Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

PERMANENT SAMPLE PLOT (PSP) FIELD PROCEDURES MANUAL

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TABLE OF CONTENTS

1.0 INTRODUCTION

In order to manage our forest resource effectively, we need to acquire a better understanding of stand dynamics, i.e. how trees grow and stands change over time. An accurate method of determining growth and yield is through the use of permanent sample plots (PSPs). The growth of a stand can be estimated directly by taking measurements of the same trees at periodic intervals. This information is vital in the establishment of a sustained yield program.

The main objectives in permanent plot sampling are:

1. to assess stand dynamics such as succession, regeneration, ingrowth and mortality
2. to provide a data base that can be used to develop yield curves
3. to provide representative areas for study of management techniques

To meet these objectives, over 650 permanent sample plots (PSPs) have been established since 1960. More PSPs will be needed (over 3000 in total) in order to provide representative information for a variety of densities, heights, species, ages and site conditions.

1.1 Schedule of Remeasurements

Remeasurements of existing PSPs should take place at the same time of the year as the initial establishment. In order to monitor the stand dynamics of different types of stands, different remeasurement schedules are used. These schedules are as follows:

1. Every 5 years
    - for coniferous stands < 80 years old or > 130 years old.
    - for deciduous stands < 60 years old or > 100 years old

2. Every 10 years
    - for coniferous stands between 80 and 130 years old
    - for deciduous stands between 60 and 100 years old.

Determination of the remeasurement schedule is dependent upon the current age of the stand and not the age at the time of plot establishment. In mixedwood stands the age of the leading species will be used. If budget constraints are a concern, then coniferous plots over 50 years old could be put onto a 10-year cycle.

2.0 FIELD PROCEDURES

Prior to April 1981 an alternate procedure was used for establishing plots than the procedure described in Section 2.1. The difference between the methods is the plot layout. This can create confusion when remeasurements are done and for this reason a description of the plot layout prior to April 1981 is in Section 2.2.1.

2.1 Plot Establishment Procedures

The plot establishment procedures described in this section are for all plots established after April 1981.

2.1.1 Location of Plot Centre

The approximate location of the PSP should be pre-determined on a stand map. The selected stand must be large enough to ensure that the entire plot is within the desired cover type. After the preliminary map work is completed and a tie point (using a permanent land feature) has been selected, a pre-determined horizontal distance and azimuth is chosen to locate a potential plot centre and the ground plot centre is established. An aluminum tag, labelled with the PSP number and the word "CENTRE" (e.g. PSP456-CENTRE), is attached to the top of the post.

A tie-point is then established to link the plot centre to a permanent land feature on a Phase 3/AVI map for the purpose of locating the plot for future remeasurements. Section 2.2.2 deals with maintenance and establishment of tie-points. The tie-point information is then used to locate the plot on the aerial photographs and the forest cover type map. For tallying purposes, the legal land description is recorded as the section and legal subdivision containing the centre of the PSP group.

The following plot establishment sequence is used to establish a PSP with a plot size of 1/10 hectare. Plot centres are Gpsed at least twice. Second time is to verify that the first GPS location is ±-3m.

2.1.2 Plot Establishment Sequence

The plot establishment sequence must be followed closely to orient the plot properly and to produce the nested sampling design. All posts and metal pins, for the regeneration and sampling plot corners, are to be tagged and labelled as shown in Figure 2.1.

To establish a one-tenth hectare plot, as shown in Figure 2.2, the following sequence is used.

1. Using a staff compass go on a bearing of 45 degree for 22.36 m, from the centrepost and locate the NE corner of the tree plot. Pound a post into the ground at this point and attach a tag with the PSP number and "NE" corner marked on it (e.g. PSP# 456-NE). An aluminum angle post are also placed into the ground at each corner post. It is pounded in the ground until at least 10cm remains above ground.

   Note: The centre metal post must be removed before the staff compass is used.

2. In the same manner locate the other 3 tree plot corners using the following bearings:

   SE Corner - 135°
   SW Corner - 225°
   NW Corner - 315°

If possible, check the alignment of the plot (ie. a square with right angle corners) by standing at one corner and sighting through the centre to the opposite corner. The tree posts, NE, CENTRE and SW should form a straight line. If the posts do not line up they must be located until they do.

Note: All distances are horizontal distances (if slopes are ≥ 10% the distance must be corrected – use the slopes correction factor tables in Appendix 4.5).

3. The length of each side is measured using a 50 m tape and must be 31.62 m ± 0.25m (31.37 m – 31.87m). Relocation of the corner posts is necessary if the length of a side falls outside this range. Record the distance of each side and each diagonal on the Plot Maintenance Report Figure 2.10. The tree plot boundaries and azimuth are determined by running string between corner posts. Care must be taken with borderline trees. A tree is considered "in" if more than half of the stem, at breast height, falls inside the plot.

4. A sapling/regeneration plot (1/16 the size of the plot) must be established even if there are no saplings or regeneration present. To establish the sapling/regen plot, place an aluminum angle post 11.18m, at an azimuth of 315°, from the plot centre. This marks the SE corner. The NE and SW corners of the sapling/regen plot are located by running lines north and west, respectively, from the SE corner to the tree plot boundary. Check the lengths of the plot to ensure that they are 7.9m ± 0.06m (7.84m – 7.96m). Attach a tag labeled with the PSP number, "SAP/REGEN, and the corner (e.g. PSP456-SAP/REGEN-SE). The sapling/regen plot boundaries are defined with string to determine "in" and "out" stems.

5. The reservation boundary (buffer) is established by running a line, using a topofil, for 100m at 360° from plot center. Using blue paint, mark the trees, at 5m to 10m intervals, for 200m in each of the cardinal directions creating a square shaped buffer surrounding the plot. Paint a small rectangle 22cm x 28cm, one –third of the circumference, on each tree, at eye level (2m above ground) facing away from the plot. To aid in the relocation of the buffer corners, paint every tree for the first 10m and the last 10m on each side of the buffer. The trees used for buffer corners should have "C"s painted on the two sides facing out from the plot. Also paint NW to indicate Northwest corner of buffer NE to indicate Northeast corner of buffer, etc. Avoid if possible painting dead trees, wind-blown trees and trees with thick, low-hanging branches. When remeasuring the plot, PSP blue tags (and/or Blue PSP flagging tied to the trees) are stapled above the blue painted trees. Repaint the blue trees and put blue tags on every 2nd blue painted tree. Buffer is GPSed for mapping and GIS applications.

6. To assist in the future location and remeasurement of the plot, trees (called a witness trees), outside of the tree plot, at each tree plot corner is painted blue, on the side that faces in towards the plot centre.

In Summary:

Table 1

Tree Plot				Sapling/Regen Plot			Buffer	
Area (ha)	Area (m^2)	Side (m)	Diagonal (m)	Area (m)	Side (m)	Diagonal (m)	Area (m^2)	Side (m)
0.10	1,000	31.62	44.72	62	7.90	11.18	40,000	200.0
0.15	1,500	38.73	54.77	94	9.69	13.70	56,250	237.0
0.20	2,000	44.72	63.24	125	11.18	15.81	90,000	300.0

2.1.3 Plot Assessment at Establishment

Plot assessment refers to plot data related to the physical characteristics of that area. Plot assessment is collected in the following categories using the given descriptions.

