Manning Diversified
Forest Products Ltd.

Volume Sampling Field Manual

February 2002

Prepared by:

Julian Deck, M.Sc.
Kathleen Hebb, F.I.T.
Stephen Stearns-Smith, RPF
Katherine Wolters, F.I.T.

Reviewed by:

Gyula Gulyas, F.I.T.
John Hammons, RPF

OLYMPIC RESOURCE MANAGEMENT
Suite 300, 475 West Georgia Street
Vancouver, B.C. Canada
V6B 4M9

Table of Contents

List of Tables

List of Figures

Page

Appendices

ACKNOWLEDGEMENTS

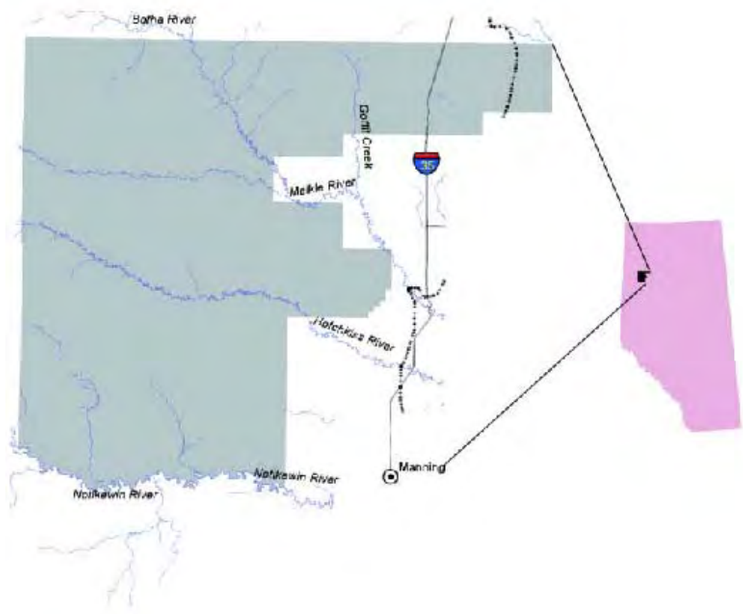
This field manual was compiled and edited from many existing information sources on forest sampling and ecological classification. We gratefully acknowledge the contributions from various Alberta Land and Forest Service PSP manuals and from the Ecological Assessment and Cruising Manual from Canadian Forest Products, Grande Prairie, Alberta.

1. Introduction

Effective forest resource management requires accurate data measurement and entry to support the analysis, modeling and monitoring of tree growth, timber yields and other non-timber values such as biodiversity and wildlife habitat. This manual describes procedures for Manning Diversified Forest Product's (MDFP) volume-sampling program designed to compliment the new Alberta Vegetation Inventory (AVI) on Forest Management Unit (FMU) P9 and the existing AVI on P6 (Figure 1). Systematic installation of temporary sample plots (TSPs) are intended to meet the immediate need for merchantable volume estimates as well as to provide descriptions of advanced regeneration and understudy tree components, course woody debris (CWD) and ecological characteristics. These data and the estimates derived from them will be used to produce growth and yield predictions for MDFP's first Detailed Forest Management Plan and the allowable annual cut (AAC). They will also provide a framework for ecologically based operational and strategic planning decisions. This sampling design is flexible and preserves the option to convert some or all of the TSPs into permanent sample plots (PSPs), providing a long-term data source for growth and yield prediction and monitoring. This means that the TSPs will be documented and monumented in a similar manner as PSPs.

Figure 1

Location of LMU P6 of Manning FMA



2. Plot Location and Access Documentation

2.1 Plot Location

Plot locations have been pre-determined on a systematic grid. Crews are provided with location documentation in the form of GPS coordinates along with GIS maps, 1:50,000 and 1:20,000 scale B/W aerial photos for navigation. Plots are not to be moved for any reason.

2.1.1 Tally vs. No-tally Plots

All plots, forested and non-forested, will be retained in the sample for possible future use as permanent sample plots. However, for the immediate volume sampling project needs, only the plots falling in AVI polygons classified as having forest cover will be visited and tallied.

TALLY EXCEPTIONS: The following accessible plots should not be tallied and monumented:

- Plots falling entirely within (non-straddling) natural and anthropogenic non-forested areas (e.g., rivers, lakes, brush, roads, etc) and in anthropogenic vegetated areas.
- Plots falling within an AVI polygon that are labeled with a Timber Productivity Rating (TPR) of U (Unproductive).
- Plots falling within an AVI polygon that is labeled with a Leading Species of SB (Black Spruce) and/or Lt (Tamarack) and a TPR of F (Fair) or M (Medium).
- Small, unmapped (AVI) areas inside forested polygons. However, small-unmapped non-forested areas inside forested polygons still need to be visited, documented and classified by filling out a header card and the plot header section in the datalogger. If an accessible straddle plot contains a forested cover type, it must be tallied.

2.1.2 Inaccessible Plots

Every reasonable attempt should be made to visit every tally plot. However, plots may be deemed inaccessible for safety reasons (at the crew's discretion) or where access has been denied (secured areas and/or private land). Partially inaccessible plots may be deemed entirely inaccessible if the plot centre is inaccessible. Inaccessible plots are coded "0" (zero) for ACCESS. A plot header card and the plot header section in the datalogger should still be completed for ALL plots (accessible and inaccessible) for documentation purposes. Efforts should be made to fill out all plot header fields to the greatest extent possible.

All accessible plots are classified to AVI 2.2 standards. Inaccessible plots are also classified if **location and classification** can be safely and accurately estimated from a safe distance. Inaccessible plots that are unobservable or the location cannot be reliably estimated for classification purposes are assigned an "UNDETERMINED" overstorey classification under Cover Type 1.

2.2 Access Documentation

Basic access information must be entered on the header card and in the plot header section in the datalogger for all plots visited or attempted, including plots that are measured and unmeasured, accessible and inaccessible. However, no permanent field monumentation (stakes, tie-point tags, flagging, etc.) is required for inaccessible and non-measurement plots.

For all measured plots, crews will monument and document an access route to the plot for the benefit of future measurement crews and audits. An ideal access route consists of a single tie line from plot centre out to a TIE-POINT established along the primary access road or trail. This tie line should be straight and as short as practical. The tie line is marked with flagging at visible intervals. Intermediate tie-points are permitted if absolutely necessary. A TIE-POINT tag (3x5" aluminum) should be affixed to a tree or other permanent object in sight of the road or trail. The TIE-POINT tag is inscribed with the follow information:

- "MDFP VSP Plot"
- "Tie Point # x of n" where x is the tie point's number and n is the total number of tie points used for the plot
- date;
- Township, Range, Meridian, Section and plot number – format "TxxRxxMxSxxPxxx;
- distance and compass bearing **TO** plot centre or the next intermediate tie point.

In addition to a TIE POINT, a STARTING POINT should be established along the main access road or trail. The STARTING POINT and the TIE POINT may be the same if appropriate. The STARTING POINT is an easily identifiable landmark that won't change in the near future (examples: a bridge crossing, road junctions, seismic line crossings). This landmark should be a permanent topographic or cultural feature that is distinguishable on air photos and or maps. The STARTING POINT is not monumented on the ground but its description will be used as a reference to find the TIE POINT. The distance and direction from the STARTING POINT to the TIE POINT is recorded on the header card, along with the distance and bearing from the TIE-POINT to plot centre. Draw a diagram of the access map in the space provided on the header card. Label all the points, distances and bearings; include any important landscape or cultural features. Also write a brief access description in the comments area.

IMPORTANT NOTES: Pay particular attention in recording all the access bearings to ensure they are recorded as oriented TOWARD the plot not away from it. GPS coordinates are also recommended to document the STARTING POINT and TIE POINT(s).

2.3 Plot Monumentation

Monument the plot centre with a 1 metre long metal conduit stake driven into the ground for at least half its length. If necessary, build a rock cairn around the stake for extra support.

Decorate the stake with flagging tape. Similar to the tie point, attach tags to two (2) trees below stump height, which are in the plot and very near plot centre. Select trees with bearings to plot centre that are close to 90 degrees from one another. This will facilitate triangulation should the stake become dislodged or lost. Face the PLOT CENTRE TAGs to be visible when approaching the point along the tie line. Inscribe on the tag the following information:

- "MDFP VSP Plot Centre"
- date;
- Township, Range, Meridian, Section and plot number – format "TxxRxxMxSxxPxxx;
- "TO PLOT CENTRE: distance and bearing"

Bearings are to be taken from the tree toward the stake. Distances are to be taken from the pith, to avoid growth problems. Record the tree number, distance and bearing for both tagged trees on the header card in the Comments area.

MONUMENTATION EXCEPTION FOR SAFETY: The centre stake may be omitted if the crew determines that placing a stake would be physically impossible (impenetrable ground with no rocks available for a cairn) or the stake itself would present a safety hazard to other forest users (on active roads, etc). The plot itself is not moved, and is still measured from the GPS-located centre. A PLOT CENTRE TAGs should still be located in an adjacent safe area, as close as practical to the true centre. Note also that if plot centre is deemed inaccessible, the whole plot must be declared inaccessible.

3. Plot Configuration

3.1 Plot Layout

Each complete plot installation consists of three fixed-area measurement sub-plots arranged as three concentric (nested) circles. Each sub-plot targets a unique tree size class. This fixed-area design accommodates the possibility of switching the TSPs to PSPs in the future. Refer to Table 1 and Appendix I.

Table 1

Plot Types, Sizes and Measurement Requirements

Plot Type	Standard Area and Radius	Dense Plot * Area and Radius	Super Dense Plot** Area and Radius	Measurement Requirements
Main Tree Plot	0.08 ha 15.96 m	0.04 ha 11.28 m	0.02 ha 7.98 m	Trees >= 9.1 cm DBH within Main, Sapling and Regen Sub-Plots
Sapling Sub-plot	0.02 ha 7.98 m	0.01 ha 5.64 m	0.005 ha 3.99 m	Trees >1.3m in height up to 9.0 cm DBH within Sapling and Regen Sub-Plots
Regen Sub-plot	0.005 ha 3.99 m	0.0025 ha 2.82 m	0.00125 ha 1.99 m	Trees 0.3 m to 1.3m in height within Regen Sub-Plot

* Dense Plot sizes are to be used when the combined live tree count on Main and Sapling sub-plots exceeds 80 when using the Standard Area and Radius.

**Super Dense Plot sizes are to be used when the combined live tree count on Main and Sapling sub-plots exceeds 80 when using the Dense Area and Radius.

3.2 Establishing the Main Plot Perimeter

Measure the main-plot radius from the plot centre stake. Refer to Table 1 for plot dimensions. Note that Table 1 includes optional reduced plot sizes when dense stands (where the combined live tree count on Standard Main and Sapling sub-plots exceeds 80) or super-dense stands are encountered.

On level and gently sloping terrain, hold the tape horizontally. On sloping terrain, hold the tape parallel to the slope. Measure the slope with the clinometer using the percent scale, and apply a slope correction to the radius. See “Slope Correction Factors and Tables” in Appendix XVII.

Measure the plot radius a minimum of eight directions and mark the perimeter with flagging tape. Also check questionable “line trees”.

- Include “line trees” in the plot when their pith at DBH is inside the plot.
- Flag the line trees that are in the plot.

NOTE: If a laser distance/slope-measuring device is available, it can significantly speed up plot perimeter establishment.

3.3 Establishing the Sub-Plots

Follow the same general procedures to establish the sapling and regen sub-plot perimeters. Refer to Table 1 for dimensions.

4. AVI land Classification and Cover-typing

4.1 Pre-existing Air-photo Map Labels

On the header card and in the header section on the datalogger, record the aerial-photo interpreted map label according to the Alberta Vegetation Inventory Standards version 2.2 (AVI 2.2); spaces are provided for recording up to three layers; the overstorey, understorey and a third Layer. Normally this information will be provided to the crew as part of the plot location package from MDFP (Appendices XXIV and XXV). This should be recorded "as is" with no adjustments for what is actually found on the plot. However, please record any unique situations in the comments, for instance, plots falling on a type line.

The fields on the plot cards and on the datalogger are set up to accommodate the basic five part AVI 2.2 vegetation label with the timber productivity rating substituted for breast-height age. Refer to Appendix XXIII for a brief explanation of the codes to be used. The Alberta Vegetation Inventory Standards Manual Version 2.2 also provides a complete explanation of the inventory system used in creating the codes. The following describes the abbreviations used in this manual and the fields that they refer to in the plot list provided.

Plot Card Field	Datalogger Field	
POLYGON NO.	**Poly**	POLYGON_NO (FOREST_ID in previous versions)
MOIS.	**M**	MOISTURE code
C.C.	**CC**	CC - Crown Closure Class
HEIGHT	**Ht**	HEIGHT of the dominant and codominant trees of the leading species
SP1	**SP1**	SP1 – leading species
SP1%	**SP1%**	SP1PER – species composition of leading species
TPR	**TPR**	TPR – timber productivity rating

NOTE: As the AVI mapping for P9 is still being completed, the Phase Three Inventory information for P9 has been provided for your information. Leave the Map AVI fields blank for all P9 plots until the updated AVI labels can be provided to you.

4.2 Classification in the Field

AVI cover calls are to be made on all accessible plots and all inaccessible plots that can be reliably observed from a safe distance. Cover classifications are recorded in the plot header card and plot header section of the datalogger using AVI 2.2 standard map labeling codes. Field calls are to be made independent of pre-existing air-photo interpretation and mapping. However, the AVI cover map and 1:20,000 B/W photo can be used to estimate the size and extent of cover types in proximity to the plot.

Space is provided on the plot header card for coding up to three cover types with up to three layers each. Space is provided in the plot header screen on the datalogger for coding up to four cover types on the plot with up to three layers each. Cover Type #1 is always assigned to the condition at plot centre. It is expected that MOST plots will only have one

cover type. Normally, the only forest cover type differences that should be delineated and mapped separately within the plot are those with contiguous areas large enough to be delineated as aerial-photo polygons. Normal stand variability resulting in small patches and types less than 2 ha and/or 20 m wide should definitely be ignored. Refer to the AVI 2.2 standards for minimum polygon sizes and more specific restrictions.

The fields on the plot cards and on the datalogger are set up to accommodate the basic five part AVI 2.2 vegetation label with **Total Age** substituted for breast-height age. The following describes the abbreviations used in this manual:

Plot Card Field	Datalogger Field	
POLYGON No.	**Poly**	POLYGON_NO
MOIS.	**M**	moisture regime from Ecological Assessment
C.C.	**CC**	CC - Crown Closure Class
HEIGHT	**Ht**	HEIGHT of the dominant and codominant trees of the leading species
SP1	**SP1**	SP1 – leading species
SP1%	**SP1%**	SP1PER – species composition of leading species
TOT. AGE	**Tot Age**	Estimate the age of the stand

EXCEPTIONS: Smaller areas of high-contrast non-forest cover types within larger mapped forested cover types may be identified and mapped separately within the plot. The overstorey and understorey are to be coded the same as the parent mapping unit. Only the "third" layer code is used to differentiate the non-forest condition. This is only to be used for high-contrast cover types such as water bodies (NWx), roads (AIx) and seismic lines (AIS). This does not apply to the normal variability in natural forest cover within mapping units, including small rock outcrops and wet areas. Inaccessible portions of the plot (other than Cover Type #1) should also be assigned a separate cover type. The third layer is coded "inaccessible" and the other layers are typed as usual.

