Chapter 3
Remeasuring Experimental Plots in Natural Stands – June 1998

Introduction..............................................................................................................................................1
Preparing for Field Work .......................................................................................................................1
  Field Training .......................................................................................................................................1
Relocating the Plot .................................................................................................................................2
  Checking Location and Access ............................................................................................................2
  Checking the Tie Point .........................................................................................................................2
  Checking the Tie Line ..........................................................................................................................3
  Checking Corner Posts .........................................................................................................................3
Remeasuring the Plot and Sub-plot .........................................................................................................4
  Converting the Breast Height in Experimental Permanent Sample Plots .........................................4
  Tagging Trees .....................................................................................................................................4
  Measuring D.B.H. ...............................................................................................................................5
  Classifying Trees ...............................................................................................................................5
Pathological Indicators ..........................................................................................................................7
Assessing Pest and Injury Damage ......................................................................................................8
Assigning a Crown Class Code ............................................................................................................9
Estimating Live-crown Length .............................................................................................................9
Tagging Ingrowth Trees .......................................................................................................................9
Sub-plot and Tree Count ......................................................................................................................10
Determining the Stand Structure .........................................................................................................13
Height Sample Trees ............................................................................................................................13
Estimating The Sample Crown Closure and Slope Position ............................................................17
Quality Control ....................................................................................................................................17
Inspecting the Sample .........................................................................................................................18
Damage to the Experimental Plot .........................................................................................................20
Returning the Samples to Victoria .........................................................................................................20
Introduction

From 1921 until 1949, the Research Branch established permanent plots to evaluate the growth and yield of different forest types. To protect this large investment from any type of disturbance, a reserve was placed around each plot. In 1957, the Research Branch transferred responsibility for 65 experimental plots, all of them still in a natural state, to the Resources Inventory Branch.

Since then, the Growth and Yield Section has continued to remeasure them at 10-year intervals. Some of the original 65 plots were abandoned owing to increased pressure on the area for other uses, or to the fact that sufficient data had been collected.

The standards of measurement for permanent samples are listed in Appendix 1.

If not already done, ecologically classify, according to Research Branch specifications, all experimental samples due for remeasurement.

Since permanent samples are cost intensive, protecting them is of the utmost importance. To ensure their protection, the protection buffers illustrated in Appendix 19 are recommended.

Preparing for Field Work

Before starting field work, prepare and collect:

Copies of the original field sheets

Maps to show you how to get to the sample – example, 1:250 000 contour maps – and photocopies of parts of forest cover maps, which have an approximate scale of 1:20 000 and show the plot’s location in detail.

Photos showing original tie points, either those used when the sample was established, or, preferably, the latest photos on which tie points and sample locations were replotted.

Equipment. See Appendix 4 for the equipment needed.

Field Training

All personnel involved in remeasurement work must attend a field procedures course.
Relocating the Plot

Checking Location and Access

At first, only general descriptions of access were required. This occasionally resulted in time lost. For the benefit of future remeasurement crews, describe in detail the location of, and access to, the experimental plot.

1. Always start from an easily identifiable point.
2. From your starting point, describe the routes and distances to the tie point.
3. On the way to the tie point, clock the kilometres from road junctions, creek crossings, or other prominent features.
4. Describe the tie tree well. Note its:
   - species
   - diameter
   - location.

Checking the Tie Point

Whenever possible, the reference or tie point was located close to a prominent topographic feature. The tie point was marked with a cedar post driven firmly into the ground. Unfortunately, many of these posts rotted and are now difficult to find.

When you can’t find the tie point:

1. Locate the approximate location of the tie point.
2. Follow the tie line bearing crossing back and forth and looking for blazes or flagging tape on the trees.
3. Once you find the tie line, reverse the tie line bearing and look for the tie point or establish a new one.