2.1.3.1 Plot Overstorey/ Understorey Covertypes

There are two kinds of plot covertypes recorded. The AVI Photo-Interpreted Overstorey and Understorey species codes are recorded only at plot establishment after all field work and mapping has been completed. The AVI Field Overstorey and AVI Understorey species codes are recorded in the shaded columns by field crews during plot establishment and remeasurement. The codes used for covertypes are listed in Section 2.1.4. The variables location, slope, aspect, elevation and soils information are only recorded at plot establishment.

2.1.3.2 Topography and Elevation

Location

Location refers to the relative topographic position of the plot, in a hydrological sense, when compared to the general immediate area surrounding the plot. The codes used for location (see Appendix 2a) are:

1-Hollow
2-Flat
3-Slope
4-Hilltop

Slope

With the use of clinometer the average slope for the plot is recorded to the nearest %. If theres is no slope, zero is recorded.

Aspect

Average aspect (the direction when facing away from the slope) of the plot recorded as N, NE, E, SE, S, SW, W, or N. (Note: if slope percent is zero, make note in comments section).

Elevation

Elevation is recorded as the height above the sea level to the nearest metre and is taken at the PSP group/plot centre. The contour line closest to the plot location on a National Topographic System (NTS) map is recorded in the comments section on the PSP Header Sheet to act as a guide for field elevation reading. In order to obtain an accurate reading, the altimeter must be set daily at a location with a known elevation (e.g. airstrip, benchmark, etc.) This elevation is recorded (Reading 1) in the comments section on the header sheet. Upon entering the PSP, the elevation is read and recorded (Reading 2) in the columns 77 – 80 allocated in the header and may be subject to change. The altimeter is read (Reading 3) once again at the location with the known elevation. The average difference between Reading 3 and Reading 1 is added to Reading 2 to obtain the final elevation of the plot. If the final calculated elevation differs from the field reading (Reading 2), the Header sheet must have the elevation record changed.

e.g. First reading at known elevation = 1000m (Reading 1)
PSP elevation = 1500m (Reading 2)
Final Reading at know elevation = 980m (Reading 3)

$$\frac{\text{Reading 3} - \text{Reading 1}}{2} + \text{Reading 2} = \text{Final PSP elevation}$$

$$\frac{980\text{m} - 1000\text{m}}{2} + 1500\text{ m} = -10\text{m} + 1500\text{m}$$
= 1490m (final calculated elevation)

Reading 2 is not to be changed if Reading 3 is drastically different from Reading 1 due to changes in barometric pressure (e.g. a storm front has come through since Reading 1 was set).

2.1.3.3 Soils

Erosion Potential
This describes the chance of water eroding down to or into the mineral soil layer. This is a based upon water flow, slope, and soil type. The codes used for erosion potential (see Appendix 3a) are:

1 – Slight
2 – Moderate
3 – High

Drainage
Soil drainage is assessed by evaluating the plot position, soil texture, humus depth, location of the water table, permeability and water storage capacity. The codes used for soil drainage (see Appendix 3b) are:

1 – Very rapidly drained
2 – Rapidly drained
3 – Well drained
4 – Moderately well drained
5 – Imperfectly drained
6 – Poorly Drained
7 – Very poorly drained

Depth of Mineral Soil
The average depth of the duff layer (organic matter) to the mineral soil (or the water table in boggy conditions) is recorded to the nearest centimetre.

2.1.3.4 Surface Vegetation

Type

There are nine possible types or combinations of grass, lichen/moss, herbs (flowers and non-woody stems) and shrubs (woody stems). The dominant vegetation type is recorded.

1 – Grass
2 – Grass and herbs
3 – Grass and shrubs
4 – Lichen/moss
5 – Lichen/moss and herbs
6 – Lichen/moss and shurbs
7 – Herbs
8 – Herbs and shrubs
9 – Shrubs

Ground Cover

The percent of the ground that is covered by surface vegetation is recorded to the nearest percent. In most cases this will be, or very close to, 100%. Plots with a lot of surface rock, woody material or water will have a lower percent of ground cover. A comment why cover is not 100% must be made on the comments section of the header sheet.

2.1.3.5 Plot Maintenance Report

The maintenance report data is recorded on both plot established and plot remeasurement. Refer to Section 2.2.3.1 for information on access, plot damage and buffer damage.

2.1.4 Tree Plot Measurement

All standing trees (live and dead) $\geq$ 9.1 cm DBH (diameter at breast height) within the tree plot are tagged, measure, and tallied. Any standing dead trees must be capable of withstanding a firm push before being measured (standing dead trees are tagged at establishment to assist in plot remeasurement and for possible use in growth modeling).

If for some reason this 1/16 sapling/regen plot is not representative of the plot, a note must be made in the comments section indicating this is the case but sapling are still tagged and measured.

2.1.4.1 Species Code – see Master Appendix 12

2.1.4.2 Tree Measurement

In order to aid in the tally of the trees within the tree plot, the plot is divided into four north-south strips, called swaths. Each swath is approximately ¼ the width of the plot, runs the length of the plot and is defined with

strings as shown in Figure 2.3. Swaths are marked with topophil string as shown in Figure 2.3, Swaths are marked with topophil string and/or yellow geo flagging.

All talliable trees are tagged (numbered from 1 to 9997) starting with the tree closest to the NW corner post. Trees are numbered consecutively from side to side within each swath in a forward direction. Tags on the trees tallied in the southern direction are tagged on the south side of the tree (see Figure 2.3). By tagging trees in this manner, remeasurement is simplified and plots are easier to locate as tags can be seen when entering the plot from any direction.

Tags are nailed to the tree/saplings at exactly breast height (see Section 2.1.4.3) using 6.5 cm (2.1/2 inch) spiral nails. Nails must have the head sloped slightly downwards and pounded until 2.5 – 3.5 cm remain outside of the tree. This will keep the tags secure and not grown over by the tree. The tree numbers are to be written vertically on the tree tags (see Figure 2.3 B). Wire is to be used on deciduous trees because they do not take nails well. Leave lots of room.

2.1.4.3 Diameter at Breast Height (DBH)

Breast height is 1.3 metres from the point of germination as shown in Figure 2.4. A blue bar is painted at DBH also.

Breast height is determined using a straight stick 1.3m long. Using a metal diameter tape, measure the tree's diameter to the nearest 0.1 cm making sure the tape is perpendicular to the stem. Diameters are always taken directly above the nail unless there are large branches or swelling right at breast height. These defects are to be avoided and the diameter is taken immediately above or below the distortion and a comment noting the problem is made. Also see appendix #14 for determining breast height. An example on the tally sheet is the comments section (e.g. DBH taken below swell). See Figure 2.14, tree#1.

2.1.4.4 Height

With the advent of electronic height measuring devices it was decided that in 1998, the heights of all trees (alive) will be taken. Height to top live branches on trees that have damaged tops.

All height trees are to be marked at breast height with any colour of geo-flagging tape. As well a blue painted dot facing the direction in which the cruiser went in order to complete the height measurement shall be put on each height tree. The dot should be no longer than 5 cm in diameter and must be located between .75m – 10 from the ground. Do <u>not</u> measure the height of standing dead trees even if it was a sample tree last remeasurement. Do <u>not</u> measure height on dead and down trees. See Master Appendix for tree height measurement methodology.