4.3 Mapping and Measuring Straddle Plots

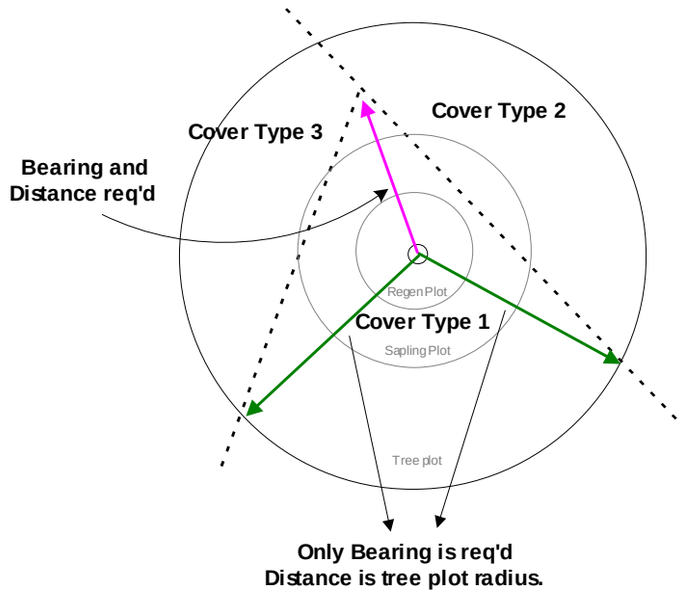
Plots having more than one cover type recorded are termed straddle plots. Cover type boundaries on all straddle plots are to be mapped on the plot diagram provided on the header form. This requires that this portion of the plot header card be completed even if a datalogger is being used -- Be sure to fill in the plot ID information, too.

The purpose for mapping cover types is to enable calculation of cover type areas in the office. Carefully draw the cover type boundaries on the plot diagram and label the distance and bearings to all boundary intersections and line joints FROM plot centre. All boundaries should be drawn as straight lines. Curved boundaries should be approximated with jointed line segments (forming "dog legs"). All boundary intersections with the main plot perimeter can be documented simply with a bearing, the distance will be assumed as the plot radius. Documenting intersections with sub-plot perimeters is not necessary. Interior boundary intersections and line joints need to be mapped using both bearings and distances from the plot centre.

NOTE: Cover type numbers will be coded for every numbered tree (main and sapling plots) and CWD on straddle plots. Cover type on non-straddle plots can be left blank. Regen tallies are also segregated by cover type. Soils and eco data is only collected on cover type one.

Figure 2

Example of Required Measurements for Straddle Plot with Multiple Cover Types



5. Nailing, Tagging and Numbering Trees

All trees on the main and sapling plots are nailed, tagged and numbered. Trees >2.0cm are tagged using a nail. Saplings <2.0cm are tagged on a lateral branch near DBH using loose wire. Only tree species with codes in Appendix II are tagged and measured. Shrub species (e.g., alder and willow) are not tagged or measured.

OPTIONAL: Tags may be omitted and tree numbers written on smooth-headed aluminium nails with a standard soft-lead pencil. Similar markings in Florida have lasted 25+ years.

NOTE: If the cruiser determines a small tree >2.0cm cannot be nailed safely, a wire branch tag may be substituted.

5.1 Nailing Trees >2.0cm

Affix nails and tags at breast height facing plot centre. See "Determining Breast Height" in Appendix XV. If abnormal swelling or branch whorls occur at breast height, raise or lower the tag by a maximum of 5 cm. Nail the tag to the tree using 6 cm aluminium nails. Drive the nail slightly upward so the tag hangs away from the tree. Drive the nail into the trunk just enough to hold the tag securely and yet allow for radial growth.

5.2 Numbering Sequence

1. Begin at the north line and proceed clockwise (moving east) tagging one 45 degree sector at a time.

2. Tree number 1 will be the first main plot tree encountered closest to plot centre.

3. Continue numbering main plot trees in a serpentine pattern in the first sector (0-45 degrees) moving outward toward the perimeter. See Appendix XIX for diagram.

4. After numbering all main plot trees in sector one, move into sector two at its perimeter and continue tagging in a serpentine pattern working back toward plot centre.

5. Continue numbering all main plot trees in this fashion, one sector at a time, alternating direction in each sector.

6. After tagging all trees on the main plot, move to tagging all trees on the sapling plot in the same fashion. The sapling numbering sequence may begin where the main plot ended, or a few numbers can be skipped to highlight the sapling break and reserve a few numbers in case missed main plot trees are encountered later.

7. Regen trees (<1.3m) are not tagged or numbered.

8. Trees missed during the initial tagging can be assigned any unused number. Trees numbered out of sequence should have a comment indicating their location, for instance, “near tree 26”.

5.3 Tagging Forked Trees

Tag the stem as a single tree if the fork occurs above DBH, separately if the fork occurs below DBH (see Appendix XV).

6. Standard Tree Measurements

6.1 Main and Sapling Plots

Attributes for ALL live and dead trees within each plot will be measured and recorded as per Table 2 using the appropriate standards and codes found in the appendices.

Table 2

Tree and Sapling Attributes and Codes

Attribute to Measure	Live Trees	Dead Trees	Code Location
Species	Yes	Yes	Appendix II
DBH (cm)	Yes	Yes	Appendix XV
Crown Class	Yes	No	Appendix IV
Condition (Up to 3 per tree)	Yes	Yes	Appendix XI & XII
DECAY CLASS (subset of condition codes)	No	Yes	Appendix III

6.2 Regen Plot

Trees are not tagged or individually tallied on the regeneration plot. Only a height-class dot-tally is completed by species for live trees 0.3 to 1.3 m tall in two height classes: 0.30-0.80 m and 0.81-1.30 m.

7. Sub-sampling for Height and Crown Width

7.1 Measuring Height and Crown Width of Live Trees

On the main and sapling plots, a sub-sample consisting of 20% of the live trees will be measured for:

- total height (Appendix XIII)
- height to the base of the live crown (Appendix XIV)
- crown width

7.1.1 Selecting Sub-sample Trees

Sub-sampling of trees for height and crown width measures is to be done independent of cover type. Starting with tree number 5 select every fifth live tree (tree numbers 5, 10, 15, 20, etc). Do not select trees that are dead or have damage that seriously affects their height/diameter relationship – for instance: spike tops, major broken tops or major DBH deformities.

After rejecting a tree, continue inspecting each subsequent tree in order until a suitable replacement is found. After measuring a replacement tree, return to the next tree in the standard number 5-10-15 sequence. In the rare case where a tree "5" is rejected and no suitable substitute tree is found until the next "5" tree, or later, keep tally of the accumulated "debit" and continue selecting every suitable tree encountered. Once the "debit" is cleared, return to the standard number 5-10-15 sequence at the next incidence.

MINIMUM SAMPLE SIZE: Eight (8) trees per species. Modification of the standard 5th-tree sequence is permitted to obtain the minimum sample. For example, if there are 50 total trees in the plot consisting of 25 pine and 25 aspen, approximately every 3rd tree height will have to be measured to meet this minimum for each species. It is also acceptable, if the minimum sample size is not met, to circle the plot to pick up any extra height measurements – fill in as needed. If there are not enough trees to meet the minimum, then just measure all the trees of the species in the plot. Do not go outside the plot to pick up extra height trees.

NOTE that these same measurements (height, height to live crown and crown width) must also be taken on ALL AGE TREES, too. Refer to the section on age and site trees.

7.1.2 Taking Height Measurements

Height is defined as the length between the tip of terminal leader and the point of germination. For trees that have formed adventitious roots, measure from the point on the stem where the highest set of roots emerge. Refer to Appendix XIII.

The base of the live crown is defined as the transition point at the base of the continuously foliated live crown where branch foliation becomes sporadic or absent. Sight at the lowest green on the branches, not the branch intersections or whorls along the stem. Refer to Appendix XIV.

Heights are calculated in the field to enable the crews to check the reasonableness of the estimates and immediately correct measurement mistakes.

Options for calculating heights:

1. Manual height calculation: A height calculation form has been provided to aid in the manual calculation of heights. Use of this form is optional in case the crew prefers an alternative manual calculation technique. Calculated heights are transcribed to the tree data form. Also refer to Appendix XIII.

2. Dataloggers are programmed to prompt for distance and angles, then automatically calculate, display and record the heights.

3. Laser devices may be used which automatically calculate and display heights. Heights are then transcribed onto the field card or into the datalogger.

7.1.3 Taking Crown Width Measurements

Two separate crown width measures are taken along two axes passing through the stem at 90 degrees to each other – north south and east west – to the nearest 0.5 m. Widths are measured to vertical projections of the outermost green at the ends of each axis. A clinometer can be used to establish the vertical projection points. Width measures must be slope corrected.

7.2 Measuring the Height of Dead Standing Trees

Only measure standing dead trees that have been given the Decay Class Code (Appendix III) of 01 to 03 (inclusive). Follow the procedures described in Section 7.1.2 for measuring the height of live trees. Measure to the topmost point of the standing dead tree. If it is suspected that the tree has a broken top or is missing a portion of the upper stem, record this using the appropriate code (Code Number 24 from Appendix XI) in the third Condition Code space.

8. Sub-sampling for Age and Site Tree Measures on the Main and Sapling Plots

A sub-sample of trees to be bored for DBH age is to be selected using the criteria described below. Site trees are then identified from the selected age trees. Cores must include the pith, or obviously be within 1-2 rings of the pith. Use a hand lens to count tight rings. Record the age once counted. All cores are collected, packaged in heavy straws and labeled with TRMSP # and tree #. Cores are to be submitted with the data. Counting annual whorls above DBH is an acceptable alternative on smaller trees as long as they are obvious. This is noted in the comments, if a core is not submitted.

1. Select trees only from within Cover Type #1. If insufficient suitable age trees exist within the plot, trees representative of Cover Type #1 from outside the plot can be aged. Trees outside the plot should be numbered beginning with 999 and progressing in descending order (998, 997, etc).

2. Select two age trees from each major species within each major canopy layer. A major species is one occupying >20% of the basal area in a particular canopy layer, based on the visual estimates of the cruiser.

3. More than two ages will be collected for a single species if it occurs as a major species in more than one layer.

4. The cruiser may opt not to age shade-intolerant species in an understorey position if they have a low probability of ever becoming crop trees once released.

5. Age trees are selected to **maximize diameter** by species within each layer and **minimize visible damage/disease**, particularly any damage or disease that may have negatively affected height growth at any time during the trees' life. Gradually relax these "ideal" criteria until suitable age trees are found.

6. For practical and safety reasons, trees <4.0 cm DBH should not be bored. Instead, make annual whorl counts, if feasible.

7. Height, height to live crown and crown widths must also be taken on ALL aged trees, that are inside and outside the plot. Refer to the section on sub-sampled tree measures for procedures.

8.1 Site tree selection criteria:

For this project, site trees are defined as "ideal" age trees (maximum diameter and damage free) that **also** show no suppression along the increment core **and** are dominant or co-dominant in the main (upper) canopy (excluding veterans). Evaluate each age tree against these site tree criteria and assign a site tree status (Y/N) to each age tree. Leave site tree status and age blank for all non-age trees. If no age trees meet site tree criteria, then no trees should be coded "Y" for site tree status. However, a full compliment of age trees is always required.

NOTE: A reasonable attempt should be made to leave the plot and associated vegetation unaffected by the measurements. For example, cutting tree branches to improve line of site for height measurements should be avoided.

9. Coarse Woody Debris (CWD) Sample

Coarse woody debris (CWD) is comprised of dead woody material with a diameter of at least 6 cm. CWD is not self-supporting and is located above the soil (BC Ministry of Forests and BC Ministry of Environment, Land and Parks 1998). CWD includes:

- Woody pieces at least 6 cm in diameter at the point where the sampling line crosses the debris
- Uprooted stumps at least 6 cm in diameter at the crossing point and any of their exposed dead roots 6 cm in diameter or greater at the crossing point
- Downed horizontal or suspended (not self-supporting) dead tree boles
- Fallen trees which still have green foliage if they no longer have roots attached to the ground to keep them alive
- Tops broken off of standing live trees or snags

It does not include:

- dead branches still attached to standing trees
- self-supporting (not overturned) stumps
- exposed roots of self-supporting trees or stumps
- material that is buried beneath organic or mineral soil layers, or has decomposed enough to become part of the forest floor
- self-supporting live or dead (still rooted) trees

CWD serves as habitat for a wide variety of plants and animals and is an important nutrient reservoir in forested ecosystems. Information about CWD is used as a measure of stand structure and biodiversity. For this study, species, diameter class, and decomposition class (based on entire piece) are recorded and used to calculate CWD volume.

To measure CWD, use a compass and measuring tape to establish a single 30 metre transect that radiates 15 m either side of the cruise plot center. Follow the bearing that has been pre-assigned to the plot and that is displayed in Appendix XXII. Record the bearing of the transect. If it has to be changed from the randomly assigned one, specify the reason (i.e. unsafe conditions) in the comments section. The sampling line must be corrected for slope, so that the resultant horizontal distance equals 30 m. If the transect line crosses any portion of the central axis of the woody debris, it is tallied into the diameter ranges noted below. Mark each tallied piece with red paint. For each piece that fits the definition of CWD, note the following:

- **Species:** Identify the species of the tree that the CWD originated from. If it is difficult to assess the exact species of decayed wood, group species into categories based on **Softwood (Su)** and **Hardwood (Hu) classes**.

As a last resort, the species can be recorded as unknown (U) if the wood is decayed beyond recognition.

- **Diameter class:** Each piece of CWD is recorded into one of the diameter classes listed in Table 3. Diameter is measured perpendicularly to the central axis of the CWD at the point of intersection with the transect line.

- If there is no CWD along the transect, then record "NA" in the first row of the species column.

Table 3

Diameter Class for Coarse Woody Debris

Class	Description
1	6–15 cm
2	16–25 cm
3	26–35 cm
4	36–45 cm
5	46–55 cm
6	>56 cm

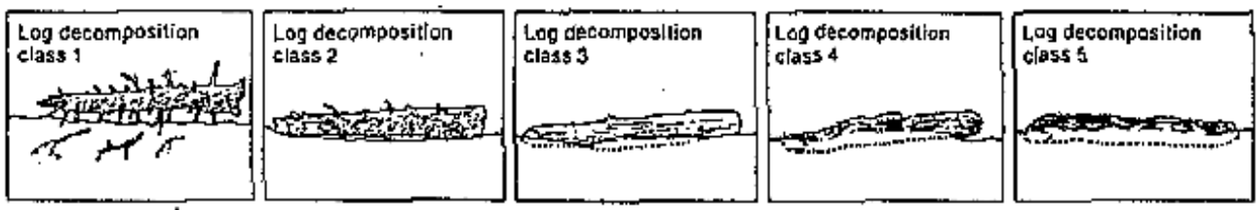
- **Decay class:** Use the decomposition classes in Table 4 and Figure 2 to rate the decay class.

Table 4
CWD Decay Classes

	Class 1	Class 2	Class 3	Class 4	Class 5
Wood Texture	Intact, hard	Intact, hard to partly decaying	Hard, large pieces, partly decaying	Small, blocky pieces	Many small pieces, soft portions
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging near ground, or broken	All of log on ground, sinking	All of log on ground, partly sunken
	Class 1	Class 2	Class 3	Class 4	Class 5
Twigs<3cm (if originally present)	Present	Absent	Absent	Absent	Absent
Bark	Intact	Intact or partly missing	Absent to trace	Absent	Absent
Shape	Round	Round	Round	Round to oval	Oval
Invading Roots	None	None	In sapwood	In heartwood	In heartwood

Figure 3

Coarse Woody Debris Decay Classes



Class 1 Class 2 Class 3 Class 4 Class 5

- **Cover Type:** For straddle plots, record the Cover Type into which the majority of the piece falls.
- **Comments:** Record any comments regarding the coarse woody debris information.

10. Ecological Assessment

10.1 Plot Establishment

The ecological assessment should be conducted within the 0.02 ha or 7.98 m radius plot (sapling plot). In cases where the sapling plot size is reduced, the ecological assessment plot should remain at 0.02 ha to get the best representation of the site. No plot monumentation is required for the ecological plot. The assessment at plot centre shall be considered representative of the whole plot. This means that only one ecological assessment will be conduced per plot even if more than one Cover Type is present.

The soil pit should be located just outside of the volume sampling plot, in an area still representative of the plot area, but where digging will not influence the growth of the trees within the plot.

Record the following information:

- date
- crew member names
- AVI stand number
- plot number
- Variable Definitions and Codes

10.2 Soil Description

10.2.1 Primary Data

Date (Yr, Mo, Day): Record the date that the plot is established. Months are numbered sequentially from 01 (January) to 12 (December). Day is recorded in a similar fashion (01 to 31). Use leading zeros where necessary.