When establishing a new tie point:

1. Choose a suitable tree near the post, paint two bands about DBH height and attach 2 aluminum plot markers approximately 2 metres above ground. Each marker should be in line with the tie line bearing and nailed on opposite sides of the tie tree. See Appendix 5 for more information on plot markers.
2. Flag the tie tree with 2 strands of plastic flagging tape, one above and one below the markers.
3. Inscribe each of the aluminum plot markers with the following information:
   - sample type (R)
   - sample number
   - plot number (1 assumed)
- bearing and distance to the plot
- region number
- compartment number
- date plot was established originally.

To aid future crews locate the tie point:
1. Use a well-marked tree rather than a cedar post.
2. Prepare a sketch showing:
   - tie point
   - the sample location
   - other significant topographic features.
3. Attach the sketch to the access notes.

**Checking the Tie Line**

From the tie point, the tie line was run with a hand compass, an abney and a chain. The tie line was marked with paint or blazes on each side of trees at approximately 10-metre intervals. When you rerun the original tie line, it is sufficient to repaint the blazes and to renew the tape markings.

If you can’t find the tie line and the experimental plot:
1. Transfer the plot location onto new photos.
2. Select a new tie point on the photos that is easy to recognise on the ground.
3. On the map, plot the new tie point and measure the new bearing and distance to the experimental plot.
4. Establish the new tie point on the ground.
5. Set the new bearing on the hand compass and run the tie line.
6. Identify the tie line on the ground every 10 metres. On sloping terrain use a clinometer to make an allowance for slope.
7. Prepare a sketch of the new tie point.

**Checking Corner Posts**

Once at the experimental plot:
1. Locate all 4 corner posts. Each of the corners was marked with a cedar post driven into the ground. Sometimes cairns were built around the posts.
2. Check that each post is solid enough to last another 10 years. When necessary, replace a post with a tubular aluminum stake.
3. Mark each post with flagging tape.
To prevent future problems locating the corners:

1. Build a cairn around all of the corner stakes or posts.

2. Stem map each of the 4 corners to 3 trees nearby in the plot. For each of the 4 corners, measure:
   - the bearings to the 3 trees
   - slope percent to the 3 trees
   - slope distance to the 3 trees.

**Remeasuring the Plot and Sub-plot**

Accurate work is required when you compare new measurements with previous ones. Check measurements that appear to be out of the expected range, that is measurements showing a very large increase compared with those showing little or no increase.

Correct any errors and note them in the remarks. Example: “Species checked.”

Experimental samples are either square or rectangular in shape.

To simplify tagging, the plot was divided into sectors. Tagging started in one corner of the plot and continued up and down each sector, beginning with sector 1. Sector numbers increased toward the opposite end. The number of sectors in a plot varies among the experimental samples.

**Converting the Breast Height in Experimental Permanent Sample Plots**

See Appendix 25 for procedures to convert experimental sample plots from imperial (1.37 m) to metric (1.3 m) breast height. The conversion is done only once, to give a base-year measurement.

**Tagging Trees**

Determine the breast height of trees with missing tags, as well as of ingrowth trees. Prior to 1991, breast height determination used the point of germination. Therefore, continue using point of germination.

At the completion of the last remeasurement (1980 to 1989 inclusive), all living commercial trees 7.5 cm and greater in diameter measured at 1.3 m breast height, were tagged with either aluminum or round blue plastic tags in one of the following methods. The first method is the most common.

**Method 1**

The tree number tags were nailed to the trees at 1.3 m above germination. A second nail was driven into each tree at 1.3 m.
If method 1 was used:
1. Pull out the nail and tag at 1.37 m.
2. Nail the tree tag at 1.3 m, near the nail previously driven in at 1.3 m.
3. Pull out the original nail at 1.3 m.

Method 2

The tree number tags were nailed to the trees at 1.3 m above germination.

If method 2 was used, do nothing. The tag and nail are already at 1.3 m.

Missing Tags

For all previously measured living trees with missing tags:
1. Determine breast height at 1.3 m above germination.
2. Nail a tag which has the same tag number as the missing one.

Measuring D.B.H.

For all numbered living trees, measure above the nail to the nearest millimetre, the diameter at 1.3 m.