For office purposes and a method of checking field calculations record the tree number, species, top %, top % to live crown, and bottom % readings, (slope distance and slope % when applicable) on the back of the tally sheet (see Figure 4.2A). To be done if measuring with clinometer and loggers tape. If heights taken with an electronic height finder, record person and type of machine on back of tally sheet. The space allocated for correction is used when a bottom percentage reading cannot be taken for the base of the tree and a known

height (ie. DBH) or measured height must be used (this correction must be added to the calculated height to get total height). In addition, the calculated net percentage, horizontal distance, and total height should be recorded for each tree. The calculated heights are to be transferred onto the front of the tally sheet in the appropriate columns.

2.1.4.5 Height to Live Crown

The height from the ground to the base of the live crown (see Figure 2.5) is measured on all trees that have been measured for total height. The base of the live crown is the point that separates the continuously branched portion of the tree and the part that has sporadic or no branching. Live crowns on deciduous species start at the leaves, not at the branches. Live crowns on coniferous species start at the tip of the live branch, not at the base of the branch. The height to live crown is quite variable depending on stand maturity and density with young, open stands having low live crowns and mature, stocked stands having higher, live crowns. Height to live crown is measured on age trees when they are on the ground and being prepared for sectioning.

2.1.4.6 Crown Class

Crown class (CC) refers to the position of an individual tree within the canopy of the stand inside the plot. Crown class is assessed on a plot-by-plot basis, not on the stand as a whole. For example, an intermediate tree in one PSP plot may be codominant in the next. The following figure shows the types of crown class in a single layer stand. Crown classes are recorded for all tress with the exception of those with a broken top/system, are dead, cut down, missing, or have a severe lean (see Figure 2.6).

2.1.4.7 Age

The age of a PSP is determined by felling and sectioning a minimum of three codominant/dominant trees of each major species found within the plot. The selected trees are found outside the plot inside the reservation boundary (buffer) and the same stand types as the plot. When selecting trees for sectioning, preference should be given to healthy trees. Trees are sectioned in accordance with the Public Lands and Forests Division Tree Sectioning Procedure Manual and tallied on the Tree Sectioning Tally Sheet (CSTM 04 or CSTM 04A). Information pertaining to species, DBH, height, height to live crown, crown class, and condition codes are transferred onto the PSP Header Sheet under tree number 0000. For each sectioned tree the DBH age, stump age, and stump increments for 0 –10 years and 10 – 20 years are also recorded. See Figure 2.7.

Refer to Section 4.11 for special measurements for immature and mistletoe plots.

The three stump ages for each species must be within a ten-year frame of each other or more trees must be felled (i.e. 90-100-110 represents a 20 year gap – need to fall 1 more tree with an age between 90-100 or 100-110; 96-99-104 represents an 8 year gap – no more trees need to be felled). The cookies should be marked with the plot number and tree number, then taken back to the field office for verification. Care must be taken with aging as some species, such as aspen, can have false rings that may result in inaccurate age counts. This would affect growth and yield calculations. Approximate locations of sectioned trees shall be indicated

with an “X” on the maintenance report. As well, yellow geo-flagging shall be used to indicate the field locations.

2.1.4.8 Stem Mapping

All tagged stems within the tree sapling plot are stem mapped. Stem mapping is used to identify the position of each tree or sapling with respect to other surrounding trees or sapling and can be used in distance dependent growth models and is used in plot remeasurement to locate missing trees or sapling.

A staff compass and a metric tape is used to determine the azimuth and distance to the centre of each tree or sapling, at breast height, from the plot centre. Azimuth are recorded from 1°-360° and distances are measured to the nearest 0.1 m. Standing dead trees are to be stem mapped.

Regeneration are not stem mapped.

2.1.5 Sapling/Regen Plot Measurement

Sapling/Regeneration History

1968
During re-measurements in 1968, saplings were measured and recorded for the first time. Saplings were considered to be all stems inside the tree plot with a diameter at breast height (DBH) of 0.1 – 0.6 inches. However, saplings were not measured in every PSP or even in every subplot of a PSP. When saplings were tallied, they were termed “regeneration”.

Regeneration has been tallied by height class and species since 1960. All regeneration within a subplot were counted until 1981.

1981
Sapling plot sizes are required to be ¼ the size of the tree plot while regeneration plot sizes are 1/16 of the tree plot. The 900 series drainage plots and 700 series immature plots are also exceptions. These dimensions are used for all subplots for field measurements unless there are over 100 saplings in the sapling plot. When this occurs the sapling plot is reduced to the regeneration plot. (See table on plot sizes)

PLOT SIZES

Year of establishment	TREE PLOT			SAPLING PLOT		REGENERATION PLOT	
	Area (ac.)	(m²)	Length of Side (m)	Area (m²)	Length of Side (m)	Area (m²)	Length of Side (m)
1960-1981	1/20	202	14.23	50	7.11	13	3.56
	1/10	405	20.12	101	10.06	25	5.03
	1/8	506	22.49	126	11.25	32	5.62
	1/5	809	28.45	202	14.23	50	7.11
	1/4	1012	31.81	253	15.9	63	7.95
	1/2	2023	44.98	506	22.49	127	11.25
Post 1981		1000	31.62	250	15.81	62	7.90
		1500	38.73	375	19.37	94	9.69
		2000	44.72	500	22.36	125	11.18
		2000	40 x 5	-	-	25	5.00

Saplings were not numbered until 1981. Since this time all saplings inside the sampling plots within all subplots are assigned tree number 9999. Saplings will be numbered 9999 from 1981 until the year 2000 when the saplings actual got a tree numbers starting at 8001 (see following page 2000 field season).

PSP's established in immature stands since 1989 (700 series) have sequential numbers assigned to each sapling within the sapling plot. These saplings are not distinguishable from trees in the PSP by number.

Regeneration was also supplied with a number in 1981. For tallying purposes all regeneration, inside the regeneration plots, are recorded as tree number 9998. This record is a dot tally and was recorded for each species.

Tree, Sapling and Regeneration Specifications

When PSP's were first established, all stems inside a subplot boundary were considered either trees or regeneration. The specification of a tree was any stem with a DBH of 0.6 inches or greater and regeneration was all stems less than 0.6 inches DBH to a minimum height of 0.5 feet. With this system, some subplots contained a large number of trees that contained very little volume.

In 1981, the specifications for trees, saplings, and regeneration were developed. Trees were defined as all stems with a DBH of 9.1 cm or more. Saplings were determined to be all stems with a DBH greater than 1.1

cm and less than 9.1 cm. All stems less than 1.1 cm DBH but taller than 0.16 m in height were defined as regeneration.

In the 900 series of drainage plots the sapling category was not used. All stems greater than 1.1 cm DBH were considered trees. No sapling plots were established in these plots.

The regeneration height classes were changed from the original 1960 specifications in 1981 and again in 1983. In the initial change, the height classes were converted from imperial to metric units and were labeled, using the midpoint of each height class and increased from six classes to ten. The 1983 alteration reduced the number of height classes from ten to five and again listed each class using a height range. Each of these classes was assigned a number. The following table is a summary of the changes made to the regeneration height classes.