Surveyor: Each surveyor should have their own unique three-character identifier (i.e initials) recorded. The surveyor is responsible for completing the Ecological Assessment Form accurately.

Start and End 35 mm Photo Numbers: Take two 35 mm photographs, one of the typical vegetation and one of the soil pit at each plot. The soil photo should show one face of the pit with soil horizons and unique features as visible as possible. The side of the pit that is in sunlight or bright light is usually the most discernible. Stretch a measuring tape vertically along the depth of the pit for each photo to aid in depth and distance perception. In each photo, include a sign that identifies the AVI stand number and plot number.

Record the first and last photo numbers for the photos taken at each plot. Describe the location where each photo was taken on the plot header card. Record the roll number of the 35 mm film. A master list of film roll numbers assigned to each crew will be kept by the crew chief.

10.2.2 Soil Data

It is recommended that the soil pit be dug to a minimum depth of 60 cm for the most accurate assessment.

Humus Form: Humus form is a classification of organic matter based on the origin of the decomposed material and the degree of mixing with the mineral layers. Most humus forms can be classified into one of the five groups described below. The definitions of diagnostic organic horizons follow those of the Ontario Institute of Pedology (1985). If there is no humus, then circle "N/A".

Humus forms

- *Peaty mor (P):* The peaty mor humus form is strongly associated with lowland, poorly or very poorly drained sites. It is sharply delineated from the mineral soil and can comprise Of, Om, and/or Oh horizons (horizons formed of mosses, rushes and woody material at various stages of decomposition).

- *Mor (R):* The mor humus form has diagnostic F and H horizons, with a distinct boundary evident between the organic and mineral layer. Abundant fungal mycelia are present. There is little or no intermixing of organic and mineral horizons.

- *Raw moder (W):* The raw moder humus form is transitional between the moder and mor humus forms. It has an L, F, and a thin Hi horizon that is composed of organic granules intermixed with loose mineral grains.

- *Moder (D):* Diagnostic organic horizons of the moder humus form have varying degrees of intermixing between the organic and mineral horizons, producing a gradual transition between the horizons. The F horizon is loose and contains insect droppings.

- *Mull (U):* In the mull humus form, the diagnostic F and H horizons are commonly lacking or very thin. There is considerable mixing of organic material into the surface mineral horizon, thereby creating a relatively thick Ah horizon. Insect droppings and earthworms are usually abundant. Mulls are rare in this area of Canada.

Seepage: Seepage is the flow of water above ground level that occurs where the water table intersects the ground surface. Seepage is generally dispersed and indistinct. If the flow is distinct and concentrated in one area, the seepage is called a spring. Evidence of seepage could include the occurrence of water seeps, wet ground, or hydrophytic plants and should not be confused with downward drainage through the soil profile. Choose either yes (Y), no (N), or suspected (S) to indicate the presence or absence of seepage.

Drainage: Soil drainage refers to the rapidity and extent of water removal from the soil in relation to additions, especially by surface runoff and percolation downwards through soil Soil drainage ranges from very rapid to very poor. Remember that soil profile morphology (e.g. mottling) may reflect the soil conditions of the past and that recent natural or artificial

changes may have altered soil drainage characteristics. The definitions of soil drainage follow those of Beckingham and Archibald (1996) and Beckingham *et al.* (1996).

- *Very rapid (1):* Soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions. Soils are coarse in texture and commonly develop in coarse-textured sands and gravels of fluvial or fluviolacustrine origin. These soils are dry and precipitation is absorbed almost immediately.

- *Rapid (2):* Rapidly drained soils commonly develop in medium, fine or loamy sands, generally of eolian or fluviolacustrine origin. Soil moisture content seldom exceeds field capacity in any horizon except immediately after water additions.

- *Well (3):* Soil moisture content does not normally exceed field capacity in any horizon (except possibly the C horizon) for a significant part of the year. Parent materials are variable, but soil texture is generally moderately coarse to moderately fine. The most common deposit is glacial till. At least one horizon has the ability to significantly restrict water penetration. Well-drained soils are water deficient for short periods of time and may be found on all slope positions, although their most common occurrence is from the middle slope to crest positions.

- *Moderately well (4):* Soil moisture in excess of field capacity remains for a small, but significant period of the year. At least one horizon has the ability to significantly restrict water penetration. The characteristic differentiation from a well-drained soil is the presence of a few mottles that may occur throughout the soil profile. However, these soils do not have distinct or prominent mottling above 50 cm depth.

- *Imperfect (5):* Soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods of the year. Soil texture is variable depending upon slope position. Soils are distinctly mottled above 50 cm and can be prominently mottled between 50 and 100 cm.

- *Poor (6):* Soil moisture in excess of field capacity remains in all horizons for a large part of the year. The mineral horizons can be heavily gleyed or mottled and are usually overlain by a thin layer of peat.

- *Very poor (7):* Free water remains at or within 30 centimetres of the surface for most of the year. Prominent mottles or gleying may be present within 30 centimetres of the surface. Soils are either composed of deep organics or if mineral in composition, the water table is generally high.

Parent Material: Parent material is the underlying material from which a soil has developed, usually found at the base of the soil profile, weathered but otherwise unchanged. There may be more than one parent material. The following are commonly encountered parent materials:

Mineral

- *Colluvium (C):* Rock debris that has moved down slope due to the force of gravity. Colluvial material usually appears as unsorted to poorly sorted materials of variable texture and size. Angular in shape. Usually found below steep slopes of deeply incised gullies and river valleys.

- *Eolian (E):* Wind-deposited materials. Eolian deposits are usually well-sorted, poorly compacted fine sands and coarse silts.

- *Fluvial (F):* Materials that have been picked up and re-deposited by the action of streams or rivers. Fluvial deposits are found on river terraces and floodplains. Materials consist primarily of sands and gravels with various proportions of silts and clays depending on deposition conditions. Materials are commonly stratified.

- *Fluvioeolian (FE):* Deposits (fluvial or eolian) that have been reworked by fluvial or eolian processes.

- *Fluviolacustrine (FL):* Lacustrine deposits that have been partially reworked by fluvial processes.

- *Glaciofluvial (GF):* Materials that were deposited by glacial meltwaters that flowed alongside or below glaciers. Glaciofluvial deposits typically consist of well-sorted, coarsely textured sands and gravels.

- *Glaciolacustrine (GL):* Sediments deposited in glacial lakes. Evidence of glaciolacustrine deposits can be confirmed by the presence of alternating bands (varves) of very fine sands and clays.

- *Lacustrine (L):* Lake-bottom sediments, generally consisting of either stratified fine sands, silts and clays deposited on the lake bed, or moderately well-sorted and stratified sand and coarser materials deposited by wave action.

- *Morainal/till (M):* Materials that have been transported and deposited by glaciers. Morainal deposits are generally well-compacted and consist of a heterogeneous mixture of particles ranging in size from sands to clays.

- *Rock (R):* A consolidated or unconsolidated aggregate of mineral or organic matter. Rocks can be broadly classified as sedimentary, igneous or metamorphic.

Organic (peat)

- *Bog (B):* Bogs are wetlands that derive water and nutrients only from the atmosphere *(i.e*., water is stagnant rather than received from overland flow). Bogs are highly acidic, nutrient-poor sites. Peat formed in bogs is composed primarily of *Sphagnu*m spp.

- *Marsh (H):* Mineral material or organic matter with a high mineral content and little peat accumulation. Marshes typically develop along the margins of lakes or streams.

- *Fen (N):* Peaty materials derived primarily from sedges. Such peats develop under nutrient-rich conditions under the influence of mineral-rich waters.

- *Swamp (S):* Peat developed in a swamp; a forested wetland, flooded during all or part of the year. Peats developed in these sites are typically shallow to deep mesic to humic forest peat and fen peats.

- *Undifferentiated organic (O):* Peaty deposits that have not been differentiated into bog, fen, swamp or marsh-derived peats.

Depth to Water Table (cm): Record the depth to the water table in centimetres from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils).

Depth to Mottles (cm): Record the depth to mottling in centimetres from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils).

Depth to Gleying (cm): Record the depth to gleying in centimetres from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils).

Depth to Root Restrictive Layer (cm): Record the depth from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils) at which the rooting abundance declines to few (Alberta Environmental Protection 1994). Rooting abundance class Few is fully defined in Land Resource Research Institute (1983) as <10 very fine/fine roots and <1 medium or coarse root per square decimetre of soil.

Depth to Bedrock (cm): Record the depth from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils) to bedrock.

Depth to Carbonates (cm): Record the depth from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils) to carbonates or calcareousness. This could be indicated either by visual clues or by effervescence.

Depth to Pit Bottom (cm): Record the depth from either the top of the mineral horizon (in mineral soils) or from the surface (in organic soils) to the pit bottom.

Organic Layer Thickness (cm): Record the thickness each of the organic layers in centimetres from the ground surface to the top of the mineral soil layer.

Mineral Layer Thickness (cm): Measure the thickness of each mineral layer in centimetres. Layers are distinguished based on differences in texture, coarse fragments, colour, structure and organic matter. The top six layers in the soil pedon are described or the top 60 centimetres, whichever comes first.

Texture: Texture is determined with hand texturing techniques. For mineral soil, record the appropriate mineral soil texture. Mineral soil texture is based on the sand, silt, and clay composition of the soil (Figure 3). For organic soil, record the appropriate class of the von

Post scale based on the degree of decomposition. Table 5 lists the codes for both mineral and organic layers.

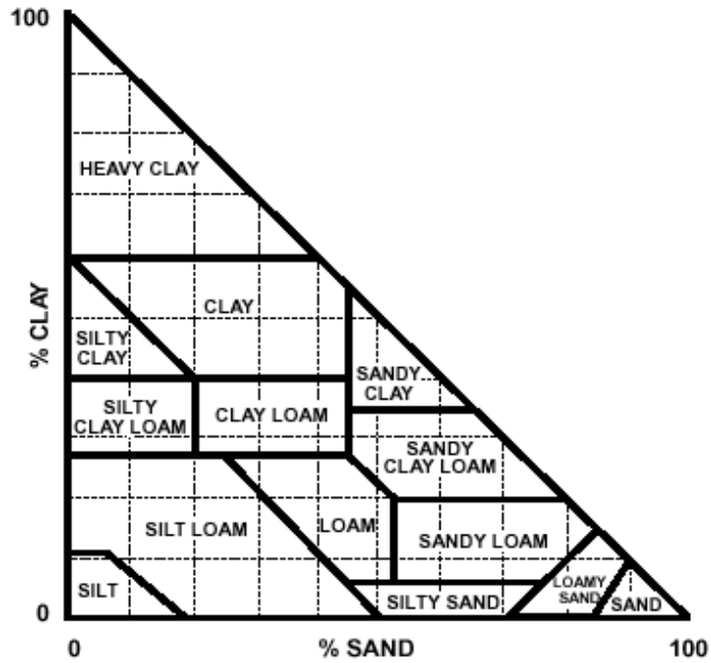
Table 5

Mineral and Organic Soil Textures and Codes

Allowable Code	Soil Texture/Decomposition Class
Mineral	
S	sand
LS	loamy sand
SiS	silty sand
SL	sandy loam
Si	silty
SiL	silty loam
L	loam
Allowable Code	**Soil Texture/Decomposition Class**
SCL	sandy clay loam
CL	clay loam
SiCL	silty clay loam
SC	sandy clay
C	clay
SiC	silty clay
hC	heavy clay
Organic (peat)	
1	Undecomposed
2	almost undecomposed
3	very weakly decomposed
4	weakly decomposed
5	moderately decomposed
6	strongly decomposed
7	strongly decomposed
8	very strongly decomposed
9	almost completely decomposed
10	Completely decomposed

Figure 4

Soil textural Triangle (Ontario Institute of Pedology 1985)



Soil Horizon: A soil horizon is a layer of mineral or organic soil, or soil material, approximately parallel to the land surface that has characteristics determined by the processes of soil formation. It differs form adjacent horizons in properties such as colour, texture, structure, consistency, and in chemical, biological and mineralogical composition. Mineral horizons contain approximately 17% or less organic C (about 30% organic matter) by weight. Organic and mineral soil horizons and modifiers are described below.

- Determine the soil horizon(s) using *The Canadian System of Soil Classification* (Agriculture Canada Expert Committee on Soil Survey 1987) designations.

- For mineral soils, measure the depth of each layer using the top of the uppermost mineral horizon as zero depth.

- Zero depth for organic soils is the top of the organic material or the soil surface. When entering the information for organic soils, the L, F and H layers already marked can be ignored.

Diagnostic organic horizons

- *L:* The L horizon is characterized by an accumulation of leaves, twigs, and woody materials. The original structure of the organic material is easily discernible.

- *F:* The F horizon is characterized by an accumulation of partially decomposed organic matter derived mainly from leaves, twigs, and woody materials in which some of the original structures are difficult to recognize.

- *H:* The H horizon is characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. It differs from the F horizon by having greater humification chiefly due to the action of organisms.

- *Hi:* The Hi horizon is characterized by an accumulation of spherical or cylindrical animal droppings with considerable mixing with mineral particles. It is generally an intermediate stage between H and Ah horizons.

- *Of:* The Of horizon is developed mainly from mosses, rushes, and woody material in which the plant structures are readily identifiable. It corresponds to 1–4 on the von Post scale of decomposition.

- *Oh:* The Oh horizon is developed mainly from mosses, rushes, and woody material in which the plant structures are indistinct to unrecognizable. It corresponds to 7–10 on the von Post scale of decomposition.

- *Om:* The Om horizon is developed mainly from mosses, rushes, and woody material in which the plant structures are somewhat indistinct. It corresponds to 5 and 6 on the von Post scale of decomposition.

Mineral horizons

A: This is a mineral horizon formed at or near the surface in the zone of leaching or eluviation of materials or of accumulation of organic matter or both. The accumulation of organic matter is usually expressed morphologically by a darkening of the surface soil (Ah), and conversely the removal of organic matter is usually expressed by a lightening of the soil colour usually in the upper part of the solum (Ae). The removal of clay from the upper part of the solum (Ae) is expressed by a coarser soil texture relative to the underlying subsoil layers. The removal of iron is indicated usually by a paler or less red soil colour in the upper part of the solum (Ae) relative to the lower part of the subsoil.

B: This is a mineral horizon characterized by enrichment in organic matter, sesquioxides, or clay; or by the development of soil structure; or by a change of colour denoting hydrolysis, reduction, or oxidation. The accumulation in B horizons of organic matter (Bh) is evidenced usually by dark colours relative to the C horizon. Clay accumulation is indicated by finer soil textures and by clay cutans coating peds and lining pores (Bt). Soil structure developed in B horizons includes prismatic or columnar units with coatings or stainings and significant amounts of exchangeable sodium (Bn) and other changes of structure (Bm) from that of the parent material. Colour changes include relatively uniform browning due to oxidation of iron (Bm), and mottling and gleying of structurally altered material associated with periodic reduction (Bg).

C: This is a mineral horizon comparatively unaffected by the pedogenic processes operative in A and B, except the process of gleying (Cg), and the accumulation of calcium and magnesium carbonates (Cca) and more soluble salts (Cs, Csa).