To more accurately measure the diameter of trees that are or will soon be joined together at d.b.h., use the “1/2 wrap” method. To do this, measure or estimate, as accurately as you can, the diameter of each affected tree. Then, from the nail with the tag, measure half of the diameter around the bole of the tree and place a second nail. Note in the remarks that these are “1/2 wrap” measurements. In the future, the distance between the two nails will be measured and multiplied by two to arrive at the diameter of the tree.

After remeasuring the diameter:
• Pull out the nail holding the number enough to allow for tree growth until the next remeasurement.

For all previously numbered living trees now dead:
1. Measure the diameter above the nail at 1.3.
2. If you can’t find the dead tree, assign it the same diameter as in the previous measurement. If the tree was cut down, record it as Tree Class 6 and assign the same diameter as in previous measurement.

Classifying Trees

Classify each tagged tree according to its pathological indicators. To classify a tree properly, view it from all sides. 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. The recorder should move around the tree to classify the upper two thirds.
In the pathological remarks section, record each decay indicator occurring on the lower, middle or upper third of the total height of the tree. Do this by entering the correct numerical position code as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Position on Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower third</td>
</tr>
<tr>
<td>2</td>
<td>Middle third</td>
</tr>
<tr>
<td>3</td>
<td>Upper third</td>
</tr>
<tr>
<td>4</td>
<td>Lower and middle third</td>
</tr>
<tr>
<td>5</td>
<td>Middle and upper third</td>
</tr>
<tr>
<td>6</td>
<td>Lower and upper third</td>
</tr>
<tr>
<td>7</td>
<td>All thirds</td>
</tr>
</tbody>
</table>

**Tree Classes**

Each tagged tree is classed in one of the following categories:

- **Tree Class 1: Residual**
  - Record Tree Class 1 if:
    - the tree is alive, not a veteran and free of any decay indicators

- **Tree Class 2: Suspect**
  - Record Tree Class 2 if:
    - the tree is alive,
    - the tree is not a veteran, and
    - the tree has one or more decay indicators

- **Tree Class 3: Dead Potential**
  - Record Tree Class 3 if:
    - the tree is dead, either standing or down
    - the tree contains at least an estimated 50% of sound wood by volume, and
    - the tree is greater than or equal to 10 cm d.b.h. and greater than or equal to 3 m in height or length.
If you can determine the tree died as a result of an insect or a disease, record the primary insect or disease responsible for the death. See Appendix 14 for pest and injury codes.

**Tree Class 4: Dead Useless**

Record Tree Class 4 if:
- the tree is dead, either standing or downed, and
- the tree is not potentially useful. See Tree Class 3.

If you can determine the tree died as a result of an insect or a disease, record the primary insect or disease responsible for the death. See Appendix 14 for pest and injury codes.

**Tree Class 5: Veteran**

For single-layered stands, record Tree Class 5 if:
- a tree is at least 40 years older than the mean age of the main stand, and
- the veteran component has an estimated crown closure of less than 6% for the sample.

In complex-layered stands, a tree is considered a veteran only when it:
- is a remnant of a much older stand,
- is at least 100 years older than the oldest sample trees of the main stand, and
- has a much larger diameter than 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.

Veterans are not recognised in stands 121 years or older, except in lodgepole pine stands, which may have a veteran component of Douglas fir or larch.

Record pathological indicators for veteran trees the same way as for other trees.

**Tree Class 6: Dead, Cut Down**

Record Tree Class 6 if the tree is dead as a result of being cut down.

**Pathological Indicators**

The eight indicators of decay (pathological indicators) are:
- **Fork or Crook** the result of damage to the main leader.
- **Scar** must be weathered and may be open or closed.
- **Frost Crack** may resemble a scar but always follows the grain.
- **Dead or Broken Top** a broken or dead leader.
Conk the fruiting body of decay fungi.

Mistletoe a parasitic flowering plant.

Blind Conk pronounced swelling of depression around knots.

Rotten Branch obviously decayed large branches with a DIB of over 10 cm.