1960 – 1980	**1981 – 1982**		**1983 - present**	
(ft.)	(m)	Midpoint (m)	(m)	Height class
0.5 – 1.4	0.1 – 0.44	0.3	0.10 – 0.30	1
1.5 – 2.4	0.45 – 0.74	0.6	0.31 – 0.60	2
2.5 – 3.4	0.75 – 1.04	0.9	0.61 – 0.90	3
4.5 – 5.4	1.05 – 1.34	1.2	0.91 – 1.20	4
5.5 – 6.4	1.35 – 1.64	1.5	1.20 +	5
6.5 – 7.4	1.65 – 1.94	1.8		
	1.95 – 2.24	2.1		
	2.25 – 2.54	2.4		
	2.55 – 2.84	2.7		
	2.85 +	3.0		

1991
Sapling and regen plots combined. Only the regen plot size is used now (1/16 of plot/sub-plot size).

2000
Starting in 2000 field season, sapling located in the 1/16 sapling/regen plot will be measured and tagged just like trees in the tree plot. Any tree that has a height of =>1.3m will be measured, tagged, azimuth and distance taken, etc. All stems ≥ 0.10m in height up to 1.29m inside the sapling/regen plot are tallied as regen. Note that on 700 series type plots (immature) all saplings are already tagged. Trees that are ≥ 1.3m in height are now included, a minimum DBH is not required. These saplings are numbered starting at 8001, 8002,etc.

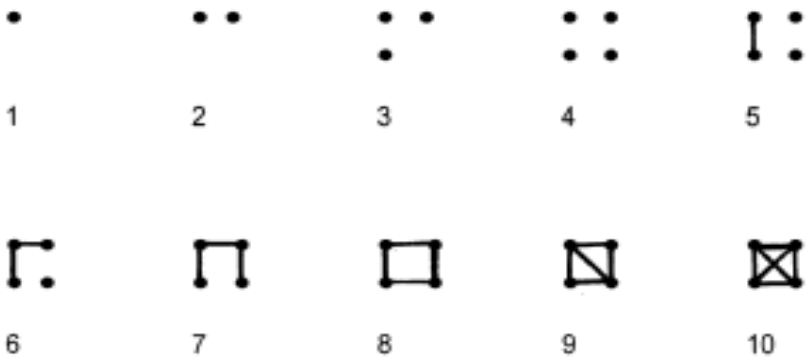
Saplings are to be measured exactly as a tree if they fall within the 1/16 sapling /regen plot. Saplings are =>1.3m in height. The numbering on sapling start at 8001, 8002, etc. Regeneration (regen) is classified as

any stem 0.10m or taller to a maximum Height of <=1.29m. Regen is counted by species and height class and recorded on the regeneration tally sheet (see Figure 2.15) using a standard dot tally.

The five height classes are as follows:

Class 1: 0.10 – 0.30m
Class 2: 0.31 – 0.60m
Class 3: 0.61 – .90m
Class 4: 0.91 – 1.20m
Class 5: 1.21m – 1.29m

The dot tally is recorded as follows:



If regen are present of a species not listed on the tally sheet, such as PF or FA; record the species in the blank spaces in the species column at the bottom of the sheet. To assist in determining which height class a regen is in, the stick used to measure breast height should be marked at 0.10m, 0.30m, 0.60m, 0.90m, and 1.20m.

Regen, as shown on the tally sheet are recorded as tree number 9998.

If there is no regen present in the plot, record "No Tally" diagonally across the green shaded area. On plots with 4 subplots a regen tally form must be completed for each subplot.

2.1.5.1 Crown Width Measurement

Started with year 2000 field season the crown width of a sample of trees/sapling/regen by species will have 4 crown widths measured. The crown width to the North, West, South and East of the selected tree/sapling/regen will be recorded in the comments section. The criteria for selecting trees/saplings/regen to have crown width measured **by species** is as follows for new trees/saplings/regen (previous measured trees/saplings/regen have already been selected).

a) If <10 trees/sapling/regen, select all new trees/saplings/regen for crown measurements.

b) If >10 but <=20 trees /sapling/regen, select every second tree for crown measurements.

c) If >20 but <=40 trees /sapling/regen, select every fifth tree for crown measurements.

d) If > 40 but <=100 trees /sapling/regen, select every eight tree for crown measurements.

e) If > 100 trees /sapling/regen, select every tenth tree for crown measurements.

This measurement is to be taken in the 4 cardinal point directions and is measured from the stem out. A reading of 2.5 metres is to be recorded as 25 (decimeters). This measurement is not to be done on dead trees/saplings/regen. If a tree has died that has been selected to have it crown measured, do not measure dead branches. Select the next tree of the same species as the new crown width tree and record the 4 measurements on the tally sheets. Do not select dying or leaning trees as a new crown width tree. See Figure 2.8.

The crown measurement is estimated at the widest portion (half of crown diameter for that cardinal direction of the foliage looking up from the base of the tree. For deformed or leaning trees/saplings regen do not use due to difficulty in properly calculating crown width. Chose another tree of the same species.

2.1.6 Plot Photography

Colour photographs of each plot are taken once the measurements are completed. These photographs serve as a method of visual documentation of the overstorey and understorey for the plot and cover type. Numbered cards should be used in the photographs to identify the plot. Two photographs are taken from the group plot center in 4 subplotters and plot center of one subplotters; one facing east and the other facing west, with the photographer standing at back from plot center so that the flagged center post is in the photograph. Record picture frame numbers on checklist for subplot #1.

2.1.7 Vegetation and Soils

The Public Lands and Forests Division is interested in correlating PSP data with information regarding site, vegetation and soils. For this reason information and samples are being collected.

2.1.7.1 Vegetation Sampling

Vegetation plots shall be circular with an area of 400m^2 (radius 11.25m) and central around the group centre (pre-1981) or plot centre (post – 1981). Methods of vegetation identification are outlined in Land Information Branch manual “Site Description”.

2.1.7.2 Soil Sampling

In plots established before April 1981, the soil sample pit is located as close to group centre as possible without disturbing the vegetation plot.

For plots established after 1981, the pit is located within the buffer as close to the tagged trees as possible. Be careful not to disturb the roots of the tagged trees.

Methods for determining soil type, texture, etc. shall be done as outlined in the Canadian System of Soil Classification. Collected data is recorded on the "Soil Description Form".

2.2 PLOT REMEASUREMENT PROCEDURES

Plots are remeasured according to the time schedule presented in Section 1.1. It is essential that the remeasurement is done accurately as the incremental growth for a particular time frame is necessary for growth and yield calculations. Section 2.1, Plot Establishment, should be read first as it explains the methodology for measurements in this section.

2.2.1 Plot Layout

Permanent sample plots established prior to April 1981 have a different plot layout format and a variety of plot sizes. Each of these PSP's (group) contains four separate plots (see Figure 2.9) with a reservation boundary surrounding the entire group.

The distance from the group centre to the nearest corner of each plot is either 20.1m or 50.3m. With this design the buffer is 100m or 150m from the group centre in any cardinal direction.

The size of a plot varies in order to obtain a minimum of 100 living trees per plot. All plots in each group have the same plot size with sapling plot 1/4 the size of the tree plot and the regeneration plot 1/16 the size of the tree plot. The various tree plot sizes, along with the corresponding sapling/regeneration plot sized are listed on the next page. Post 1981 plot size was changed to 1/16 of plot for both saplings/regen plots.

Pre April 1981 Plot Layout

Tree Plot				**Sapling/Regen Plot**	
Area (ac)	Area (m^2)	Side (m)	Diagonal (m)	Plot Area (m^2)	Side (m)
1/20	202	14.23	20.12	13	3.56
1/10	405	20.12	28.45	25	5.03

1/8	506	22.49	31.80	32	5.62
1/5	809	28.45	40.23	50	7.11
1/4	1012	31.81	44.98	63	7.95
1/4	2023	44.98	63.61	127	11.25

Note: All distances are horizontal distances

Prior to 1981, all PSPs were established using the above metric measures. PSPs established since 1981 used plot sized given in Section 2.1.2. ie. tree plot of 1/10 hectare. All distances are horizontal distances.