Mineral horizon modifiers

- *b*: A buried soil horizon.
- *c*: A cemented (irreversible) pedogenic horizon.
- *ca*: A horizon of secondary carbonate enrichment in which the concentration of lime exceeds that of the unenriched parent material.
- *cc*: Cemented (irreversible) pedogenic concretions.
- *e*: A horizon characterized by the eluviation of clay, Fe, Al, or organic matter alone or in combination. When dry, it is usually higher in colour value by one or more units than an underlying B horizon. It is used with A (Ae).
- *f*: A horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It must have a hue of 7.5YR or redder, or its hue must by 10YR near the upper boundary and becomes more yellow with depth. When moist the chroma is higher than 3 or the value is 3 or less. It is used with B alone (Bf), with B and h (Bhf), with B and g (Bfg), and with other suffixes.
- *g*: A horizon characterized by gray colours, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less. It is used with A and e (Aeg); B alone (Bg); B and f (Bfg, Bgf); B, h, and f (Bhfg); B and t (Btg); C alone (Cg); C and k (Ckg); and several others. In some reddish parent materials matrix colours of reddish hues and high chromas may persist despite long periods of reduction. In these soils, horizons are designated as g if there is gray mottling or marked bleaching on ped faces or along cracks.
- *h*: A horizon enriched with organic matter. It is used with A alone (Ah), or with A and e (Ahe), or with B alone (Bh), or with B and f (Bhf).
- *j*: This is used as a modifier of suffixes e, f, g, n, and t to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies. For example, Bfgj means a Bf horizon with a weak expression of gleying; Bfjgj mans a B horizon with weak expression of both f and g features.
- *k*: Denotes the presence of carbonate as indicated by visible effervescence when dilute HCl is added. It is used mostly with B and m (Bmk) or C (Ck) and occasionally with Ah or Ap (Ahk, Apk), or organic horizons (Ofk, Omk).
- *m*: A horizon slightly altered by hydrolysis, oxidation, or solution, or all three to give the change in colour or structure, or both. It has evidence of alteration in one of the following forms:

a) higher chromas and redder hues than the underlying horizons;

b) removal of carbonates either partially (Bmk) or completely (Bm);

c) a change in structure from that of the original material;

d) illuviation, if evident, too slight to meet the requirements of a Bt or a podzolic B;

e) some weatherable minerals; and

f) no cementation or induration and lacks a brittle consistence when moist. This suffix can be used as Bm, Bmgj, Bmk, and Bms.

- *n*: A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. It must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry. It is used with B as Bn or Bnt.

- *p*: A horizon disturbed by human activity such as cultivation, logging, and habitation. It is used with A and O.

- *s*: A horizon with salts, including gypsum, which may be detected as crystals or veins, as surface crusts of salt crystals, by depressed crop growth, or by the presence of salt-tolerant plants. It is commonly used with C and k (Csk), but can be used with any horizon or combination of horizon and lowercase suffix.

- *sa*: A horizon with secondary enrichment of salts more soluble than Ca and Mg carbonates; the concentration of salts exceeds that in the un-enriched parent material. The horizon is 10 centimetres thick

- *t*: An illuvial horizon enriched with silicate clay. It is used with B alone (Bt), with B and g (Btg), with B and n (Bnt), *etc.*

- *u*: A horizon that is markedly disrupted by physical or faunal processes other than cryoturbation. Evidence of marked disruption such as the inclusion of material from other horizons or the absence of the horizon must be evident in at least half of the cross-section of the pedon. Such turbation can result from a blowdown of trees, mass movement of soil on slopes, and burrowing animals. The u can be used with any horizon or subhorizon with the exception of A or B alone; *e.*g., Aeu, Bfu, BCu.

- *x*: A horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content. When dry, it has a hard consistence and seems to be cemented. When moist, it has moderate to weak brittleness. It frequently has bleached fracture planes and is overlain by a friable B horizon. Air-dry clods of fragic horizons slake in water.

- *y*: A horizon affected by cryoturbation as manifested by disrupted and broken horizons, incorporation of materials from other horizons, and mechanical sorting in at least half of the cross-section of the pedon. It is used with A, B, and C alone or in combination with other subscripts, *e.g.,* Ahy, Ahgy, Bmy, Cy, Cgy, Cygj.

- *z*: A frozen layer. It may be used with any horizon or layer, *e.g.,* Ohz, Bmz, Cz, Wz.

Coarse Fragment Percentage: Coarse fragments are composed of rock particles >2 mm in diameter. Record the percent of coarse fragments found in each layer. If there are no coarse fragments, record a value of 0.

Coarse Fragment Type: Determine the dominant surface coarse fragment type in the upper 20 centimetres of the mineral soil horizons. Coarse fragments are divided into four classes according to Table 6. Record N/A if no coarse fragments are present.

10.2.3 Site Information

Table 6

Coarse Fragment Type Classes and Codes

Allowable Code	Class	Description
N/A		no coarse fragments
G	gravels	0.2–7.5 centimetres
C	cobbles	7.6–25 centimetres
S	stones	26–60 centimetres
B	boulders	>60 centimetres

Field Guide (on plot header card only): The Field Guide to Ecosites of Northern Alberta (Beckingham and Archibald. 1996) (N) and The Field Guide to Ecosites of West-Central Alberta (Beckingham, Corns and Archibald. 1996) both cover the MDFP FMA (FMU P6) area of concern.

Natural Subregion: A natural subregion is an area characterized by a distinctive regional climate as expressed by vegetation. See Figure 3 for a visual representation of Manning's FMA (FMU 6) subregions (Subcommittee on Biophysical Land Classification 1969).

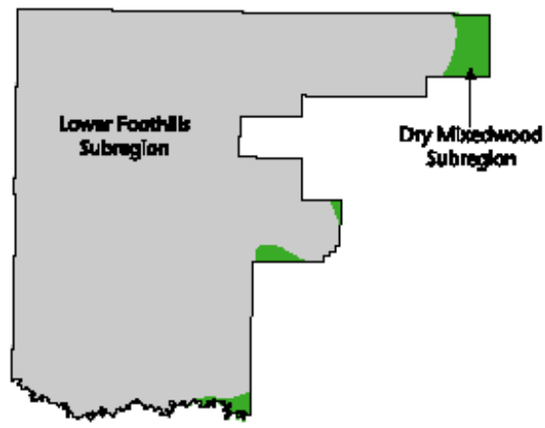
Table 7

Natural Subregions and Codes

Allowable Code	Natural Subregion
Northern Alberta	
LF	Lower Foothills
DM	Dry Mixedwood

Figure 5

Manning FMA (FMU P6 only) Subregions



Ecosection (on plot header card only): An ecosection is an area that is unique within natural subregions and are characterized by recurring parent materials, landforms, soils and vegetation assemblages.

Ecosite (on plot header card only): Ecosites are ecological units that develop under similar environmental influences (e.g., climate, moisture and nutrient regimes) (Beckingham and Archibald 1996, Beckingham et al. 1996). Up to fourteen ecosites have been defined for each natural subregion and are designated by a lowercase letter ('a' through 'n'), ordered by increasing moisture regime.

Ecosite Phase (on plot header card only): Subdivision of ecosite based on the dominant species in the canopy. In areas without a tree canopy, the tallest structural vegetation layer with >5% cover determines the ecosite phase. This is a mappable classification unit. Although it is defined by canopy and it correlates with forest cover on inventory maps, this classification also has a strong ecological basis (Beckingham and Archibald 1996, Beckingham et al. 1996).

Plant Community Type (enter plant community number on plot header card and combination of ecosite phase and plant community number in datalogger): Subdivision of ecosite phase. This classification level reflects understorey species abundance and composition differences and is not mappable (Beckingham and Archibald 1996, Beckingham et al. 1996). Up to nine plant community types have been identified for each ecosite phase.

Soil Type: Taxonomic unit used to group soils based on soil moisture regime, effective soil texture, organic matter thickness and solum depth. There are 17 soil types listed in Table 8. Soil types are fully defined in Beckingham and Archibald (1996) and Beckingham *et al.* (1996).

Table 8

Soil Types and Codes

Allowable Code	Soil Type
SV1	very dry/sandy
SV2	very dry/coarse loamy
SV3	very dry/silty-loamy
SV4	very dry/fine loamy-clayey
SD1	dry/sandy
SD2	dry/coarse loamy
SD3	dry/silty-loamy
SD4	dry/fine loamy-clayey
SM1	moist/sandy
SM2	moist/coarse loamy
SM3	moist/silty-loamy
SM4	moist/fine loamy-clayey
SMp	moist/peaty
SWm	wet/mineral
SWp	wet/peaty
SR	organic
SS	shallow

Slope (percent): The slope is recorded as the percentage of vertical rise relative to horizontal distance. Record the percent slope using a clinometer. Level sites have no slope and percent slope should be recorded as zero. If there is a small variability in the slope within the plot, record an average value.

Aspect (degrees): Aspect is the direction that the slope faces. Record the aspect in degrees. Use 360° for a north aspect and 'NA' for a level site with no aspect.

Surface Expression/Landform: Surface expression describes the form of the land surface. The definitions follow those of Agriculture Canada Expert Committee on Soil Survey (1987).

- *Apron (A):* A relatively gentle slope formed at the base of a steeper slope. Aprons develop by the movement of materials down slope.
- *Blanket (B):* A mantle of material thick enough to mask minor irregularities in topography, but conforms to the general underlying topography.
- *Fan (F):* A fan-shaped form similar in shape to a segment of a cone and having a perceptible gradient from the apex to the toe.
- *Hummocky (H):* A complex sequence of slopes consisting of somewhat rounded depressions and irregular-shaped and -sized knoll features (knob and kettle Topography)
- *Inclined (I):* A uniform surface with a unidirectional, constant slope.

- *Level (L):* A flat, or very gently sloping landscape (<2%); irregular surface features are absent.

- *Rolling (M):* A regular wavelike pattern of relief with distances between slope crests >1.5 kilometres and slope grades >5%.

- *Ridged (R):* A long, narrow, sharp-crested feature with steep sides.

- *Steep (S):* A surface with a slope in excess of 70%.

- *Terraced (T):* A nearly flat portion of a landscape, terminated by a sharp edge.

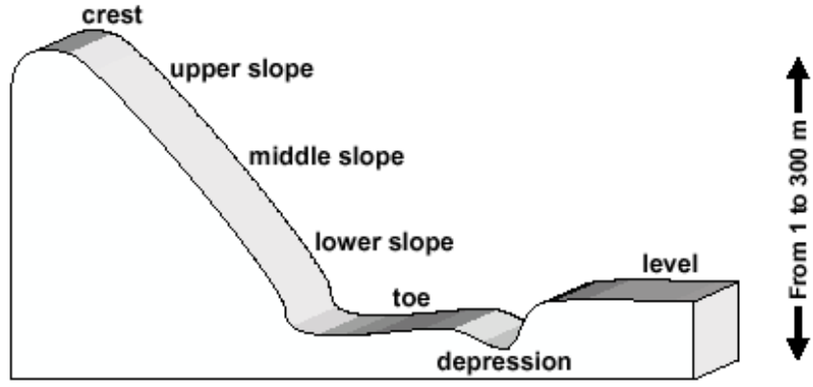
- *Undulating (U):* A regular, wavelike pattern of gentle slopes, <800 metres from slope crest to slope crest. The slope grade generally varies from 2 to 5%.

- *Veneer (V):* A mantle of organic material too thin to mask the minor irregularities of the underlying surface *(c*f. blanket)

Slope Position: The slope position is determined by assessing the site relative to adjacent sites within a range of several hundred metres (Figure 6). Vertical differences in the area should exceed 1 metre if a slope position other than level is to be assigned.

Figure 6

Slope Position (after Beckingham et al. 1996)



- *Crest (C*): The uppermost portion of a slope. It is usually convex in shape, with no distinct aspect.

- *Upper slope (U*): The uppermost portion of a slope, located immediately below the crest. The slope shape is generally convex and has a specific aspect.

- *Middle slope (M):* That part of a slope below the upper slope and above the lower slope that has a straight surface profile and a specific aspect.

- *Lower slope (L):* The portion of a slope located directly below the middle slope. It generally has a concave surface profile and a specific aspect.

- *Toe (T):* The lowermost portion of a slope, located immediately below and adjacent to the lower slope. The surface profile is concave, grading rapidly to level, with no distinct aspect.

- *Level (E):* Any generally horizontal area (excluding toe slopes) with no distinct aspect.

- *Depression (D):* Any concave area; often occurring as a shallow pothole within a generally level landscape.

Moisture Regime: Moisture regime represents the amount of water available for plant growth. It is assessed through an integration of indicator plant species and site and soil characteristics. Moisture availability is a dynamic property that changes throughout the year, so it is important that it be assessed on the basis of the entire growing season.

- *Very xeric (1):* Water is removed extremely rapidly in relation to supply. Soil is moist for a negligible time after precipitation.

- *Xeric (2):* Water is removed very rapidly in relation to supply. Soil is moist for brief periods following precipitation.

- *Subxeric (3):* Water is removed rapidly in relation to supply. Soil is moist for short periods following precipitation.

- *Submesic (4):* Water is removed readily in relation to supply. Water is available for moderately short periods following precipitation.

- *Mesic (5):* Water is removed somewhat slowly in relation to supply. Soil may remain moist for significant but sometimes short periods of the year. Available soil water reflects climatic input.

- *Subhygric (6):* Water is removed slowly enough to keep the soil wet for significant part of the growing season. Some temporary seepage and mottling are possible below 20 centimetres.

- *Hygric (7):* Water is removed slowly enough to keep the soil wet for most of the growing season. Permanent seepage, mottling and possibly weak gleying are present.

- *Subhydric (8):* Water is removed slowly enough to keep the water table at or near the surface for most of the year. Soils are gleyed mineral or organic. Permanent seepage is <30 centimetres below the surface.

- *Hydric (9):* Water is removed so slowly that the water table is at or above the soil surface all year. Soils are gleyed mineral or organic.

Nutrient Regime: Nutrient regime reflects the available nutrients necessary for plant growth. It is assessed from a number of biotic and abiotic site factors. Nutrient regime

classes are fully defined in Alberta Environmental Protection (1994).

- *Very poor (A):* Very poor nutritional status, very small supply of available nutrients.
- *Poor (B):* Poor nutritional status, low supply of available nutrients.
- *Medium (C):* Medium nutritional status, medium supply of available nutrients.
- *Rich (D):* Rich nutritional status, abundant supply of available nutrients.
- *Very rich (E):* Very rich nutritional status, abundant supply of available nutrients.

10.2.4 Vegetation Cover Tally

Number: Each species is numbered to aid in the labelling of unknown species. Numbers 1–60 have been pre-printed on the plot card. If more than 60 species are present in the plot, then use additional plot cards.

Species Code: List each plant species (vascular, nonvascular, and fungi) in the sapling (7.89 m or 5.64 m radius) plot using a seven-letter code derived from the scientific name. A list of species used in the field guides to develop the ecosite classification system is in Appendix II, which identifies species codes and strata for selected species. Note that these are not complete species lists for the area. The seven-letter species code is comprised of the first four letters of the genus and the first three letters of the species name. If the genus only has three letters, then the first four letters of the species name are used. A lberta Environmental Protection (1993) gives exceptions for species where the normal seven-letter code would be the same for two or more species. If a plant can only be identified to the genus level, then the last three letters of the code are ‘SPP’.

Vegetation Strata: Record the cover class for each species in the appropriate vegetation stratum using the Domin-Krajina Cover-Abundance Scale (Table 9).

Table 9

Domin-Krajina Cover-Abundance Scale (Mueller-Dombois and Ellenberg 1983)

Class	Description	Percent Cover
X	Any number of plants with complete cover	~100%
9	Any number with >3/4 but less than complete cover	>75%
8	Any number with 1/2–3/4 cover	50–75%
7	Any number with 1/3–1/2 cover	33–50%
6	Any number with 1/4–1/3 cover	25–33%
5	Any number with 1/10–1/4 cover	10–25%
4	Any number with 1/20–1/10 cover	5–10%
3	Scattered plants with cover under 1/20 cover	1–5%
2	Very scattered with small cover	<1%
1	Seldom with insignificant cover	<1%
+	solitary with insignificant cover	<1%

The seven vegetation strata are fully defined in Alberta Environmental Protection (1994). Alberta Environmental Protection (1993) lists the correct strata for each species on the master list.

- *Main Canopy:* The main canopy is comprised of tree and shrub species 35 metres tall that are the tallest plants in the canopy. Generally, dominant, codominant, and intermediate trees are included in this layer.

- *Second Canopy:* The second canopy are trees and shrubs 35 metres tall that are below the main canopy. The average height of plants in the second canopy must be at least 3 metres lower than the average height of plants in the main canopy. This stratum is commonly referred to as the understorey and generally comprised of suppressed trees. This layer may or may not be present.

- *Tall Shrub:* The tall shrub layer is comprised of woody plants between 2.5 and 5 metres tall.

- *Low Shrub:* Low shrubs consist of woody plants <2.5 metres tall.

- *Herbs:* Non-woody vascular species with the exception of graminoids are to be tallied in the herbaceous layer.