See Appendix 11 for definitions and illustrations of these pathological indicators.

The following abnormalities are not decay indicators:
- butt rot
- flute
- candelabra branch
- branch fan
- black knot
- burl and gall
- sapsucker hole
- insect boring.
- sweep
- exposed root
- spiral grain
- dry side

Assessing Pest and Injury Damage

We collect insect, disease and injury data to quantify the effects on tree growth.

For each tree affected:
1. Identify, if possible, the pest species
2. Assess the severity of the pest attack.
   - If you are suitably trained, assess the severity of the pest attack using the rating system in the “Quantification of Damage” section of the “Pest and Injury Codes Table” in Appendix 14. Assess only the severity of attacks by pests listed within the table. For pests not listed, consult the appropriate specialist for a rating system.
   - If you are not suitably trained, assess the severity of the pest attack using the following subjective assessment codes:
     L = Low
     M = Medium
     S = Severe
     P = Past Attack.
3. Record the primary pest or injury code as listed in Appendix 14.
   - If you are unable to identify the insect or disease species, a short, incomplete label is still useful. Example: You may identify a defoliating insect and assess the percent defoliation for the tree as 30%. Record this as ID_3.

For the sample:
1. Make a general assessment of the primary insect, disease or injury for the total sample.
2. Record the assessment for the total sample in the sample header section. If known, also record the year of the attack.
Assigning a Crown Class Code

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.

There are six crown classes:
- Crown Class 1: Dominant
- Crown Class 2: Codominant
- Crown Class 3: Intermediate
- Crown Class 4: Suppressed
- Crown Class 5: Veteran
- Crown Class 6: Understory

For more details on crown classes, see Appendix 12.

Assign a crown class code of 1 through 4 and 6 to each tagged tree classed as Tree Class 1, 2 or 6. For tree class 5, assign crown class 5. See “Classifying Trees” in this chapter.

Note: Crown Class 6 should be used sparingly; do not confuse it with Crown Class 4. Use Crown Class 6 only in stands 60 years or older where the understory trees, usually shade tolerant, are clearly much younger than the main stand.

Estimating Live-crown Length

Live-crown length is the distance between the treetop, if the top is alive, or from the top of the live portion, if the treetop is dead, and the base of the lowest contiguous live crown. The estimate is expressed as a percentage of the total height of the tree.

1. Estimate, to the nearest 10%, the live-crown length of tagged tree.
   - When determining the base of the lowest contiguous live crown, do not consider forks or epicormic branches.
   - The tops of defoliated trees may appear dead at the time of the assessment. Make sure it is or you may underestimate the live crown length.

2. Assign to each live tagged tree a live-crown length, estimated to the nearest 10%.

Tagging Ingrowth Trees

The term ingrowth trees refers to commercial and non-commercial trees that were below the tagging limit during the last measurement but that now exceed that limit.

When all previously numbered trees have been remeasured, tag all commercial and non-commercial living trees now 4 cm d.b.h. and greater, by consecutive number for the plot.

Dealing with Forked Trees

Special rules govern the tagging of forked trees:
- If the fork occurs above 1.3 m, tag the stem as a single tree, provided it has a d.b.h. of at least 4 cm.
- If the fork occurs below 1.3 m, and two or more stems of the fork are 4 cm or greater in d.b.h., tag each stem separately using consecutive numbers. Record, in the remarks, that these stems are forked together.
- If the fork occurs below 1.3 m, and only one of the stems is 4 cm or greater, tag it as a single tree.

**Tagging Procedure for Ingrowth Trees**

1. If a large number of ingrowth trees are present, use consecutive, pre-numbered blue plastic tags. If a few trees are present, use aluminum tags and inscribe the consecutive tree numbers for the plot.
2. Nail the tag to the tree 1.3 m above the germination point – or above the base of the tree on the uphill side, for samples established after 1990.
3. Do not use a previously used number within the plot.
4. Record:
   - the tree number
   - the species
   - the sector
   - the measured diameter at 1.3 m, to the nearest millimetre
   - the tree class
   - any pathological indicators
   - the crown class
   - the live-crown length
   - pest or injury codes, if applicable
   - the tree number of the closest, previously numbered living tree.