2.2.2 Plot Maintenance

The following items are checked:

1. Evaluate the access (see Appendix 4.7)
2. GPS the reservation boundary (buffer) and repaint/tag it blue. All buffer trees should have a rectangle (22cm x 28cm) painted, (1/3 of the circumference on each tree), at eye level (2m above ground) facing away from plot. The trees used for buffer corners should be painted/tagged on two sides facing out from the plot and have "C" painted on them to indicate a buffer corner and the bearing designation (i.e. NW, SE, etc.) In the event that plot has two blue buffers painted, the incorrect one must be covered with black paint and noted on the maintenance report.
3. Check the condition and tags of all the posts, centre and corners. Replace and retag where necessary.
4. Replace any tree tags and nails if necessary (for example if<2 cm of nail is protruding out). Do not worry about missing tags at this time.
5. Rate the overall condition of the plot and buffer, noting any damages and their location on the plot maintenance sheet (Figure 2.10).
6. Measure all Saplings/Regen and tree plot sides. Record sizes on maintenance tally sheet. These only have to be remeasured if posts/pins have been disturbed since previous measurements. Reproduce map using previous sizes if okay.
7. The tie-point for each plot must be confirmed. This includes checking the distance and azimuth from the plot centre to the tie-point. Keep in mind the distances are horizontal and must be adjusted for slopes exceeding 10%. Whenever possible, a second-tie-point should be established in the event that the original tie-point is destroyed. Suitable tie-points include definite bends in roads, stream crossing such as bridges and culverts or any other permanent land features. A topofil or survey chain must be used to measure the distance between tie points. A vehicle odometer is not accurate by our

standards therefore it is not acceptable for measuring distance. The tie-point must be easily located on a forest cover type map.

8. Ensure North arrow is correctly located on maintenance tally sheet.
9. If there is any type of seismic or logging damage to the buffer or tree plot that was not noted on the previous maintenance report, record details such as distance away from the tree plot, approximate number of trees cut if the tree plot was disturbed and approximate year of damage (needles still present coniferous trees is a good indicator that the plot was disturbed within the last year). Check with supervisor if plot should be closed. If the plot was damaged by seismic activity, look for aluminum tags nailed to a tree along the line. Record all data off the tag on the maintenance report. This will help in determining what company was responsible for the damage.

2.2.3 Plot Assessment at Remeasurement

Plot assessment at remeasurement is done using the same techniques given in Section 2.1.3.4

2.2.3.1 Maintenance Report

The information recorded on the maintenance report is also documented on the Header Sheet. Some of this information is subjective and requires good judgment as budget requirements, planning of field work and other office decisions are based on this information.

The PSP maintenance sheet (Figure 2.10) is located on the reverse side of the PSP Header Sheet, TM 267 (Figure 2.13). For PSP's established before April 1981 where there are four sub-plots the maintenance information should all be recorded on the maintenance sheet of sub-plot one.

The legal location of the group is confirmed once the tie-point information and associated map work is completed (see Appendix 8). A PSP group can conceivably occupy up to four sections and legal sections and legal subdivisions. In the comments section of the PSP Maintenance Sheet you must note the location of plot center. In addition, careful location of the plot on the map is necessary for reservation purposes and relocation for subsequent remeasurements.

Access is extremely important for planning purposes for both remeasurement and maintenance crews. Budget estimates rely heavily on the amount of time it takes to travel to a plot and what type of transportation is required (ie. 4-wheel drive vehicle, all terrain vehicle or helicopter). Access is assessed using the following codes (see Appendix 7).

1	All weather road
2	Dry weather road
3	Deteriorating road
4	All terrain vehicles only
5	Helicopter access only
6	Unknown

Alberta Vegetation Inventory Field (AVI) overstorey calls are determined using the AVI Standards Manual V2.1. This information is used as a field check of photo interpreted overstoreys.

Plot and buffer damage to the plot is assessed using the following codes:

1 No Damage
2 Natural damage
3 Manmade damage
4 Natural and manmade damage
5 Closed

Code 6 is used to indicate buffer damage only.

6 Damage inside buffer greater than 20m from subplot

Code 7 is to be used by office staff only. Field crews ignore this code.

7 Plot was previously closed but has been reopened.

Figure 2.11 illustrates the buffer damage zones for both the large and small groups. The buffer damage zones surround each subplot by 20m from any point on the tree plot boundary. Any disturbance inside a buffer damage zone will have the appropriate damage code recorded for that subplot only. If there is disturbance inside the buffer, that is further than 20m from a subplot, code 6 is recorded. (See Figure 2.12 for examples).

On the PSP Maintenance Sheet, crews must draw in either 1-plot group or a 4-plot group in the space provided. Drawings must be clear and concise so that the information is not misinterpreted.

For those PSPs that contain four plots, the horizontal distance from the group center to the four nearest plot corners is measured. This will assist in re-establishment of the plots if the entire group is destroyed. The plot sides are measured and recorded for each tree plot. Corner posts for the tree plot may have to be re-established using the appropriate distances (Section 2.2.1) if the previous location cannot be found. Sapling/regeneration plots must be located in establishment and remeasurement situations but is not required for general plot maintenance.

Length of sides of buffer are also recorded on maintenance sheet. Each plot has a checklist, which must be completed after the plot is completely finished (one for each subplot on 4-subplot PSP's)

2.2.4 Plot Remeasurement

Before proceeding with the plot remeasurement, obtain a copy of the previous plot measurements to prepare the PSP tally sheets. In the shaded columns, copy the species, DBH and height obtained from the last measurement for each tree number so that comparison can be made between measurements in the field. Previous tree measurements have caused conflicts in the data base are to be noted on the tally sheet and double checked in the field (see Section 2.6)

Field Program Note
In 1998 an electronic field program was developed for data entry of tree measurement data. See instruction manual for how the program operates. A copy of previous measurement data should be kept on hand in a file folder in case of problems with field computer. Spare PSP tally sheets are available from crew leaders.

Plot maintenance tally sheet checklist, and regeneration tally sheets are still to be completed. Once plots has been remeasured, regeneration data has to be inputted into electronic field program. See instruction manual on program.

2.2.4.1 Tree Remeasurement

The size limits defining trees, saplings and regeneration remain the same as stated in the plot establishment procedure (see Section 2.1.4). In addition, all tagged trees that have died and are standing since the last measurement must have DBH measured. On a number of plots, established prior to 1981 and 700 type plots, stems have been tagged that have diameters less than 9.1 cm and were considered as trees. These stems are still to be measured and considered as trees (do not count as saplings if they fall in sapling/regen plot).

2.2.4.2 Species Coding

A species code (see Master Appendix 12) is recorded for all trees unless the tree is missing or cut down. By recording a species, the records for the previous measurement are confirmed. In the event that the species is not the same for a given tree, record the proper code and make a note in the comments section (eg. Tree 70 is a white spruce and write double checked (√ √) species in comments section. Species is recorded for standing dead and dead and down trees.

2.2.4.3 DBH Remeasurement

All tagged stems are measured for diameter directly below the nail. In the event that tag is located below 1.05m or above 1.55m from the point of germination, the diameter is taken at the location; the measurement is recorded in the comment section and the tag is relocated to breast height. This new diameter is measured and recorded in the DBH column on the tally sheet.