- *Grasses:* The grass layer consists of grasses and grasslike plants *(e.g.*, grasses, sedges and rushes).

- *Moss/Lichen:* Bryophytes, hepatics, lichens, and fungi are to be recorded in this field.

Total Stratum Cover: Record the cover class of each stratum. This number is to be assessed for all plants in the each stratum, it is not the sum of the cover classes of each species.

Cover of Other Substrates: Record the ground cover of leaf litter, deadfall, bare soil, and rock using the Domin-Krajina Cover-Abundance Scale in Table 9.

Lichen Species: Record the abundance of arboreal lichens using the scale shown in Table 10. Record the abundance of each lichen species. For genera that are difficult to separate in the field *(e.g., Usnea* or *Bryoria*), assess the cover by genera instead of species. Avoid spending a lot of time in identifying the various lichen species. The 2 genus' that are most significant in terms of caribou habitat are *Alectoria* and *Bryoria.* There are several other genus' (*Usnea* and *Ramalina thrausta*) that resemble these 2, but are less important.

Table 10

Cover Scale for Arboreal Lichens

Cover Class	Description
0	lichens are absent
1	lichens are scarce
2	lichens are present in moderate amounts
3	lichens are abundant

Tree species: Cover of arboreal lichens will be assessed for each tree species using the cover classes in Table 10.

Landscape Cross-section: Draw a schematic diagram of the cross-section of the landscape showing plot location and surrounding topography. Indicate plant physiography, tree species, landform, seepages, drainage, parent materials, *etc.* If using the datalogger, please use the comments section on the plot header card. Make sure to draw an arrow showing the direction of the profile.

Comments: Describe where the 35 mm photos are taken from. The plot diagram on the plot header can also be used to place photo numbers to record the location the photograph was taken in. Record any additional comments related to the ecological plot.

11. Cruise Quality Control

11.1 Cruise Checks

Sampling crews should emphasize accuracy over production. Sampling programs rely on consistent, careful measurement of the sampling plot. Table 11 lists allowable errors for the various plot measurements. If any of the following errors are exceeded, that portion of the plot will be rejected.

Table 11

Allowable Error Specifications

MEASUREMENT	ALLOWABLE ERROR
Header Information	
Location of Plot Center	Allowable error is to the extent of current GPS error
Plot Size	No error allowed
Choice of plot size	Must be appropriate to density of trees of present so that 80 – 90 sample trees are selected
Tally sheet	Legible and completely filled out
Header Information	Must be complete and accurate
Tree- Sapling- Regeneration Information	
Number of trees tallied or species identified	No error allowed
Number or species of saplings or regeneration	No error allowed
DBH	Breast height within 2% DBH within 0.2 cm or 1%, whichever is greater 5% of DBHs can be out more than 5%
Tree tag position	No error allowed
Height, Height to live crown	Within 1.0 m for trees and 5% for any measured saplings For trees >20 meters in height, height should be within 1.5 m 5% of heights can be out 5 - 8% no heights can be out more than 8%
Age	5% error allowed
Slope	2% error allowed
Condition codes	5% of trees can be incorrect
Crown class	5% of trees can be incorrect
Coarse Woody Debris	
Species	Must be correct, or as specific as possible
Diameter class	Must be within 1 class
Decomposition class	Must be within 1 class
Bearing (degrees)	Must be within 3 degrees of true bearing

Table 12 describes the allowable errors for the measurements of ecological and soil data. If any of the following errors are exceeded, that portion of the plot will be rejected.

Table 12

Site Ecology Allowable Error Specs

MEASUREMENT	ALLOWABLE ERROR
Soil Characteristics	
Humus form	Must be correctly identified
Seepage	The presence of seepage must be correctly identified or suspected. If there is no seepage, it must be correctly identified.
Drainage	Must be within 1 drainage class
Parent material	Must be correct
Header Information	Must be complete and accurate
Depth to Water Table (cm)	Must be within 10%
Depth to Mottles (cm)	Must be within 10%
Depth to Gleying (cm)	Must be within 10%
Depth to Root Restrictive Layer (cm)	Must be within 10%
Depth to Carbonates (cm)	Must be within 10%
Depth to Pit Bottom (cm)	Must be within 10%
Soil Horizon	Subject to interpretation; must be justifiable
Texture	Estimation must be within one texture class of true texture
Soil Layer Thickness (cm)	Must be within 20%
Coarse Fragment Percentage	Estimation must be within 20%
Coarse Fragment Type	Estimation of type must be correct
Site Characteristics	
Slope (%)	2% error allowed
Aspect (degrees)	Must be within 5 degrees
Surface Expression	Must be correct
Slope Position	Must be correct
Moisture Regime	Within one moisture class
Nutrient Regime	Within one nutrient class
Ecological Characteristics	
Natural Subregion	Must be identified and labeled exactly
Ecosite	Correct classification at ecosite level
Phase	Correct classification at ecosite phase level
Community	Within one type of the actual community type
Soil Type	Classification must be correct
Plant Cover	
Species Code	Up to 5% of species may be missed; Code must conform to guidelines
Vegetation Strata Cover Class	Within 1 cover class
Total Stratum Cover	Within 1 cover class
Cover of other substrates	Within 1 cover class
Lichen Species	Species or genera must be correctly identified
Cover Abundance	Within 1 cover class

11.1.1 Sampling Crews Checks

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

- Inspect at least 10 percent of all samples established. If the sample has been poorly done, the original crew may be required to redo it.
- Make spot checks as work progresses to check tie points are properly marked and tie lines run on the designated bearings and horizontal distance.
- To observe sampling crew performance, occasionally visit each crew on the sample.

11.1.2 Checking the Samples in the Office

Data from EVERY plot should be checked for the following items prior to submitting the sample for database entry:

- The sample identification is correct, valid and consistent on all hardcopy and electronic data forms.
- The sample header information is as complete as possible.
- If hardcopy tree data forms were used, a visual inspection should be made for completeness and to identify any obvious missing data.
- The number and distribution of tree heights were met.
- The required number of ages has been taken. All cores have been counted and all cores are present or accounted for.
- The access notes are complete and include the tie point sketch.

11.2 Inspecting the Samples

Once the samples have been checked in the office, randomly select one-tenth of the plots for check cruising and conduct each inspection in three stages:

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

11.3 Pre-field Inspection

For each plot randomly selected for check cruising, enter the following information in the section at the top of the plot inspection report:

- sample identification - TRMSP

- the plot and sub-plot sizes
- the inspection date
- the original tally crew
- the measurement date

Randomly select seven trees for tree detail checking. Transcribe the measurements of the seven trees to the plot inspection report. Randomly select five trees from the sample tree section for height checking. Transcribe the height measurements of the five trees to the sample tree section of the plot inspection report. Select two age trees and check the age count on the cores in the office. Transcribe the crown closure, aspect, slope and slope position of the plot to the appropriate section of the plot inspection report. Randomly select one tree count diameter class for a species. Later, use this diameter class in the field to check that the dot tally is correct for the species and class.

12. Field Inspection

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

2. Check that the tie point is correctly marked. See “Choosing a Tie Point” in this manual.

3. Make sure the tie line bearing and distance run within the allowable standards and are consistent with the methods detailed in this manual.

4. Make sure the plot centre markers are correctly inscribed, and that the plot centre stake is protected with a cairn if necessary.

5. Check the plot and sub-plot radii at a minimum of three different locations. Check for trees that were missed or that should have been excluded from the plot or sub-plots.

6. Within the plot or sub-plots, make sure trees larger than the tagging limits were not missed. Also check for trees that were tallied when they should not have been. Flag with a circled asterisk any missed or erroneously tallied tree.

7. Make sure all sub-plot trees of the selected tree count class were counted in the dot tally.

8. Carefully measure all the trees selected for field inspection:

    - **Tree identification** - Make sure the genus or species of each tree is correct. If not, place a circled asterisk beside the tree.

    - **Tree tag height** - Check the tag height of the seven selected trees to verify that breast height is 1.3 m above germination point. At the same time, make sure the nails were securely driven into the trees.

    - **Diameter and condition codes** - Measure the dbh of the seven selected trees and classify them.

    - **Sample tree heights** - Measure the five selected trees for height.

9. Compare your measurements with the crew's measurements. Give the crew the benefit of the doubt.

10. Check that the results conform to the standards of measurements. See Tables 11 and 12.

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

15. Record your rating of the sample and any other comments in the remarks section of the plot inspection report.

12.1 Post-field Inspection

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

13. Recording Data

All measurements entered on plot cards are later entered into a computer, so legibility is very important. All header lines must be completed.

1. All letters must be capitalised.

2. Use only the species codes listed in the Appendices.

3. Asterisks, numeric characters in alphabetic fields (e.g. B3 in the species columns) and alphabetic characters in numeric fields (e.g. H in DBH columns) are not acceptable.

4. Comments are written in the designated areas only. Comments written elsewhere on the tally sheets are not acceptable.

5. Alphabetic characters that are commonly illegible are:

    - N that looks like W
    - C that looks like L or O
    - D that looks like P or O
    - I that looks like T or L

6. Numeric characters that are commonly illegible are:

    - 2 that is 'looped' and looks like 0
    - 6 and 9 that looks like 0 or 4
    - 0 incompletely closed and looks like 6
    - 5 that looks like S
    - 6 and 1 mistaken for each other
    - Scientific (European) 7 is not acceptable
    - The number four is written open at the top (i.e. not 4)

14. References

Agriculture Canada Expert Committee on Soil Survey. 1987. The Canadian system of soil classification. 2nd ed. Agric. Can., Ottawa, Ontario. Publ. 1646.

Alberta Environmental Protection. 2000. Alberta vegetation inventory standards manual, ver. 2.2. Alberta Env. Prot., Res. Data Div., Data Acquisition Branch. Edmonton, Alberta.

Alberta Environmental Protection. 1993. Alberta plants and fungi—master species list and species group checklists. Pub. No.: Ref. 75. Edmonton, Alberta.

Alberta Environmental Protection. 1994. Ecological land survey site description manual. Canada-Alberta Partnership Agreement in Forestry. Edmonton, Alberta.

Beckingham, J.D.; Archibald, J.H. 1996. Field guide to ecosites of northern Alberta. Nat. Resour. Can., Can. For. Serv., Northwest Reg., North. For. Cent., Edmonton, Alberta. Spec. Rep. 5.

Beckingham, J.D.; Corns, I.G.W.; Archibald, J.H. 1996. Field guide to ecosites of west-central Alberta. Nat. Resour. Can., Can. For. Serv., Northwest Reg., North. For. Cent., Edmonton, Alberta. Spec. Rep. 9.

BC Ministry of Forests and BC Ministry of Environment. 1998. Field Manual for Describing Terrestrial Ecosystems. BC Min. For. And BC Min. Environ., Lands and Parks, Victoria, BC Land Manage. Handbook 25.

Land Resource Research Institute. 1983. The Canadian Soil Information System (CanSIS): manual for describing soils in the field. J.H. Day (Ed.) LRRI Contrib. No. 82-52. Agriculture Canada, Ottawa, Ontario.

Lee, P.C.; Crites, S.; Nietfeld, M.; Nguyen, H.V.; Stelfox, J.B. 1995. Changes in snags and down woody material characteristics in a chronosequence of aspen mixedwood forests in Alberta. In: Relationships between stand age, stand structure, and biodiversity in aspen mixedwood forests in Alberta. Stelfox, J.B. (Ed.) Alberta Environ. Cen. (AECV95-R1), Vegreville, Alberta, and Canadian For. Serv. (Project No. 0001A), Edmonton, Alberta.

Luttmerding, H.A.; Demarchi, D.A; Lea, E.C.; Meidinger, D.V.; Vold, T., editors.1990. Describing ecosystems in the field. 2nd ed. British Columbia Minist. Environ., Lands and Parks with Minist. For. MOE Manual 11.

Mueller-Dombois, D.; Ellenberg, H. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, Toronto, Ontario.

Ontario Institute of Pedology. 1985. Field manual for describing soils. 3rd ed. Ontario Inst. Pedol. & Univ. Guelph, Ontario. OIP Publ. No. 85-3.

Subcommittee on Biophysical Land Classification. 1969. Guidelines for biophysical land classification. D.S. Lacate, (Ed.) Can. Dep. Fish. For., For. Serv., Ottawa, Ontario. Publ. 1264.

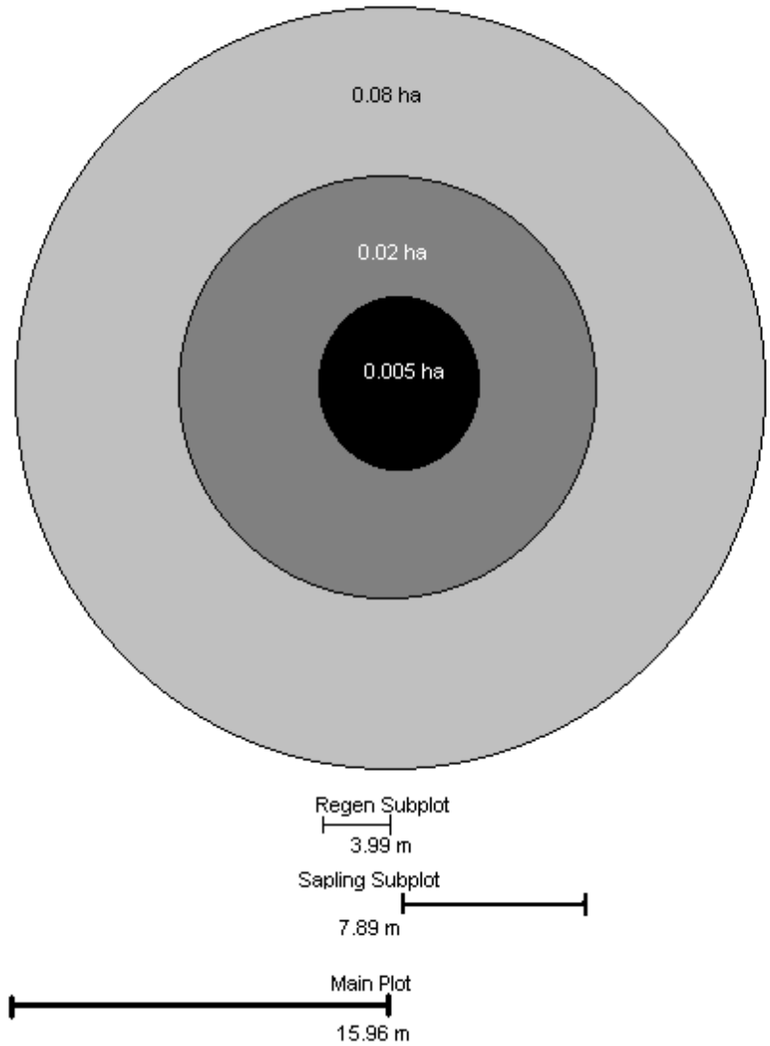
Appendices

Appendix I

Plot Configuration (not to scale)

APPENDIX I

PLOT CONFIGURATION (NOT TO SCALE)



Appendix II

Tree Species Codes

Appendix II

Tree Species Codes

COMMON NAME	GENUS/SPECIES	SPECIES CODE
Alpine Fir	Abies lasiocarpa	FA
Balsam Fir	Abies balsamea	FB
White Birch	Betula papyrifera	BW
Douglas-fir	Pseudostuga menziesii	FD
Alpine Larch	Larix lyallii	LA
Tamarack	Larix laricina	LT
Western Larch	Larix occidentalis	LW
Limber pine	Pinus flexilis	PF
Jack Pine	Pinus banksiana	PJ
Lodgepole pine	Pinus contorta	PL
Whitebark pine	Pinus albicaulis	PW
Aspen (White poplar)	Populus tremuloides	AW
Balsam poplar (Black Poplar)	Populus balsamifera	PB
White Spruce	Picea glauca	SW
Englemann Spruce	Picea englemannii	SE
Black Spruce	Picea mariana	SB

Appendix III

Dead Tree (Condition Code 25) Decay Classes for Sample Plot Trees

APPENDIX III

DEAD TREE (CONDITION CODE 25) DECAY CLASSES FOR SAMPLE PLOT TREES

For dead trees measured in the sample plots, Condition Code 25 (Dead and standing) will be recorded in the column for Condition Code 1, with the column for Condition Code 2 reserved for Decay Class. Also if it is suspected that the dead tree has a broken top, record the appropriate code from Appendix XI (Code No. 24) for the 3rd Condition Code. Live trees will not have a decay class recorded for them.