**Sub-plot and Tree Count**

To have some representation from trees below the plot tagging limit, a circular sub-plot was established with its centre at the intersection of diagonals from the corner posts. The objective was to obtain a minimum of 20 living commercial trees that were less than the plot tagging limit but at least 0.3 m in height. The sub-plot size was selected from Appendix 6. However, the sub-plot radius was less or equal to one-half the length of the shortest side of the rectangle even if less than 20 stems were obtained.

The centre was marked with an aluminum tabular stake. A plot centre tree close to the aluminum stake was selected and marked with aluminum markers.

If the plot centre tree is missing, whether from natural causes or not:
1. Select another centre tree near the plot centre.
2. Mark it properly. Nail two aluminum plot markers approximately 2 metres above the ground.

3. Inscribe the following information on the markers:
   - sample type (R)
   - sample number
   - plot number (1 assumed)
   - region number
   - compartment number
   - the original date the plot was established.

4. Mark the centre tree with two strands of plastic flagging tape, one above and one below the aluminum markers.

If the centre tree is present but its markers are missing or illegible, replace them.

If the stake was pulled out, the bearing and distance from the centre stake to 3 trees nearby were recorded. Use this information to relocate the centre stake.

Within the sub-plot, all living commercial trees 2 cm d.b.h. and greater but less than the plot tagging limit were tagged using one of two methods. See “Tagging Trees” in this chapter.

Trees of commercial species less than 2 cm d.b.h. but 0.3 m in height had their tags wired either to a branch or to the main stem.

Measuring Sub-plot Trees

For trees 2 cm d.b.h. and greater previously tagged within the sub-plot, use the same method as in the main plot.

Attach a number tag to the tree with a nail at breast height (1.3 m) if the tree:
   - was less than 2 cm d.b.h. during the last measurement,
   - now has a d.b.h. of 2 cm or greater, and
   - is a commercial species.

Include the tree in the dot count if the tree:
   - is less than 2 cm d.b.h., and
   - is a commercial species.

Special rules govern the tagging of forked trees at least 2 cm d.b.h. but less than 4 cm d.b.h. within the sub-plots:
   - If the fork occurs 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 cm d.b.h. and greater.
Gathering and Recording Information about Sub-plot Trees

Trees 2 cm d.b.h. and greater:

For each tree 2 cm d.b.h. and greater in the sub-plot, record the following:
- the measurement number
- the tree number
- the species
- the sector number
- the d.b.h. at 1.3 m
- the tree class
- any pathological indicators
- the crown class
- the live-crown length
- pest or injury codes, if applicable
- the number of the closest previously tagged plot living tree.

Trees less than 2 cm d.b.h.:

Count trees less than 2 cm d.b.h. in a dot tally and record them:
- as d.b.h. class 0 or 1 (see Table 1 below)
- by species. See Appendix 3.

Table 1  Metric d.b.h. Classes and Limits

<table>
<thead>
<tr>
<th>d.b.h. class</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.3 m to 1.3 m high</td>
</tr>
<tr>
<td>1</td>
<td>0.1 cm to 1.9 cm d.b.h.</td>
</tr>
</tbody>
</table>

Forked trees less than 2 cm d.b.h.:

Give special attention to the method of counting forked trees less than 2 cm d.b.h. For example: To avoid counting numerous leaders of trees that have been severely browsed, count only the tallest leader. See Appendix 10 for a further explanation.

Unusual trees:

Now and then, you will find unusual live trees within the sub-plot. Special rules apply when measuring the height of abnormal trees less than 2.0 cm d.b.h. See Appendix 10.
Determining the Stand Structure

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

The recognized stand structures are:

1. Simple layer (even age and height)
   - with veterans
   - without veterans

2. Complex layer (uneven age and height)
   - with veterans
   - without veterans

3. Multi-layer
   - layer 1 is the top layer
   - layer 2 is the bottom layer

For single layer stands, layer 1 is assumed for trees in the main stand and tree class 5 identifies the veteran layer.