In some plots, very small trees have had tags wired to them. Replace the wire with a nail, at breast height, if the tree is large enough to withstand a nail or wire with copper wire and tie tag to wire.

When it is evident that a tag will be grown over within 10 years, remove the nail and replace it with a new nail in the same location. Tags are to be replaced if the number is not legible.

Deciduous trees do not take nails well. Copper wire is used. Leave lots of slack in wire so that tree is not girdled by next measurement. Tie tag to copper wire.

If a tree has died and is still standing since the last measurement, measure and record the current diameter. Trees that are dead and down or standing dead in the previous measurement are not to be measured. Only

condition codes 25 or 61 (see Master Condition Code List) are recorded for these situations. Can also add on 2nd or 3rd condition codes if necessary. A tree is determined as dead when there is no evidence of living leaves or buds. Tags are not to be removed but nailed in completely on these trees. Hold tag horizontally when pounding in nail.

In the event that two separate trees have grown together, continue to measure them as separate trees. If a diameter tape cannot be wrapped around the individual trees, use tree calipers and take an average of two measurements, taken perpendicular to each other, for each tree.

If there are two trees with the same number, one of the tags must be replaced and labeled with the number following the last tree number used in the previous measurement for that plot and noted in the comments section.

2.2.4.4 Missing Trees

The missing condition code (15) is used when a previously numbered tree cannot be found. When a specific tree cannot be found, check for trees without tags in the numbering sequence that are the same species and have a comparable diameter. If the tree is the one in question, retag the tree; otherwise it is considered ingrowth. In plots that have been stem mapped, the azimuth and distance information can be used to locate missing trees. Stem mapping, itself, often locates missing trees by checking that all trees, with condition codes other than 15 or 61, have an azimuth and a distance. Do not record a species if the tree is missing.

2.2.4.5 Ingrowth

All untagged stems in the tree plot that now have a DBH $\geq$9.1 cm must be tagged, measured, and stem mapped. The tree numbers for these stems will start with the number following the last tree number in the previous measurement. The exception to this is 700 series plots, refer to Section 4.11.

2.2.4.6 Completing the Tree Remeasurement

Tree heights and heights to live crowns are measured using the procedure outlined in Section 2.1.4.4. Do not take heights on trees that were previous sample trees and have died since the last measurement. Crown classes are recorded as stated in Section 2.1.4.6 and condition codes (see Master Condition Code List) are applied to tagged trees and saplings. Stem mapping is done on remeasurement plots only if it has not been done in previous measurement. Ingrowth is stem mapped. Do not measure ages and increment widths unless directed to do so.

2.2.4.7 Sapling and Regeneration Remeasurements

The sapling/regen plot is measured in the same manner outlined in Section 2.1.5

2.2.4.8 Nails

Nails should be pulled out as the trees grow. Maintain the 2.4-3.5 cm of nail extruding from the tree. Turn tag at 90° from the tree and pound the nail in it tree standing is dead.

2.2.5 Plot Photography

Colour photographs are taken as directed in Section 2.1.6. For plots established prior to 1981, the photographs are taken at group center, with the photographer standing so that the flagged group plot center is in the photograph.

2.3 PLOT CLOSURE

PSP's are never closed. PSP's lost to Forest Fires have a regeneration type PSP established over top of the old one.

2.3.1 Re-opened Plots

If a plot was previously closed, every attempt to re-open it should be made. The plot should be checked for missing, dead, or cut-down trees. If the tags were removed, an attempt to locate or re-establish plot corners should be made. If plot corners cannot be re-established, a recommendation to cancel the plot shall be made to the Forester in charge and the reservation will be cancelled.

2.4 DATA ENTRY ON HEADER AND TALLY SHEETS

Measurements taken on permanent sample plots are recorded on Permanent Sample Plot Header Sheets (TM267), Permanent Sample Plot Tally Sheets (TM249) and on Regeneration Tally Sheets (TM261). Data recorded on the front of each tally sheet in the white columns is keypunched in the same format to keep the tally sheets and computer files compatible. It is important that all letters and numbers are legible to avoid keypunch errors resulting in costly computer errors. Quality measurements are of no value if they are not legible. See Appendix 14 for common problems.

2.4.1 PSP Header and Tally Sheets

The PSP Header Sheet is separated into a section of general information and is recorded as type: 01 (see Figure 2.13 – columns 36,37).

The PSP Tally Sheet is separated into one record type: 02 (see Figure 2.14 – columns 36, 37).

2.4.1.1 General Information (columns 1-37)

This information must be recorded on the Header Sheet and repeated in the green shaded area of every Tally Sheet. The following columns match the electronic database format.

Column	Name	Data Entry
1	Agency	Right justified, zero filled. The agency list is in Appendix 4.10.1.1
3	Group Number	Right justified, zero filled eg. 20 is written as 020 (see Figure 2.13)
13	Sub -Plot Number	Numeric 1-4. Sub Plot number is always 1 for plots established since April 1981.
14	Measurement Number	Numeric, zero filled 00 for establishment, subsequent measurements are 01,02,03, etc. eg. 3rd remeasurement records as 03
16	Year	Recorded to 4 digits
20	Month	Right justified, zero filled eg. June is recorded as 06
22	Day	Right justified, zero filled. Note: Date is the same on all tally sheets even if the sub plot took several days to measure
24	L. S. (Legal Subdivision)	Right justified, zero filled – 2 digits
26-27	Section	Right justified, zero filled – 2 digits
28-30	Township	Right justified, zero filled – 3 digits
31-32	Range	Right justified, zero filled – 2 digits
33	Meridian	Right justified, zero filled
34	Plot type	Left justified, zero filled, priorized. Where no codes are used, '000' fill.
37	Imp	An "x" is written only if the data is collected in imperial units, blank if collected in metric.

2.4.1.2 Record Type 01 – Header Information (Columns 38 – 212)

This information is filled out on the Header Sheet of each plot.

Column	Name	Data Entry
38-39	Record Type	Right justified, always "01"
40 – 60	Tree plot Size Saplings Plot Size Regen Plot size	Right justified, zero filled in square metres for the three plot sizes. The horizontal distances for each plot side is measured and recorded on the maintenance sheet. The plot sizes are calculated and recorded in the office.
61-71	Phase 1, 2 or 3 Interpreted Type Overstorey	
61		**Density** Code — Crown Density % A — 6-30 B — 31-50 C — 51-70 D — 71-100 All stands>6.0m average stand height
62		**Height** Code — Stand Height

		0 0 - 6.0 m 1 6.1 - 12.0 m 2 12.1 – 18.0 m 3 18.1 – 24.0 m 4 24.1 – 300. m 5 >30.m
63-70		Species composition is listed as a percent of the gross roundwood (13/7) (13 cm stump, 7 cm top) volume for stands over 12 m in height. For stands under 12 m in height the crown cover is used for species composition.
		Species is recorded in order of decreasing content up to a maximum of three species above 20% (major). Species 11-20% are recorded in brackets (minor) and species 10% or less are not recorded.
		An understorey is recognized only when it is two or more height classes lower than the overstorey.
		An example of a field overstorey and a field understorey type is: B3AW (PL) and A1SW. Note: These columns are only completed at establishment by offices staff.
		Left justified
71		Overstorey Stand Commercialism
72-93	AVI Interpreted Type Overstorey	See 4.10.1.2 for methodology
94-108	Phase 1,2 or 3 Interpreted Type Understorey	
94		**Density** Code Crown Density % A 6 – 30 B 31 – 50 C 51 – 70 D 71 – 100 All stands >6.0 m average stand height
95		**Height** Code Stand Height 0 0 – 6.0 m 1 6.1 – 12.0 m 2 12.1 – 18.0 m 3 18.1 – 24.0 m 4 24.1 – 30.0 m 5 >30.0 m
		Species composition is listed as a percent of the gross roundwood (13/7) (13 cm stump, 7 cm top) volume for stands over 12 m height. For stands under 12 m in height the crown cover is used for species composition.
		Species is recorded in order of decreasing content up to a maximum of three species above 20% (major). Species11-20% are recorded on brackets (minor) and species 10% or less are not recorded.
96 – 103		An understorey is recognized only when it is two or more height classes lower than the overstorey

