 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, (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 alongside each tree number on the growth sample 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 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 growth sample record sheet.

#### 8.126 Quality Control

Refer to Appendix 8-1 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 percent of all samples remeasured, and where the inspection shows that a growth sample has been poorly done, the original crew may be required to redo it. To observe a crews' performance, occasionally visit them on the plot.

Check all field sheets in the office before sending them to the Growth and Yield Section, at the Inventory Branch. A proper office check involves checking that:

- A. All information recorded is legible and dark enough for clear photo copying.
- B. The region number, compartment number, compartment letter, sample number, and the plot number have been recorded on every page and that the tree information is complete, is recorded in the proper column, and is correctly justified.
- C. A general summary on the condition of the sample has been recorded in the "Notes" section of the growth sample record sheet. For example:

1980 - Centre stake was in place  
- Ten percent of the original tags were missing.

- D. The bearing and distance from plot centre to three tagged living trees have been recorded in the stem map columns for each plot.
- E. The required information on the set-up and location of the staff compass has been recorded for card type 6 for plots that were stem mapped.
- F. A zero has been recorded in the slope percent column, that is, for stem map and height measurements if the distance measured is a horizontal distance.
- G. The assignation of the tree class meets the criteria for that class:
  - 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 - Tree is dead.
  - Tree class 5 - Tree is a veteran.
  - Tree class 6 - Tree is dead but cutdown.
- H. The latest remeasurements of diameter compare with those of the previous measurement. If a diameter has not increased, has decreased, or has increased more than normal, make sure that the crew rechecked the diameter and placed a check mark in the remarks column.
- I. The sample trees have been selected in accordance with the specifications in this manual (see Section 8.1249).

- J. Height calculations are correct by comparing the latest height remeasurements with those of the previous measurement. If the height has decreased or has increased excessively, make sure that the crew rechecked the height and placed a check mark in the margin.
- K. For each ingrowth or sub-plot tagged tree, the sector in which it is located and the tree number of the closest tagged living tree have been recorded in the appropriate columns of the growth sample record sheet.
- L. For stem-mapped samples, the tree number of the tree to which the flag for 70 mm photography is attached, has been recorded in the "Notes" section of the growth sample record sheet.
- M. A one has been recorded in the sub-plot tree column for each tagged tree less than 7.5 cm d.b.h. within the sub-plot.
- N. A tree count has been recorded for both imperial (if applicable) and metric d.b.h. classes, especially if the number of tagged sub-plot trees is less than 20. The metric tree count is always equal to or greater than the imperial tree count. Ensure that the tagged sub-plot trees plus those in the metric tree count total a minimum of 20 trees.
- O. The mean sample total age and sample top height have been calculated correctly and have been recorded only on the first sheet of each plot.
- P. The measurement number, sample and sub-sample sizes and per hectare factors, percent damage to the sample (if applicable), T.S.A., F.I.Z., stand disturbance (if applicable), plot and sub-plot sizes and radii, crown closure, and the date of remeasurement have been recorded only on the first sheet of each plot.
- Q. The pages have been numbered properly and the tally person has signed the sample.

8.1262 Plot Inspection Procedures

Pre-field Inspection

- A. Randomly select one plot that has been office checked according to the procedures in Section 8.1261.
- B. Randomly select six trees from the tree detail section (card type 3) of the growth sample record sheet and transcribe their respective measurements onto the top section of the natural stands plot inspection report (see Appendix 8-15). Of the six, select one from the newly tagged ingrowth trees and another from the newly tagged sub-plot trees.

- C. Randomly select four trees from the sample tree section (card type 4) of the growth sample record sheet and transcribe their height measurements onto the sample tree section of the natural stands plot inspection report.
- D. Select two trees for age (i.e. two of the four 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 assessment of crown closure (percent) of the plot into the appropriate section of the plot inspection report.
- F. Enter the sample identity (region, compartment, sample, and plot), plot and sub-plot sizes, plot and sub-plot radii, inspection date, original tally crew, and the date of measurement in the top sections of the plot inspection report.
- G. Randomly select one sub-plot sector to check (in the field) that all sub-plot trees less than 7.5 cm d.b.h. but at least 0.3 m in height were either tagged or counted in the dot tally.

Field Inspection

- A. Use the access notes to get to the plot.
- B. If a new tie tree was selected on remeasurement, check that it has been marked as specified in Section 8.1231.
- C. If a new tie line was run, verify that the bearing and distance were run within the allowable standards.
- D. Check that the aluminum plot centre markers have been inscribed correctly and the plot centre stake has been properly protected with a cairn.
- E. Check that the bearings and distances from plot centre to the three stem-mapped 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 7.5 cm d.b.h. but at least 0.3 m in height were either tagged or counted in the dot tally.

H. 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 selected ingrowth and sub-plot trees to verify that breast heights (if applicable) have been located at 1.3 m and 1.37 m above the germination point. 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 six selected trees for d.b.h. and classify them.

4. Sample tree heights

Measure the three selected trees for height.

5. Stem mapping

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

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

I. Check that the results conform to the standards of measurement (see Appendix 8-1).

J. Use an asterisk in the margin of the form to indicate that the difference between the two measurements is greater than the allowable error.

K. Use a circled asterisk in the margin to indicate that the error is greater than one and a half times the allowable error.

L. Complete the inspection items section of the inspection report.

M. Rate the quality of the work on the plot using the weighted system in Appendix 8-16.

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

8.1262 cont.

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. Correct, on the original field sheets, all data flagged with an asterisk or circled asterisk.

8.127      Damage to the Sample

Plots can be damaged by slides, windthrow, snow, fungi, insects, and fire, or by logging, road building, right-of-way (pipe-line, power line) clearing, and escaped fires.

Remeasure a plot if at least 50 percent of the initially measured trees are still alive, and attach a detailed description of the damage to the remeasurement growth sample record sheet.

8.128      Return of Growth Sample Record Sheets (F.S. 820)

Once the field sheets have been office checked and corrected, make good legible photo copies of them before sending the originals to the Growth and Yield Section at the Inventory Branch. Store the photo copies 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 it for field office records. If the data are being sent by mail, register them.