For multi layer stands, record 1 for the top layer trees and 2 for the bottom layer. The sample primary layer, according to regional priorities, must be identified.

For further details on stand structure, see Appendix 13.

Height Sample Trees

Local height-diameter curves are constructed from sample data before samples are compiled. To construct reliable curves, a substantial number of heights is needed for each species. The number depends on the stand composition which, ultimately, is based on gross volume. In the field, use the calculated basal area for stand composition.

For single-layered stands, or for each layer in a multi-layered stand, select height sample trees as follows:

For Major Species

For each major species (20% or greater by composition), select trees as follows:

1. Select the required number of top height trees to a maximum of 10.

**Note:** Top height trees are measurement specific. They can change from measurement to measurement.

Top height is the average height of the 100 largest diameter suitable trees per hectare of the same species. Suitable trees have the following characteristics.

- largest diameter trees
- living
- free of major defects
- crown class of 1 or 2. The exception is in the case of the second layer in a two-layer stand where crown class 3 and 4 are acceptable.
- cannot be substituted

**Example:** On a 0.1 hectare sample, the 10 largest d.b.h. trees are selected for top height measurements. Similarly, four top height trees would be measured in a 0.4 hectare sample.

**Note:** The maximum number of top heights needed per species in any sample is 10. In those cases where the sample is larger than 0.1 ha, consider the number of top height trees based on the 100 largest trees per hectare but use only ten. Use the largest and smallest d.b.h. and distribute the remaining eight among the balance.

2. Select an additional 15 trees distributed evenly across the remaining d.b.h. range, down to 2 cm d.b.h.

**For Minor and Scattered Species**

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 across the d.b.h. range down to 2.0 cm d.b.h. Place the emphasis on larger diameter classes.

**For Veterans**

For the veteran layer:
1. Select one sample tree from each species present.
2. Estimate the height of all others.
3. Record the estimated height of all the veterans in the small tree or Vet height section.

**Remeasuring Heights Consistently**

Ensure that height sample trees previously taken are remeasured for height and from the same direction as indicated by the blue painted dot (unless no longer suitable) even if the resultant distribution over the d.b.h. classes is not optimum. If possible, strive for the full range of diameters down to 2.0 cm d.b.h.

To ensure future height measurements are taken consistently from the same direction, paint a blue dot, if not already done, at d.b.h. to indicate the direction from which the height measurement was taken.
Selecting Sample Trees

When possible, select residual trees (Tree Class 1). See “Classifying Trees” in this chapter. 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 select trees with:

- diameters that were estimated,
- sweeps or leans greater than 5 degrees.

In some areas, it may be impossible to meet sample height requirements if only suitable trees as described above are taken. In this situation, take the best of the “poor” trees to meet the requirement. However, do not select a tree if its height is less than 95% of what it would be without its defect – lean, fork, broken top, etc.

Measuring Suppressed Trees with Flattened Tops

To ensure accurate measurements of suppressed trees:

1. Sight on the highest point of the top.
2. For hemlock trees, sight on the highest point of the droop.
3. For cedar trees, make sure you take the top reading on the tiny leader and not on a lateral branch, which may be higher.

Age Sample Trees

Note: If all the present top height trees had their ages taken at 1.3 m during the last measurement, no further ages are required. If a top height tree does not have an age at 1.3 m, it must be taken now.

In simple layered stands, pure and mixed, the age of the stand is determined by averaging the ages of the top height trees of the leading major species in the sample. However, ages of the top height trees of the second major species must also be taken.

In mixed stands, take one additional age for any other major species to determine if their age is in the same age class. If the third major species belongs to a different age class, and its basal area is within 10% of the second, then also take the same number of ages for it.

The sample mean age is derived from the top height trees of the leading species only, even if part of their cores are rotten. The rotten portion must be estimated to derive a total age for the tree. See “Counting Rings on Rotted Cores” in this chapter.