		An example of a field overstorey and a filed understorey type is B3AW (PL) and A1SW. Note: These columns are only completed at establishment by office staff.
		Left justified.
104		Understorey Stand Commercialism
105-108		Understorey Stand Origin
109-128	AVI Interpreted Type Understorey	See 4.10.1.2 for methodology
129	Location	
130-132	Slope Percent	Right Justified
133-134	Aspect	N, W, NE, etc. "NA" for No Slope
135-138	Elevation	Right justified
139	Erosion Potential	
140	Drainage	
141-142	Depth to Mineral Soil	Right Justified in cm.
143	Surface Vegetation Type	
144-146	Ground Cover Percent	Right Justified
147	Access	
148	Plot Damage	
149	Buffer Damage	
150-153	Establishment Year	
162-163	Plot Type	Usually=1 may have other management practices done on plot later and will have to be changed.
164	Plot configuration	Always – 1
180-183	Stand Origin	
184	Site Index/TPR	Character
185-186	Site Index/TPR	Numeric
187-190	Photo Year	
191-193	Stand Structure	
194-198	Ecosite	
199-201	Aspect in degrees	Right Justified
202	Nutrient Regime	
203-204	Natural Subregion	Right Justified
205-208	Minimum Diameter Measured (mm)	Right Justified
209-210	Stump Height (cm)	Right Justified
211	Surface Expression	
212	Slope Position	

2.4.1.3 RECORD TYPE 02 (COLUMN 38-124)

Header information columns 1 to 37 are repeated on each record.

COLUMN	NAME	DATA ENTRY
38-39	Record Type	Right Justified, always "02"
40-43	Tree Number	Right Justified, numeric, either: -consecutive 1 ->9997 (tagged trees/saplings) -0000(felled trees outside plot) -(number prefilled on Header Tally Sheet) Filled in prior to remeasuring with the previous measurements to assist in remeasurement. This area is not keypunched.

	Darkened columns – Species, DBH, Height	
44-45	Species	Recorded as two capitalized letters as given in Section 2.1.4.1
46-49	DBH	Right Justified to one decimal point.
50-53 54-57	Height Height to Live Crown	Right justified to one decimal point. Right justified to one decimal point.
58	C.C.	Crown class is recorded as one letter (D,C,I,S, or 0) as per section 2.1.4.6
59-64	Condition codes	Left justified, recorded as a 2 digit number, as per Section 2.1.4.7, but do not zero fill eg. a leaning tree with conks is recorded as 5851 blank, blank. If a tree has no defect, it is recorded as '00'.
65-67	DBH Age	Right justified, recorded only for tree numbers 0000.
68-70	Stump age	Right justified, recorded only for tree numbers 0000.
71-73	Stump Increment Width-Previous 10 Years	Measured as indicated in Figure 2.7. Recorded to one decimal place in centimeters. Zero filled, eg 23 mm is recorded as 02.3. In digital file entered as mm.
74-76	Stump Increment Width-Previous 11-20 years	In digital file, entered as mm.
77-79	Azimuth	Right Justified, recorded as 1°-360°.
80-82	Distance	Right justified to one decimal point.
83-89	Tree Plot Size (m^2)	Right justified
90-96	Sapling Plot Size (m^2)	Right justified
97-103	Regen Plot size (m^2)	Right justified
104-107	Establishment Year	Right justified
108	Crown Status	"Y" indicates tree needs crown measurements "Blank" indicates no crown measurement required.
109-112	Crown Width North	Recorded in decimeters (dm). Right Justified
113-116	Crown Width West	Recorded in decimeters (dm). Right justified
117-120	Crown Width South	Recorded in decimeters (dm). Right justified.
121-124	Crown Width East	Recorded in decimeters (dm). Right justified.

2.4.1.4 Other Data

Information that is shaded in green and to the right of record type 01 on the Header Sheet is not keypunched. It is, however, required that this data be recorded: crew, page number including the regen tally sheet (eg. 1of 10), photo and line number, and tie point. Space is also provided at the bottom of the page of the Header Sheet or any comments the crew would like to record.

On the Tally Sheet, comments may be entered in the darkened columns to the right of the record type 02. For example, tree # 243 is near tree #100.

Height measurements are recorded and calculated on the back of the tally sheet.

An increase in buffer size must be noted in the comments section.

2.4.2 Regeneration Tally Sheet

The regeneration tally sheet is separated into general information and record type 03 (see Section 2.4.2.2 columns 38,39).

2.4.2.1 General Information (Columns 1-37)

This area is shaded in green but is still the same format, as described in Section 2.4.1.1 with the same data as recorded on the PSP Header Sheet.

Header information 1 to 37 is repeated on each record.

2.4.2.2 Record Type 03 (Columns 38-85)

COLUMN	NAME	DATA ENTRY
38-39	Record Type	Right Justified, always "03"
40-43	Tree Number	Pre-entered, is always 9998 for regeneration
44-45	Species Darkened columns – Height Class 1-5	Recorded in the blank column at the bottom of the sheet, as two capitalized letters as per Section 2.1.4.1, if the species presents is not already listed.
46-48,49-51,52-54, 55-57,58-60	Total (1-5)	Used to record the dot tally, This area is not keypunched. Right justified, zero filled, numeric.
61-67	Tree Plot Size (m^2)	Right justified
68-74	Sapling Plot Size m^2)	Right justified
75-81	Regen Plot Size (m^2)	Right justified
81-85	Establishment Year	Right justified

2.5 VEGETATION AND SOILS

Vegetation and soil data are collected at remeasurement only if it has not been done at establishment or if directed to do so by office staff.

2.6 DOUBLE CHECKING TALLY SHEETS

Before leaving the PSP, crews will double check for shrinking or non-growth DBHs, height and species changes. Place a double check mark in the comments section to note that the correct information was tallied.

ie. √√ SP double checked species
√√ DBH double checked diameter
√√ HT double checked height

Before handling in tally sheets to the supervisor for keypunching, please double check that the following information is recorded correctly on the Header and Tally Sheets:

1. Write clearly and concisely. Keypunchers do not know what codes mean and cannot interpret sloppy writing.
2. Erase all extra marks in the white area of tally sheets, or they will be keypunched, ie. checkmarks in the azimuth columns.
3. Check again for any species changes and for shrinking DBHs and heights
4. There should be no crown classes for dead and down, cutdown, standing dead, missing broken top, broken stem and severe leaning trees (>45°)
5. Crown classes are recorded for dead tops and die back (code 16).
6. Make sure heights have been correctly calculated and copied properly from the back to front of tally sheets
7. Make sure all header information is the same throughout group.
8. Trees that are coded as missing (15) or cutdown (29) should not have a species.
9. All pages are in place and in order
10. If using a direct read suunto, make sure it is mentioned on the Tree Height Calculation sheet and the appropriate columns are relabeled.
11. Code 25 & 61 trees need the species recorded in column 42-43

3.0 PLOT CHECK

Plot checks are done to ensure that the standards or measurement for permanent sample plots are being met. These standards are designed to minimize non-sampling errors that occur in all sampling. The standards given here are for the maximum error allowed before the plot must be redone. Plot checks should be viewed as a method of assessing the performance of field crews with the intent of identifying the human errors that can occur due to a lack of care or knowledge in field procedures.