CLASS	WOOD TEXTURE/ SHAPE	TWIGS AND BRANCHES	BARK
01 Height should be measured	hard, recently dead, sap is still present, log whole and un-decayed	may have brown needles or leaves	present, still moist between the bark and sapwood
02 Height should be measured	hard, the stem is dried out	fine branches and twigs present	tight bark, most of bark still present
03 Height should be measured	hard, the stem is mostly sound	major branches are still present	most of bark is still present (varies by species)
04	hard, stem is mostly intact, but it may be starting to soften	few or no major branches present	amount of bark varies by species
05	soft, stem is starting to decompose (noticeably punky)	branch stubs	amount of bark varies by species
06	decomposed, stem is very punky or rotten, small pieces of wood lost	branch stubs	bark is mostly absent
07	large wood fragments lost, outline of trunk is deformed	no branches or twigs	vascular plants are beginning to colonize (herbs, shrubs, trees)
08	wood mostly well decayed	no branches or twigs	log completely moss covered and colonized by various vascular plants
09	no evidence of hard wood, humification nearly 100%, hard to define as log, outline indeterminable	no branches or twigs	log completely moss covered and colonized by various vascular plants
X	hard, charred stem due to fire, grey in colour (chicot)	no branches	very little bark

Appendix IV

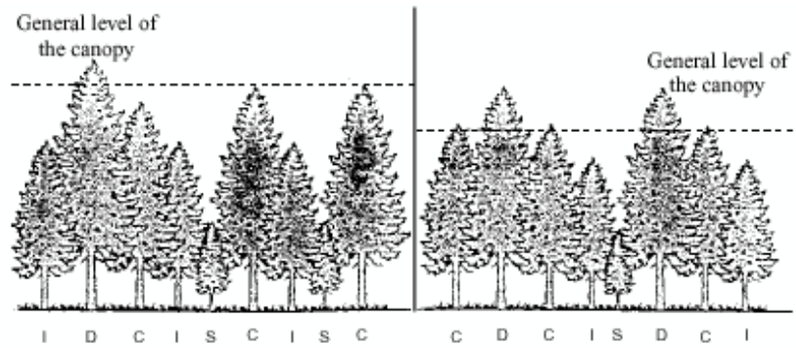
Crown Class

APPENDIX IV

CROWN CLASS

Crown class 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 SDS 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 trees with the exception of those ≥ 9.1 cm with a broken top/stem, are dead, cut down, missing or have a severe lean (see Appendix 6.5).

CROWN CLASS (CC)	CC CODE	DESCRIPTION
Dominant	D	Crowns extend above general level of canopy
Co-dominant	C	Crowns form the general level of the canopy
Intermediate	I	Crowns below but extending into the bottom of the general level of the canopy
Suppressed	S	Canopy entirely below the general level of the canopy
Open-grown	O	Used only in special situations for trees in very open stands
No Crown Class	X	Used for stems for which it is inappropriate to record a crown class (eg. Severe lean, broken top, broken stem, standing dead)



Plot 1 of Stand A Plot 2 of Stand A

Note: The top of the live foliage is used to determine crown class in cases where the tops are damaged.

Appendix V

Equipment List

APPENDIX V

EQUIPMENT LIST

INDIVIDUAL	EXPENDABLE
Clinometer (% scale)	6cm Aluminum Tree Nails (smooth head)
Cruiser's compass	Aluminum "writable" tree tags (for small trees)
	SS wire to attach tree tags
	Tree marking paint
Metal Diameter tape (metric)	Flagging – pink/black stripe (no orange, blue, yellow)
Loggers tape (metric)	Plot center stakes – 0.5in conduit, 1m long
Claw hammer	Pencils
Pocket calculator	String
Hand lens	Project Field Forms
	Aluminum "writable" plot tags (3x5")
Pocket first aid kit	Ballpoint pens to etch tags
Flare gun with flare and bear banger	**CREW**
Bear repellent	
Whistle	Axe
Cruiser's vest	50 m tape
Hard hat	Photo holder
	Covered clipboard (8.5x11)
Hand trowel or old knife	GPS unit
Carpenter's tape measure (metric)	Shovel
Water and water bottle	Hip chain
Increment bore	Camera and film
10% HCl solution	Straws and masking tape
	Plant & Eco ID books
OPTIONAL ELECTRONICS	Stretcher
Datalogger	
PC access for Daily Data Download	VSP Field Manual
Laser height measuring device	AVI 2.2 Manual

Appendix VI

Tree and Shrub Species Code

APPENDIX VI

TREE AND SHRUB SPECIES CODE

Common Name	Latin Name	Genus Code	Species Code
Alpine Fir	*Abies lasiocarpa*	ABIE	LAS
Alpine Larch	*Larix lyallii*	LARI	LYA
Aspen	*Populus tremuloides*	POPU	TRE
Balsam Fir	*Abies balsamifera*	ABIE	BAL
Balsam Poplar	*Populus balsamifera*	POPU	BAL
Balsam Willow	*Salix pyrifolia*	SALI	PYR
Barclay's Willow	*Salix barklayi*	SALI	BAR
Basket Willow	*Sdlix petiolaris*	SALI	PET
Beaked Hazelnut	*Corylus cornuta*	CORY	COR
Beaked Willow	*Salix bebbiana*	SALI	BEB
Bearberry, Kinnickkinnick	*Arctostaphylos uvaursi*	ARCT	UVA
Birch-leaved Spirea	*Spiraea betulifolia*	SPIR	BET
Black Spruce	*Picea mariana*	PICE	MAR
Blueberry	*Vaccinium myrtilloides*	VACC	MYR
Bog Bilberry	*Vaccinium ulignosum*	VACC	ULI
Bog Birch	*Betula glandulosa*	BETU	GLA
Bog Cranberry	*Vaccinium vitis-idaea v. minus*	VACC	VIT
Bog Willow	*Salix pedicellaris*	SALI	PED
Bracted Honeysuckle	*Lonicera involucrata*	LONI	INV
Bristly Black Currant	*Ribes lacustre*	RIBE	LAC
Canadian Buffaloberry	*Shepherdia canadensis*	SHEP	CAN
Cherry	*Prunus species*	PRUN	SP
Choke Cherry	*Prunus virginiana*	PRUN	VIR
Common Juniper	*Juniperus communis*	JUNI	COM
Common Wild Rose	*Rosa woodsii*	ROSA	WOO
Creeping Juniper	*Juniperus horizontalis*	JUNI	HOR
Creeping Mahonia	*Berberis repens*	BERB	REP
Creeping Snowberry	*Gaultheria hispidula*	GAUL	HIS
Dead Conifer		DC	
Dead Deciduous		DD	
Devil's Club	*Oplopanax horridum*	OPLO	HOR
Douglas-fir	*Pseudotsuga menziesii*	PSEU	MEN
Dwarf Bilberry	*Vaccinium caespitosum*	VACC	CAE
Dwarf Birch	*Betula glandulosa*	BETU	GLA
Engleman Spruce	*Picea engelmannii*	PICE	ENG
Gooseberry/Currants	*Ribes species*	RIBES	SP
Green Alder	*Alnus crispa*	ALNU	CRI
Grouse-berry	*Vaccinium scoparium*	VACC	SCO
High-bush Cranberry	*Viburnum opulus*	VIBU	OPU
Huckleberry	*Lonicera involucrata*	LONI	INV
Labrador Tea	*Ledum groenlandicum*	LEDU	GRO
Larch	*Larix laricina*	LARI	LAR
Limber Pine	*Pinus flexilis*	PINU	FLE
Lodgepole Pine	*Pinus contorta*	PINU	CON
Low Bilberry	*Vaccinium myrtillus*	VACC	MYT
Lowbush Cranberry	*Viburnum edule*	VIBU	EDU
Meadowsweet	*Spiraea species*	SPIR	SP
Menziesia	*Menziesia ferruginea*	MENZ	FER
Mountain Ash	*Sorbus scopulina*	SORB	SCO
Myrtle-leaved Willow	*Salix myrtillifolia*	SALI	MYR
Northern Black Currant	*Ribes hudsoniaum*	RIBE	HUD
Pin Cherry	*Prunus pensylvanica*	PRUN	PEN

Common Name	Latin Name	Genus Code	Species Code
Pink Meadowsweet	*Spiraea densiflora*	SPIR	DEN
Prickly Rose	*Rosa acicularis*	ROSA	ACI
Prince's Pine	*Chimaphila umbellata*	CHIM	UMP
Purple clematis	*Clematis occidentalis*	CLEM	OCC
Raspberry Species	*Rubus species*	RUBU	SP
Red Elderberry	*Sdambucus Racemosa*	SAMB	RAC
Red Osier Dogwood	*Cornus stolonifera*	CORN	STO
Red Twinberry	*Lonicera utahensis*	LONI	UTA
River Alder	*Alnus tenuifolia*	ALNU	TEN
Rose	*Rosa species*	ROSA	SP
Rough Cinquefoil	*Potentilla norvegica*	POTE	NOR
Saskatoon Berry	*Amelanchier alnifolia*	AMEL	ALN
Shrubby Cinquefoil	*Potentilla fruticosa*	POTE	FRU
Skunk Currant	*Ribes glandulosum*	RIBE	GLA
Small Bog Cranberry	*Oxycoccus microcarpus*	OXYC	MIC
Small Bog Cranberry	*Oxycoccus microcarpus*	OXYC	MIC
Smooth Willow	*Salix glauca*	SALI	GLA
Snowberry	*Symphoricarpos albus*	SYMP	ALB
Tall Bilberry	*Vaccinium membranaceum*	VACC	MEM
Thimble Berry	*Rubus parviflorus*	RUBU	PAR
Twinflower	*Linnaea borealis*	LINN	BOR
Twining Honeysuckle	*Lonicera dioica v. glaucescens*	LONI	DIO
Water Birch	*Betula occidentalis*	PETU	OCC
Western Larch	*Larix occidentalis*	LARI	OCC
White Birch	*Betula papyrifera*	BETU	PAP
White Spruce	*Picea glauca*	PICE	GLA
White-flowered Rhododendron	*Rhododendron albiflorum*	RHOD	ALB
Whitebark Pine	*Pinus albicaulis*	PINU	ALB
Wild Gooseberry	*Ribes oxyacanthoides*	RIBE	OXY
Wild Gooseberry	*Ribes hirtellum*	RIBE	HIR
Wild Red Curant	*Ribes triste*	RIBE	TRI
Wild Red Raspberry	*Rubus idaeus*	RUBU	IDA
Willow	*Salix athabascensis*	SALI	ATH
Willow	*Salix scouleriana*	SALI	SCO
Willows	*Salix species*	SALI	SP
Wolfberry	*Symphoricarpos occidentalis*	SYMP	OCC

Appendix VII

Grass and Sedge Species Code

APPENDIX VII

GRASS AND SEDGE SPECIES CODE

Common Name	Latin Name	Genus Code	Species Code
	Carex leptales	CARE	LEP
	Carex vaginata	CARE	VAG
	Carex brunnescens	CARE	BRU
	Carex concinna	CARE	CON
	Carex disperma	CARE	DIS
	Carex foenea	CARE	FOE
	Carex gynocrates	CARE	GYN
	Carex aquatilis	CARE	AQU
	Carex lasiocarpa	CARE	LAS
	Calamagrostis rubescens	CALA	RUM
	Carex obtusata	CARE	OBT
	Carex praticola	CARE	PRA
	Carex richardsonii	CARE	RIC
	Carex rostrata	CARE	ROS
	Carex species	CARE	SP
	Agropyron riparium	AGRO	RIP
	Carex houghtoniana	CARE	HOU
	Bromus inermis	BROM	INE
	Agropyron smitthi	AGRO	SMI
	Agrophron subsecundum	AGRO	SUB
	Agropyron trachycaulum	AGRO	TRA
	Alopecurus aequalis	ALOP	AEQ
	Agrodstis Scabra	AGRO	SCA
	Agropyron species	AGRO	SP
	Carex bebbi	CARE	BEB
	Bromus carinatus	BROM	CAR
	Cinna latifolia	CINN	LAT
	Bromus ciliatus	BROM	CIL
	Bromus vulgaris	BROM	VUL
	Calamagrostis canadensis	CALA	CAN
	Calamagrostis inexpansa	CALA	INE
	Calamagrostis neglecta	CALA	NEG
	Calamagrostis purpurascens	CALA	PUR
	Avena fatua	AVEN	FAT
	Festuca rubra	FEST	RUB
	Poa species	POA	SP
	Carex umbellata	CARE	UMB
	Glyceria striata	GYLYC	STR
	Festuca species	FEST	SP
	Festuca saximontana	FEST	SAX
	Festuca pratensis	FEST	PRA
	Festuco occidentalis	FEST	OCC
	Eriophorum species	ERIO	SP
	Eriophorum polystachion	ERIO	POL
	Elymus species	ELYM	SP
	Elymus innovatus	ELYM	INN
	Distichlis stricta	DIST	STR
	Deschampsia caespitosa	DESC	CAE
	Danthonid parryi	DANT	PAR
	Festuca scabrella	FEST	SCA
Alpine Sweetgrass	*Hierochloe Alpina*	HIER	ALP
Bear Grass	*Xerophyllum tenax*	XERO	TEN

Common Name	Latin Name	Genus Code	Species Code
Bluegrass	*Poa glauca*	POA	GLAU
Bluegrass	*Poa interior*	POA	INTE
Common Sweetgrass	*Hierochloe odorata*	HIER	ODO
False Melic	*Schizachne purpurascens*	SCHI	PUR
Fowl Bluegrass	*Poa palustris*	POA	PALU
Foxtale Barley	*Hordeum jubatum*	HORD	JUB
June Grass	*Koeleria cristata*	KOEL	CRI
Kentucky Bluegrass	*Poa pratensis*	POA	PRAT
Mountain Rice Grass	*Oryzopsis asperifolia*	ORYZ	ASP
Panic Grass	*Panicum species*	PANI	SP
Reed	*Phragmites australis*	PHRA	AUS
Short-awned Rice Grass	*Oryzopsis pungens*	ORYZ	PUN
Small-flowered Woodrush	*Luzula parviflora*	LUZU	PAR
Spike Trisetum	*Trisetum spicatum*	TRISI	SPI
Timothy Grass	*Phleum pratense*	PHLE	PRA
Wire Rush	*Juncus balticus*	JUNC	BAL