Bore trees that appear to be veterans to confirm they are in fact veterans. Bore the smallest diameter veteran per species only; the others can be assumed to be veterans too. Use these ages for the veteran layer.

In complex layered stands, the average age of the stand is determined from the ages of the top height trees of the leading major species. However, to show the variation of the stand’s
age, take two additional ages of the leading major species from the younger portion of the stand. For additional major species, treat them as in mixed stands.

In multi-layered stands, select sample trees, as outline above, for each layer.

**Taking the Age of a Tree**

1. Bore the selected trees at 1.3 m.
2. Remove the core. Make sure two cores per species include the pith.
3. If the core includes the pith, record Y in the pith field.
4. Re bore the tree if you missed the pith by more than an estimated:
   - 2 years on a tree younger than 100 years, or
   - 2 percent on a tree older than 100 years.
5. While in the field, count the rings on the core and record the count.
6. Measure and record the radial increment for the last 10 and 20 years.
7. If required,
8. Put the cores in plastic straws.
9. Label the straws with:
   - the region number, R#
   - the compartment number, Co#
   - the sample number, R#
   - tree number
   - species
   - counted age

**Counting Rings on Rotten Cores**

If the sample tree has rotten portions:

1. Count the rings on the sound portion of the core.
2. Estimate the number of years in the rotten portion.
3. Add the number of years in the sound portion to the estimated number of years in the rotten portion.
4. Record the total breast-height age.
5. Record R for rot in the remarks.
Estimating The Sample Crown Closure and Slope Position

Estimating Crown Closure

Crown closure is the percentage of ground area covered by the vertically projected crowns of trees.

For each plot, estimate and record the crown closure by layer to the nearest 10%.

For the veteran component of the plot, record crown closure to the nearest percent. If the crown closure of the veteran component is 6% or more, it must be classified as a separate layer.

Determining Slope Position

Slope position is the relative position of the plot within a water catchment area. Determine the slope position and record the appropriate code:

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Slope Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Crest</td>
<td>crest</td>
</tr>
<tr>
<td>U</td>
<td>Upper</td>
<td>upper slope</td>
</tr>
<tr>
<td>M</td>
<td>Mid</td>
<td>middle slope</td>
</tr>
<tr>
<td>L</td>
<td>Lower</td>
<td>lower slope</td>
</tr>
<tr>
<td>T</td>
<td>Toe</td>
<td>toe</td>
</tr>
<tr>
<td>F</td>
<td>Flat (level)</td>
<td>flat</td>
</tr>
<tr>
<td>D</td>
<td>Depression</td>
<td>depression</td>
</tr>
</tbody>
</table>

Quality Control

Sampling crews should emphasise accuracy over production. For the standards of measurement, see Appendix 1.

Checking Sampling Crews

To ensure crews follow and understand recommended procedures, carry out regular inspections.

1. Inspect at least 10% of all samples remeasured. If the sample has been poorly done, the original crew may be required to redo it.

2. Make spot checks as work progresses to be sure tie points and tie lines are properly marked.

3. To observe sampling crew performance, occasionally visit each crew on the sample.
Checking the Samples in the Office

All samples must be inspected in the office before sending them to the Growth and Yield section of the Resources Inventory Branch. Ensure that:

1. The sample identification is correct and valid
2. The sample header is as complete as possible
3. The number and distribution of tree heights – both top height and others – were met.
4. The required number of ages and pits were met.
5. Check that the access notes are complete and include the tie point sketch.

Inspecting the Sample

Once the samples have been checked in the office, randomly select one of the samples and conduct the following:

- a pre-field inspection
- a field inspection
- a post-field inspection

Pre-field Inspection

1. Randomly select one sample from the ones checked in the office.
2. Enter the following information in the section at the top of the plot inspection report:
   - the sample identification – region, compartment, sample, sample type and plot
   - the plot and sub-plot sizes
   - the plot and sub-plot radii
   - the inspection date
   - the original tally crew
   - the measurement date.
3. Randomly select 7 trees from the tree detail section.
4. Transcribe the measurements of the 7 trees to the top section of the plot inspection report. FS 822-1. See Appendix 15.
5. Randomly select 5 trees for height from the sample tree section.
6. Transcribe the height measurements of the 5 trees to the sample tree section of the plot inspection report.
7. Randomly select 2 trees for age checking.
8. Transcribe the age measurements to the sample tree section of the plot inspection report.
9. Transcribe the crown closure, aspect, slope and slope position of the plot to the appropriate section of the plot inspection report.