3.1 Inspection Procedures

PSP and regeneration tally sheets should be checked in the field office to ensure that all the appropriate columns have been filled (eg. plot size, species, DBH, C.C. etc.). The heights are recalculated using the data recorded on the back of the PSP tally sheet. Plots that lack certain data or where the data appears incorrect should be selected for a check.

Plots should be field inspected when a new crew first begins establishment or remeasurement in order to monitor training needs and to identify and correct recording errors.

The following technique is used to check plots:

1. Using a PSP Tree Tally Check Sheet (Rev. 4/87) (TM 249) (Figure 3.1) record the group and subplot number, photo information, date of check cruise, check cruise page number, names of initial field crew, and the names of the check crew for each of the plots selected for checking. Before proceeding to the field, record the data from the original tally sheets, for approximately 10% of the tagged trees including the tree number, DBH, crown class, condition codes, and azimuth and distance (when recorded) on the sheet. In addition, 10% of the measured and height to live crown measurements should be checked.

2. The selected trees are measured and tallied directly below the copied data measured by the field crew. The two measurements are compared and should be within the allowable error limits (see Section 3.2). On the Check Cruise Tally Sheet, only measurements not within the allowable error shall be "blocked in" red. If the two measurement are not within the allowable error limits, always assume the check cruise is correct. Transfer the Check Cruise Height that is "blocked in red" to the tree height calculation sheet (back of PSP Tally Sheet TM 249) as well as changing the appropriate information on the front of the tally sheets. If measurement errors are common, additional trees may be checked. Other tree plot items that may be checked include buffer painting, recorded elevations, tag replacement, etc. Data pertaining to plot establishment, plot assessment, and stem analysis (when recorded) are also checked.

3. It is important to show the field crew the original tally sheets and the check crew sheets in order to point out any discrepancies. Any problems with the plot measurements should be discussed in order to prevent future errors.

4. When the check cruise has been completed, the overall evaluation of the PSP is graded as excellent, very good, satisfactory, fair, or unsatisfactory. The following is a guide used to evaluate the plot.

   - Excellent - no mistakes have been found in the check cruise
   - Very good - an occasional, minor error has been found in the check cruise
   - Satisfactory - a few errors have been found but their severity is minimal
   - Fair - errors are frequent and of a greater severity. Additional field work is required to correct the major mistakes
   - Unsatisfactory - errors are common and judged to be severe. Field work is required as the errors constitute an unacceptable plot and must be redone

   Plots that have a grade of satisfactory or above can have any necessary corrections made on the tally sheets. The tally sheets are then submitted for keypunching.

3.2 Allowable Errors

The following is a guideline used to judge the correctness of each measurement type or required duty.

3.2.1 Plot Establishment

1.	Tie Point	Should match landmarks on Phase 3/AVI inventory map. For example seismic lines, drainage, oil well site, pipeline etc.
2.	Tie Plate Tree	Should be clearly visible, painted blue and adequately flagged.
3.	Tie Line	Bearing and horizontal distance to the plot center must be within the plot center location allowable error. The tie line should also be flagged or painted blue arrows.
4.	Location of Plot Centre	Correctly marked and within ± 2% of the tie line horizontal distance.
5.	Access Notes	Condition of access to the plot correctly noted.
6.	Post – Tree Plot Size	Must be ± 0.8%, ie, distance 31.62 m ± 0.25m (31.37 to 31.87m) 38.73 m ± 0.31 m (38.42 to 39.04 m) 44.72 m ± 0.36 m (44.36 to 45.08 m) bearings from plot center to each corner post must be within 2° of specified bearings.
	Sapling/Regen Plot Size	Must be ± 0.8%, i.e. distance 7.90 m ± 0.06 m (7.84 to 7.96 m) 9.69m ± 0.08 m (9.61 to 9.77 m) 11.18m ± 0.09 m (11.09 to11.27 m)
	Tagged and Stable	All posts must be sturdy and correctly marked

3.2.2 Plot assessment

Office staff are responsible for correctly recording all plot sized in square metres. The field overstorey and understorey (where appropriate) must be correctly identified using Phase 3/AVI specifications. Plot topography, soils, surface vegetation and the maintenance report must be reasonably estimated.

3.2.3 Tree and plot measurement

1. No. of Trees Tallied	Tree Plot	No allowable error. All Tress identified, as within or outside the plot must be correct.
	Sapling Plot	The allowable error is ± 5% of the total number of saplings tallied.
	Regen Plot	The allowable error is ± 10% of the total number of regen tallied.
2. Species Identified	Tree Plot	No Allowable error
	Sapling Plot	No allowable error
	Regen Plot	5% of the total number of regen tallied may incorrectly identified.
3. DBH		Breast height should be correctly located at 1.3m ± 6.5cm from the point of germination. The allowable error for the tree DBH ±1.0cm.

4. Height and Height to Live Crown		The allowable is ± 3% with discretion used for the identification of where the live crown begins.
5. Crown Class and Condition Codes		Only 5% of the stems tallied may have an incorrect crown class or condition code.
6. Stem Mapping		The allowable error for azimuth is ± 2° and for distance is ± 0.5m

3.2.4 Stem analysis

1. Section Lengths		The allowable error is ± 5 cm from the proper length after the "cookie" is cut.
2. Perpendicular Cuts		The allowable error is ± 10° from the perpendicular for cutting "cookies".
3. Ages		± 1 year for coniferous trees, ± 5 years for deciduous trees

3.2.5 Check cruising standards

The check cruiser will usually check a minimum of 10% of the stems within a plot. More than 10% may be checked at the check cruisers discretion. Stem analysis tree are to be checked individually and are excluded from the minimum 10% within the tagged tree plot.

1.	Diameters	If more than 3% of the total tagged trees checked (within the plot) are not within the 1.0 cm error range the entire plot/subplot will have the diameters remeasured this includes dead trees). Included in this are tags that are not readable, nails not put in at a slight downward angle, mislabeled tags (ie. numbers, written horizontally, not vertically), nails too deep or too loose.
2.	Heights	If more than 20% of those heights checked are out, the cruisers heights for that plot/subplot will be rejected.
3.	Condition Codes	If more than 5% of the condition codes checked are missed or incorrect, the condition codes for that plot shall be re-done. A "missed" code will count as an error.
4.	Crown Class	If more than 5% of the crown classes checked are incorrect, all the crown classes for that plot will be re-done.
5.	Stem Mapping	If more than 5% of the combined check of azimuths and distances are incorrect, stem mapping will have to be re-done.
6.	General	Tie points and corner posts shall be marked with orange and blue geo-flagging tape. Tie lines will be marked in 20 m intervals with orange flagging tape.
7.	Flagging Colour Codes	Orange – height trees/regen pins/tie line; Orange and blue – plot/subplot corners; Orange blue & yellow – group center; Yellow - problem trees, swaths, boundaries.

References for Condition Code Assessments for Wildlife

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