Appendix VIII

Herb Species Code

APPENDIX VIII

HERB SPECIES CODE

Common Name	Latin Name	Genus Code	Species Code
Alpine Bistort	*Polygonum viviparum*	POLY	VIV
Alpine Goldenrod	*Solidago multiradiata*	SOLI	MUL
Alpine Milk Vetch	*Astragalus alpinus*	ASTR	ALP
Alpine Speedwell	*Veronica wormskioldii*	VERO	WOT
American Hedysarum	*Hedysarum alpinum v. americanum*	HEDY	ALP
American Milk Vetch	*Astragalus frigidus*	ASTR	FRI
Annual Hawksbeard	*Crepis tectorum*	CREP	TEC
Arnica	*Arnica species*	ARNI	SP
Arrow-leaved Coltsfoot	*Petasites sagittatus*	PETA	SAG
Arrow-leaved groundsell	*Senecio triangularis*	SENE	TRI
Ascending Purple Milk Vetch	*Astragalus straatus*	ASTR	STR
Aster	*Aster folicaeus*	ASTE	FOL
Aster species	*Aster species*	ASTE	SP
Balsam Groundsel	*Senecio pauperculus*	SENE	PAU
Bastard Toadflax	*Geocaulon lividum*	GEOC	LIV
Bishop's Cap, Mitrewort	*Mitella nuda*	MITE	NUD
Bladder Fern	*Cystopteris fragilis*	CYST	FRA
Blue Columbine	*Aquilegia brevistyla*	AQUI	BRE
Bluebell, harebell	*Campanula rotundifolia*	CAMP	ROT
Blunt-fruited Sweet Cicely	*Osmorhiza chilensis*	OSMO	CHI
Blunt-leaved Orchid	*Habenaria obtusata*	HABE	OBT
Bracted lousewort	*Pedicularis bracteosa*	PEDI	BRA
Bracted Orchid	*Habenaria viridis v. bracteata*	HABE	VIR
Bristly ox-tongue	*Picris echioides*	PICR	ECH
Bronze Bells	*Stenanthium occidentale*	STEN	OCC
Bull Thistle	*Cirsium vulgare*	CIRS	VUL
Bunch Berry	*Corn canadensis*	CORN	CAN
Canada Goldenrod	*Solidago canadensis*	SOLI	CAN
Canada Hawkweed	*Hieracium canadense*	HIER	CAN
Canada Thistle	*Cirsium arvense*	CIRS	ARV
Canada Violet	*Viola canadensis*	VIOL	CAN
Cattail	*Typha latifolia*	THPH	LAT
Chickweed species	*Cerastium species*	CERA	SP
Cinquefoil	*Potentilla glandulosa spp. Pseudorupestris*	POTE	GLA
Cloudberry	*Rubus chamaemorus*		
Clover Species	*Trifolium species*	TRIF	SP
Club-moss	*Lycopodium species*	LYCO	SP
Common Dandelion	*Taraxacum officinale*	TARA	OFF
Common great bulrush	*Scirpus validus*	SCIR	VAL
Common Horsetail	*Equisetum arvense*	EQUI	ARV
Common Nettler	*Urtica dioica*	URTI	DIO
Common Pink Wintergreen	*Pyrola asarifolia*	POTE	ASA
Common plantain	*Plantago major*	PLAN	MAJ
Common Stonecap	*Sedum stenopetalum*	SEDU	STE
Common tansy	*Tanacetum vulgare*	TANA	VUL
Common Yarrow	*Achillea millefolium*	ACHI	MIL
Corydalis	*Corydalis species*	CORY	SP
Cow Parsnip	*Heracleum lanatum*	HERA	LAN
Cream-colour Vetchlin	*Lathyrus ochroleucus*	LATH	OCH
Dandelion Species	*Taraxacum species*	TARA	SP
Death Camas	*Zygadenus elegans*	ZYGA	ELE

Common Name	Latin Name	Genus Code	Species Code
Dewberry	*Rubus pubescens*	RUBU	PUB
Drummond's Cocle	*Lychnis drummondii*	LYCH	DRU
Dwarf Mistletoe	*Arceuthobium americanum*	ARCE	AME
Dwarf Raspberry	*Rubus arcticus*	RUBU	ARC
Dwarf Scouring Rush	*Equisetum scirpoides*	EQUI	SCI
Early Blue Violet	*Viola adunca*	VIOL	ADU
Early Yellow Locoweed	*Oxytropis sericeus v. spicata*	OXYT	SER
Elephant Head	*Pedicularis groenlandicam*	PEDI	GRO
Fairy-bells	*Disporum trachyearpum*	DISP	TRA
False Dandelion	*Agoseris species*	AGOS	SP
False Hellebore	*Veratrum eschscholtzii*	VERA	ESC
False Solomon's Seal	*Smilacina racemosa*	SMIL	RAC
Felwort, Northern Gentian	*Gentianella amarella*	GENT	AMA
Fern	*Dryopteris cristata*	DRYO	CRI
Fern	*Dryopteris species*	DRYO	SP
Few-flowered lousewort	*Pedicularis capitata*	PEDI	CAP
Field Chickweed	*Cerastium arvense*	CERA	ARV
Field Horsetail	*Equisetum arvense*	EQUI	ARV
Field Pussytoes	*Antennaria neglecta*	ANTE	NEG
Fireweed	*Epilobium angustifolium*	EPIL	ANG
Five-leaved bramble	*Rubus pedatus*	RUBU	PED
Fleabane	*Erigeron species*	ERIG	SP
Fringed Grass-of Parnas	*Parnassia fimbriata*	PARN	FIM
Gaillardia	*Gaillardia aristata*	GAIL	ARI
Gentian species	*Gentianella species*	GENT	SP
Geranium	*Geranium species*	GERA	SP
Golden bean	*Thermopsis rhombifolia*	THER	RHO
Golden Saxifrage	*Chrysoplenium iowense*	CHRY	IOW
Golden Whitlow-Grass	*Draba aurea*	DRAB	AUR
Goldenrod	*Solidago gigantea*	SOLI	GIG
Goldenrod species	*Solidago species*	SOLI	SP
Graceful Cinquefoil	*Potentilla gracilis*	POTE	GRA
Grape Fern	*Botrychium virginianum*	BOTR	VIR
Graundsel	*Senecio species*	SENE	SP
Green Sorrel	*Rumex acetosa*	RUME	ACE
Green Wintergreen	*Pyrola chlorantha*	PYRO	CHL
Ground Cedar	*Lycopodium complanatum*	LYCO	COM
Hawksbeard species	*Crepis species*	CREP	SP
Hawkweed species	*Hieracium species*	HIER	SP
Heart-leaved Arnica	*Arnica cordifolia*	ARNI	COR
Heat-leaved Twayblade	*Listera cordata*	LIST	COR
Hedysarum	*Hedysarum species*	HEDY	SP
Hemp Nettle	*Galeopsis tetrahit*	GALE	TET
Hop clover	*Trifolium aureum*	TRIF	AUR
Horned Dandelion	*Taraxacum ceratophrum*	TARA	CER
Horsetail Species	*Equisetum species*	EQUI	SP
Jacob's Ladder	*Polygonum caeruleum spp. occidentale*	POLY	CAE
Kidney-leaved Violet	*Viola renifolia*	VIOL	REN
Labrador Lousewort	*Pedicularis labradoricam*	PEDI	LAB
Ladies' Tresses	*Spiranthes romanzoffiana*	SPIR	ROM
Large Wintergreen	*Pyrola bracteata*	PYRO	BRA
Late Yellow Locoweed	*Oxytropis campestris*	OXYT	CAM
Leafy Arnica	*Arnica chamissonis*	ARNI	CHA
Lindley's Aster	*Aster ciliolatus*	ASTE	CIL
Long-leaved Arnica	*Arnica longifolia*	ARNI	LON
Long-leaved Chickweed	*Stellaria longifolia*	STEL	LON

Common Name	Latin Name	Genus Code	Species Code
Meadow Horsetail	*Equisetum pratense*	EQUI	PRA
Meadow Parsnip	*Zizia aptera*	ZIZI	APT
Milk Vetch	*Astragalus species*	ASTR	SP
Milk Vetch	*Astragalus eucosmus*	ASTR	EUC
Mountain Arnica	*Arnica latifolia*	ARNI	LAT
Narrow Spinulose Shield Fern	*Dryopteris spinulosa*	DRYO	SPi
Narrow-leaved Hawkweed	*Hieracium umbellatum*	HIER	UMB
Nodding Onion	*Allium cernum*	ALLI	CER
Northern Bedstraw	*Galium boreale*	GALI	BOR
Northern grass-of-Parnassus	*Parnassia palustris*	PARN	PAL
Northern green orchid	*Habenaria hyperborea*	HABE	HYP
Northern Starwort	*Stellaria calycantha*	STEL	CAL
Oak Fern	*Gymnocarpium dryopteris*	GYMN	DRY
Old Man's Whiskers	*Geum triflorum*	GEUM	TRI
One-Sided Wintergreen	*Orthilia secunda*	ORTH	SEC
Ox-eye Daisy	*Chrysanthemum leucanthemum*	CHRY	LEU
Paintbrush	*Castilleja species*	CAST	SP
Pale Coralroot	*Corallorhiza trifida*	CORA	TRI
Pale False Dandelion	*Agoseris glauca*	AGOS	GLA
Palmate-leaved Coltsfoot	*Petasites palmatus*	PETA	PAL
Pasture Sage	*Artemisia frigida v.*	ARTE	FRI
Pearly Everlasting	*Anaphalis margaritacea*	ANAP	MAR
Peavine	*Lathyrus venosus*	LATH	VEN
Perennia lupine	*Lupinus argenteus*	LUPI	ARG
Perennial sow thistle	*Sonchus arvensis*	SONC	ARV
Pink/Pale Corydalis	*Corydalis sempervirens*	CORY	SEM
Pink Wintergreen	*Pyrola asarifolia*		
Plains Wormwood	*Artemisia campestris*	ARTE	CAM
Prairie Groundsel	*Senecio canus*	SENE	CAN
Prairie Selaginella	*Selaginella densa*	SELA	DEN
Prickly Saxifrage	*Saxifraga bronchialis*	SAXI	BRO
Purple or Water Avens	*Geum rivale*	GEUM	RIV
Pussytoes Species	*Antennaria species*	ANTE	SP
Racemose Everlasting	*Antennaria racemosa*	ANTE	RAC
Raspberry Species	*Rubus species*	RUBU	SP
Rattlesnake Plantain	*Goodyera repens*	GOOD	REP
Red Baneberry	*Actaea rubra*	ACTA	RUB
Red Clover	*Trifolium pratenseq*	TRIF	PRA
Red Indian Paintbrush	*Castilleja miniata*	CAST	MIN
Richardson Geranium	*Geranium richardsonii*	GERA	RIC
Rossy Pussytoes	*Antennaria microphylla*	ANTE	MIC
Rosy Everlasting	*Antennaria rosea*	ANTE	ROS
Round-leaved Orchid	*Orchis rotundifolia*	ORCH	ROT
Round-leaved Orchid	*Habenaria orbiculata*	HABE	ORB
Running Clubmoss	*Lycopodium Clavatum*	LYCO	CLA
Rush Aster	*Aster junciformis*	ASTE	JUN
Sarsparilla	*Aralia nudicaulis*	ARAL	NUD
Shooting Star	*Dodecatheon radicatum*	DODE	RAD
Showy Aster	*Aster conspicuous*	ASTE	CON
Showy Everlasting	*Antennaria pulcherrima*	ANTE	PUL
Showy Locoweed	*Oxytropis splendens*	OXYT	SPL
Skullcap	*Scutellaria galericulata*	SCUT	GAL
Slender Blue Beardtongue	*Penstemon procerus*	PENS	PRO
Small Flowered Paintbrush	*Castilleja parviflora*	CAST	PAR
Smooth Aster	*Aster laevis*	ASTE	LAE
Sow thistle	*Sonchus species*	SONC	SP
Spike Like Goldenrod	*Solidago spathulata*	SOLI	SPA

Common Name	Latin Name	Genus Code	Species Code
Spiny Woodfern	*Dryopteris expansa*	DRYO	EXP
Spotted Coralroot	*Corallorhiza maculata*	CORA	MAC
Spreading Dogbane	*Apocynum androsaemifolium*	APOC	AND
Spurred Gentian	*Halenia deflexa*	HALE	DEF
Star-flowered Solomon Seal	*Smilacina stellata*	SMIL	STE
Starwort species	*Stellaria species*	STEL	SP
Sticky purple geranium	*Geranium viscosissimum*	GERA	VIS
Stiff Club-Moss	*Lycopodium annotinum*	LYCO	ANN
Stream bank butterweed	*Senecio pseudaureus*	SENE	PSE
Sweet Cicely	*Osmorhiza depauporata*	OSMO	DEP
Sweet-Scented Bedstraw	*Galium triflorum*	GALI	TRI
Tall buttercup	*Ranunculus acris*	RANU	ACR
Tall Larkspur	*Delphinium glaucum*	DELP	GLA
Tall Mertensia, Lungwort	*Mertensia paniculata*	MERT	PAN
Thistle Species	*Cirsium species*	CIRS	SP
Three-leaved Solomon Seal	*Smilacina trifolia*	SMIL	TRI
Twinflower	*Linnaea borealis*	LINN	BOR
Twisted Stalk	*Streptopus amplexifolius*	STRE	AMP
Variegated Horsetail	*Equisetum varriegatum*	EWUI	VAR
Veniny Meadow Rue	*Thalictrum venulosum*	THAL	VEN
Venus' Slipper	*Calypso bulbosa*	CALY	BUL
Veronica Species	*Veronica species*	VERO	SP
Vetch	*Vicia americana*	VICI	AME
Violet	*Viola species*	VIOL	SPP
Water Hemlock	*Cicuta maculata*	CICU	MAC
Western Bistort	*Polygonum bistortoides*	POLY	BIS
Western Canada Violet	*Viola rugulosa*	VIOL	RUG
Western Dock	*Rumex occidentalis v. fenestratus*	RUME	OCC
Western Twayblade	*Listera borealis*	LIST	BOR
Western Wood Lily	*Lilium philadelphicum*	LILI	PHI
White Cinquefoil	*Potentilla arguta*	POTE	ARG
White Clover	*Trifolium repens*	TRIF	REP
White Hawkweed	*Hieracium albiflorum*	HIER	ALB
White sweet clover	*Melilotus alba*	MELI	ALB
White Thistle	*Cirsium hookerianum*	CIRS	HOO
Wild Blue Flax	*Linum lewisii*	LINU	LEW
Wild Daisy	*Erigeron glabellus*	ERIG	GLA
Wild Lily-of-the-Valley	*Maianthemum canadense*	MAI	CAN
Wild Sarasparilla	*Aralia nudicaulis*	ARAL	NUD
Wild Strawberry	*Fragaria virginiana*	FRAG	VIR
Wild Vetch	*Vicia americana*	VICI	AME
Windflower, Cutleaf Anemone	*Anemone multifida*	ANEM	MUL
Wintergreen	*Pyrola species*	PYRO	SP
Wondering Daisy	*Erigeron peregrinus v. callianthemus*	ERIG	PER
Woodland Horsetail	*Equisetum sylvaticum*	EQUI	SYL
Yarrow	*Achillea sibirica*	ACHI	SIB
Yarrow Species	*Achillea species*	ACHI	SP
Yellow Avens	*Geum aleppicum*	GEUM	ALE
Yellow Avens	*Geum macrophyllum*	GEUM	MAC
Yellow Columbine	*Aquilegia flavescens*	AQUI	FLA
Yellow Corydalis	*Corydalis aurea*	CORY	AUR
Yellow Rattle	*Rhinanthus minor*	RHIN	MIN
Yellow Rattle	*Rhinanthus cristagalli*	RHIN	CRI
Yellow sweet clover	*Melilotus officinalis*	MELI	OFF

Appendix IX

Mosses and Liverworts

APPENDIX IX

MOSSES, LICHENS AND LIVERWORTS

Common Name	Latin Name	Genus Code	Species Code
	Bryoria fremontii	BRYO	FRE
	Bryoria fuscescens	BRYO	FUS
	Cetraria cucullata	CETR	CUC
	Cetraria ericetorum	CETR	ERI
	Cetraria halei	CETR	HAL
	Cetraria islandica	CETR	ISL
	Cetraria nivalis	CETR	NIV
	Cetraria pinastri	CETR	PIN
	Cladonia botrytes	CLAD	BOT
	Cladonia carneola	CLAD	CAR
	Cladonia cenotea	CLAD	CEN
	Cladonia chlorophaea	CLAD	CHL
	Cladonia coccifera	CLAD	COC
	Cladonia coniocraea	CLAD	CON
	Cladonia cornuta	CLAD	COR
	Cladonia deformis	CLAD	DEF
	Cladonia ecmocyna	CLAD	ECM
	Cladonia fimbriata	CLAD	FIM
	Cladonia gracilis	CLAD	GRA
	Cladonia multiformis	CLAD	MIT
	Cladonia pleurota	CLAD	PLE
	Cladonia pyxidata	CLAD	PYX
	Cladonia rangiferina	CLAD	RAN
	Evernia mesomorpha	EVER	MES
	Peltigera aphthosa	PELT	APH
	Peltigera canina	PELT	CAN
	Peltigera malacea	PELT	MAL
	Peltigera polydactyla	PELT	POL
	Platismatia glauca	PLAT	GLA
	Ramalina fastigiata	RAMA	FAS
	Ramalina pollinaria	RAMA	POL
	Ramalina thrausta	RAMA	THR
	Stereocaulon tomentosum	STER	TOM
	Usnea glabrescens	USNE	GLA
	Usnea hirta	USNE	HIR
	Usnea sorediifera	USNE	SOR
	Usnea species	USNE	SP
	Usnea subfloridana	USNE	SUB
Brown Moss	*Drepanocladus uncinatus*	DREP	UNC
Cladonia Species	*Cladonia Species*	CLAD	SPP
Common Red Sphagnum	*Sphagnum capillaceum*	SPHA	CAP
Coral lichen	*Stereocaulon tomentosum*	STER	TOM
Dicranium Mosses	*Dicranum acutifolium*	DICR	ACU
Dog Lichens	*Peltigera Spp.*	PELT	SPP
Fire Moss	*Ceratodon purpureus*	CERA	PUR
Glow Moss	*Aulacomnium species*	AULA	SP
Glow Moss	*Aulacomnium palustre*	AULA	PAL
Golden Moss	*Tomenthypnum nitens*	TOME	NIT
Juniper Haircap Moss	*Polytrichum commune*	POLY	COM
Knight's Plume	*Ptilium crista-castrensis*	PTIL	CRI
Leafy mosses	*Mnium species*	MINU	SP
Liverwort	*Barbilophozia hatcheri*	BARB	HAT
Peat Moss	*Sphagnum angustifolium*	SPHA	ANG

Common Name	Latin Name	Genus Code	Species Code
Ragged Mosses	*Brachythecium Species*	BRAC	SPP
Reindeer Lichen	*Cladina Spp.*	CLAD	MIT
Schreber's Moss, Feathermoss	*Pleurozium schreberi*	PLEU	SCH
Short-leaved Ragged Moss	*Brachythecium oedipum*	BRAC	OED
Stair Step Moss	*Hylocomium splendens*	HYLO	SPL
Stiff-leaved Polytrichum	*Polytrichum alpinum*	POLY	ALP
Wolf Lichen	*Letharia vulpina*	LETH	VUL

Appendix X

Condition Code List

APPENDIX X

CONDITION CODE LIST

Condition codes are recorded in the following priority (i.e. a tree may actually have 5 conditions yet there is only room to record 3, so the codes are recorded in order of priority). Record the remaining codes in the comments section on the tally sheet.