10. From the tree count summary section, randomly select one diameter class for a species. Later, you will use this diameter class in the field to check that the dot tally is correct for that class.

**Field Inspection**

1. Use the access notes to get to the sample and verify their accuracy and completeness.

2. If a new tie tree was selected on remeasurement, check that it was marked as specified in “Checking the Tie Point” in this chapter.

3. If a new tie line was run, verify that the bearing and distance were run within the allowable standards.

4. Check that the aluminum plot centre markers were inscribed correctly and the plot centre stake was properly protected with a cairn.

5. Check the plot sides and the sub-plot radius at a minimum of three different locations. Look for ingrowth trees that should have been included or excluded from the plot or sub-plot. Flag with a circled asterisk any tree missed or mistakenly tallied.

6. Check that all sub-plot trees less than 4 cm d.b.h. but at least 0.3 m in height were either tagged or counted in the dot tally.

7. Carefully measure all the trees you selected during the pre-field inspection:
   - **Tree Identification** – Check that the genus or species of each tree inspected is correct. If not, place a circled asterisk beside the tree.
   - **Tree tag height** – Check the tag height of the selected ingrowth trees to verify that breast heights, if applicable, were located at 1.3 m above the germination point for plots established before 1991, or at 1.3 m above the base of the tree on the uphill side for plots established after 1990. At the same time, make sure the nails were securely driven into the trees and the nail with the tag was driven in at a slight angle so that the tag hangs away from the tree.
   - **Diameter and pathological remarks (decay indicators)** – Measure the 7 selected trees and classify them.
   - **Sample tree heights** – Measure the 5 selected trees for height.
   - **Stem mapping** – If the sample was stem mapped, check the 7 selected trees for bearing, distance and percent slope.

8. Assess the crown closure for the plot.

9. Compare your measurements with the previous ones giving the crew the benefit of the doubt.

10. Check that the results conform to the standards of measurement. See Appendix 1.

11. If the difference between two measurements is greater than the allowable error, place an asterisk in the margin.

12. If the error is greater than two times the allowable error, circle the asterisk.
13. Complete the inspection items section of the inspection report.
14. Rate the quality of the work on the plot using the weighted system in Appendix 2.
15. Record your rating and any other comments in the remarks section of the plot inspection report.

**Post-Field Inspection**

1. Discuss the results of your inspection with the original field crew.
2. Make recommendations to the original field crew — if necessary — on how to improve their work.
3. Correct the original data changing all the data that was flagged with an asterisk or a circled asterisk in your inspection report.

**Damage to the Experimental Plot**

Damage to samples can result from natural or artificial causes.

1. If the sample was damaged by natural causes such as slides, snow, fungi, insects, disease and fire, it should be remeasured if at least 25% of the plot trees are still living.
2. If the sample was damaged (disturbed) by artificial means, refer to “Guidelines for Deciding if Damaged Permanent Plots Should be Remeasured” in Appendix 24.

If a sample is to be destroyed:

1. Remeasure it one last time if at least 3 years have elapsed since the last measurement.
2. Classify it ecologically.
3. Make sure the plot centre can be relocated after logging so that the long-term productivity effects can be determined.

**Returning the Samples to Victoria**

Once the samples are checked in the office and corrected:

1. Send a list of all the samples, any original field sheets, the electronic download from the GyHost as well as a hard copy of reports 1, 2, 3, 5 and 7 to the Growth and Yield Section of the Resources Inventory Branch.
2. Keep a copy of all the above in the forest region for security and reference.