Note: Plots established in Mountain pine beetle areas have special codes.

00	-	Healthy	45	Other mammalian/avian evidence
01	-	Insects	51	Conks/Blind Conks
02	-	Disease	52	Open Scars
03	-	Rabbit browsing	53	Burls and Galls
04	-	Sheperds Crook	54	Fork
05	-	Browsing (Other)	55	Pronounced Crook
06	-	Fire	56	Broken Top (<=10cm DIB at Break, DBH >9.1)(NO CC)
07	-	Mechanical	57	Limby
08	-	Windthrow	58	Leaning (DBH>9.1cm + if severe NO CC)
09	-	Climate	59	Broken Stem (>=10cm DIB at Break)(NO CC)
10	-	Flooding	60	Generic woodpecker feeding
11	-	Poor planting	61	Dead and Down (NO CC) (DBH>9.1 cm)
12	-	Suppression	62	Stem Insects
13	-	Frost Heaving	63	Stem Disease
14	-	Erosion	64	Foliar Insects
15	-	Missing	65	Foliar Disease (Needle blights + rusts)
16	-	Dead Top/Dieback	66	Stem Form Defect (>=7.0cm DIB at point where stem form begins)
17	-	Poor Seedbed		
18	-	Herbicide	67	Closed Scars
19	-	Western Gall Rust (only on Pine)	68	Atropellis canker
20	-	Armillaria root rot	69	Comandra Blister Rust
21	-	Moldy Planting Stock	70	Elytroderma needle cost of pine
22	-	Multiple Leader	71	Hypoxylon Canker
23	-	Poor Form	72	Spruce cone Rust
24	-	Broken Top (New or Old)	73	Stalactiform Blister Rust
25	-	Dead & Standing (NO CC)	74	Tomentosus Root Rot
26	-	Snow Press	75	Spruce Spanworm
27	-	Dead Top Dieback with NEW Leader	76	Cone Maggot
28	-	Sucker(s) from OLD Stump	77	Coneworm
29	-	Cutdown	78	Eastern Spruce Budworm
30	-	Terminal Weevil	79	Mountain Pine Beetle
31	-	SW Gall Aphid	80	Spruce Beetle
32	-	Tent Caterpillar	81	Spruce Needle Budworm
33	-	Root Collar Weevil	82	Yellow Headed spruce Sawfly
34	-	J-Root	83	Large Aspen Tortrix
35	-	Leaning	84	Excavations by woodpeckers
36	-	Same Stump	85	Yellow-bellied sapsucker feeding
37	-	Unknown	86	Small mammal feeding on tree bole
38	-	Pitch Moth	87	Small Cavity
39	-	DBH Taken on New Leader	88	Large Cavity
40	-	Nutrient Deficiency	89	Hollow tree or hollow bole section
41	-	Mouse (feeding)	90	Beaver (feeding/harvesting)
42	-	Ungulate feeding/rubbing	91	Mistletoe Rating System
43	-	Domestic livestock (rubbing	96	Data changed by office
44	-	Nest	98	Do not look for tree
			99	

Appendix XI

Condition Code Definition

APPENDIX XI

CONDITION CODE DEFINITION

Code	Category	Description
00		Healthy – No defect.
01	Insects	Damage or mortality due to destruction of plant parts or tissue by insects. Look for evidence of eggs, egg cases, nests, chewed plant parts, etc. Similar signs on plants located off site may aid in identification of insect mortality.
02	Disease	Damage or mortality caused by disease or fungi. Cankers, discoloration, rust spotting, fungal coverings, etc. help to identify mortality under this code.
03	Rabbit Browsing	Trees killed or damaged by rabbits can be identified by clean, sharp cut marks along the branches and stems (approximately 45^0 angles). Chewed bark and needles also indicate rabbit damage.
04	Shepherd's Crook	Damage results in blackening and wilting of young shoots and leaves. Tips of the blackened shoots often bend back. On older leaves brownish black, irregularly shaped spots appear.
05	Browsing (other animals)	Mortality or damage due to browsing by ungulates or other animals (e.g. moose, cattle, beavers. Look for chewed tops with rough cuts or breaks.
06	Fire	Mortality or damage due to actual burning of the seedling or scorching by nearby flames. Not to be used when seedlings are killed by sun scald.
07	Mechanical	Trees killed or damaged by mechanical or physical means such as scarification machinery, trampling or crushing by animals, etc. Stem scars and rough breakage help to identify mortality under this code.
08	Windthrow	Damage or mortality due to crushing by fallen or displaced logs, snags, branches, uprooted trees, etc.
09	Climate	Trees damaged or killed solely by climatic factors. These include death by freezing, sun scald, severe desiccation, ice accumulation, red belt, etc.
10	Flooding	Trees damaged or killed by drowning alone. Look for evidence of high water marks on the seedling, or in the immediate area. Pull tree out of ground and check roots to see if the root outer coverings is falling off and is blackened.
12	Suppression	Trees which have been suppressed by the surrounding vegetation for a period of time long enough to damage or kill them. Mortality may be due to severe lack of light, water, nutrients (removed by the competition) or by physical smothering (i.e. heavy grasses). Reference to the previous year's damage tally may help in determining this mortality call. A tree that is over topped by grass or shrubs is not necessarily suppressed. Look for a spindly main stem with very few low needles spaced wide apart or evaluate the last five increments. If the tree has only brown 1 cm a year, it is probably suppressed.
13	Frost Heaving	This code is used only when mechanical frost action can be clearly identified as the direct cause of damage or mortality. Usually upheaval and separation of the seedling's root system from the soil occurs as a result of ice lense formation. This is most commonly associated with containerized seedlings planted in silty soil.
14	Erosion	Damage or mortality due to the removal of the seedling's seedbed, by the forces of water, wind or soil slumping. Trees killed by partial or total burial (deposited soil or organic matter) would also be tallied using this code.
15	Missing	This code is to be used when a seedling from the previous year's measurement cannot be located. It can also be used where the seedling was removed from the site and probably died (i.e. tag found, no morphological signs of live seedling remaining). Using in conjunction with Code 25 ONLY.

Code	Category	Description
16	Dead top/Dieback	Top is dead (die back) without any indication of insect or climate (frost damage.
17	Poor Seedbed	This code is to be used only when the cause of death or damage for a seedling can be traced to the type of seedbed on which it is growing. In most cases the seedling will show signs of desiccation due to the poor moisture holding capacity of the seedbed material (e.g. rotten logs, dry clay).
18	Herbicide	Should only be used when the cutblock (or parts of the cutblock) has received a recent herbicide treatment; either before or after the stock was in place. Spruce seedlings exhibit needle loss and/or reddish brown coloration of stems and foliage. Deciduous species exhibit yellowish/brown leaf mottling and die-back of terminal growth. Hexazinone causes reddish brown coloration of conifer foliage and needle loss. Deciduous foliage turns red to black. Glypho-sate causes chlorosis especially in new grown shoots. 2, 4-D causes rapid growth and spiraling and twisting. If applied during conifer flush bad dieback similar to frost damage may occur. Often chemical damage will also be indicated by phytotoxicity spotting on exposed foliage.
19	Western Gall Rust (only in Pine)	This code is used when Lodgepole pine damage or death can be attributed to Western Gall Rust. This is usually clearly identifiable due to swelling of succulent tissue (and subsequent formation of a gall). This gall can be on the main stem or a lateral branch.
20	Armillaria Root Rot	This code is utilized when a seedling is damaged or killed by Armillaria Root Rot. Identification of the disease is in recognizing mycelia fans of the cambium of damaged and dead trees. Pull tree out of ground and examine root collar.
21	Moldy Planting Stock	This code is usually used on Bareroot Planting Stock. Grey mold will usually be found around the root collar and lower branches.
22	Multiple Leader	This damage code is commonly used on planted stock. When a tree has two or more leaders, but is otherwise healthy this code should be entered. The tree is considered multiple leaders if all leaders are within 5 cms (height) of each other. This code also applies to saplings and regeneration that appear forked. Be aware of normal branching of deciduous.
23	Poor Form	This code is used on trees which exhibit a general poor form, due to previous damage. It is commonly used with Advanced stock which was damaged by scarification activity.
24	Broken Top (New or Old)	It should be used as long as the broken top is noticeable and has some effect on the growth of the tree.
25	Dead Tree/Standing	Tree has no signs of being alive. A standing dead tree is one that is dead but still standing. No green foliage or buds present. The tree must be able to withstand a firm push. Record a diameter and species but do not record height. Pound nail into tree. No crown class.
26	Snow Press	This code is normally used for trees that show signs of being pressed down to the ground for a few years after germinating or being planted.
27	Dead Top Dieback with New Leader	This refers to stems that have had previous leader damage and a new leader has formed.
28	Sucker(s) (From Old Stump)	Refers to stems that have been cut-down through thinning and have started to sucker. Do not re-use the previous stem number, but assign a new number to each sucker. MDFP special use for single sprouts, for multiple sprouts use Code 36.
29	Cutdown	Self-explanatory.
30	Terminal Weevil	Terminal leaders of Pine or Spruce bend over and die. Two or more years

Code	Category	Description
		growth are affected. Bore Holes which are exit holes for the larvae MUST be present to use this code.
31	Spruce Gall Aphid	Galls located at the end of a new growth and may persist for many years.
Code	Category	Description
32	Forest Tent Caterpillar	A tent of a silk forms on the tree and the caterpillars defoliate the tree.
33	Root Collar Weevil	This weevil feeds mainly on Sw, Pj and Pl. They feed in the bark and cambial area of the host tree at or below the duff surface, causing copious flows of resin. The tunnels often girdle small trees. This insect allows root rots to enter the tree.
34	J-Root	This code is used after the tree has had a poor planting code in the previous measurement.
35	Leaning	Tree leaning more than 20% off of vertical axis.
36	Same Stump	Used when 2 or more trees can be distinguished above ground level but below DBH. Used a lot on Deciduous that have been cut down and re-sprouted at stump. MDFP special use for multiple sprouts, for single sprouts use Code 28. Multiple sprouts should be numbered successively for remeasurement ease.
37	Unknown	This condition code is to be used only when there appears to be something affecting the tree but the other condition codes do not describe the situation. This would include burnt trees etc. A description of what is affecting the tree should be included as well in the comments column. In the event that this code is used for more than 5% of the tallies, it is up to the crew leader or a forester to decide on the cause of the condition.
38	Pitch Moth	Primary host is Lodgepole Pine. May weaken or kill the terminal leader, resulting in stem deformities and height growth reduction. Blisters are mainly on main stem and are characteristic resin coated up to 20 mm in diameter.
39	DBH Taken on New Leader	
40	Nutrient Deficiency	This may occur on blocks that have had the humus layer removed by scarification (i.e., Blade). Trees are chlorotic and usually in bare mineral soil. Usually noted on spruce. May be confused with flooding damage.
41	Mouse (feeding)	Mice and voles can girdle seedlings and consume seeds. See Rangen and Roy (1997) for more detail.
42	Ungulate feeding/ rubbing	Ungulate feeding on twigs is generally recognized by the ragged appearance of twig terminals. Rubbing of trees as antler rubs and feeding on bark also occurs; these conditions are further described in Rangen and Roy (1997). Antler rubs can also be associated with "scrapes" (small patches of scraped ground) and small tufts of hair on twigs. If the bark on aspen trees has been consumed ensure that ungulates (as opposed to other mammals) are responsible. The extent of the bitten area, track identity and grooves that indicate tooth-size and pattern should all be inspected in order to differentiate ungulate bark feeding from similar feeding by small mammals (i.e. see code number 86 and applicable photograph).
43	Nest	This code indicates the presence of a nest on a given tree in the PSP. It reers only to an "open" nest; cavity nests are excluded from this category as it is difficult to ascertain if a given cavity is indeed used as a nest site. Field guides that assist with the identification of "open" nests are available (see Harrison 1979). Of particular importance are colonial complexes of large nests on islands in lakes. Mammalian nests also exist and should be indicated as such

Code	Category	Description
		if this is known. To do this use the comments section which applies to a given tree and indicate as required. If the occupants of the nest can be identified, the identity can also be entered in the comments section.
45	Other mammalian/avian Evidence	Other agents (i.e. bears, grouse, shrew, pocket gophers) which leave evidence on trees or leave evidence closely associated with trees are described in Rangen and Roy (1997). Pocket gophers leave soil mounds (Rangen and Roy 1997). Bears can leave a characteristic series of claw marks on aspen trees, indicating that the tree was scaled, and rotted stumps/logs are also occasionally ripped apart. In addition, it has been suggested that bark on live trees is occasionally consumed (see Hiratsuka 1987 for a depiction). Ensure that ripped up stumps/logs, etc., are accom-panied by other evidence of bear.
51	Conk/Blind Conk	Conks appear most frequently on the underside of dead branch stubs or on the underside of live branches in the crown. Conks, by definition, are woody, shelflike basidiocarps (fruiting bodies) of wood-rotting fungi.
52	Open Scars	Open scars are wounds which have been penetrated through to the cambium. These wounds must not be healed over and may be caused by a variety of reasons such as fire, lightning, old blazing, machinery, animals, etc. Scars are considered to be entry points for decay fungi. Open scars are illustrated in Figure 6.5. Animal damage usual usually penetrates the cambium therefore code as an open scar. A common mistake is to call stem disease such as atropellis canker an open scar.
53	Burls and Galls	Burls are abnormal swelling of the main stem or branches resulting from abnormal wood cell development following disturbance to the cambial layer. A burl is illustrated in Figure 6.6. Galls are localized trunk and branch swelling of mainly tissue. There is little or no damage to the underlying wood. Do not mistake western gall aphid for a gall, it is a foliar insect.
54	Fork	Forks usually develop when there is malformation, injury or death of the terminal leader. Forks tend to be V-shaped and will only be recorded when above 1.3 m (DBH level). Forks below this point are recorded as same stump (condition code 28). Natural branching on deciduous trees is not to be recorded. Figure 6.7 demonstrates the difference between forks and natural branching.
55	Pronounced Crook	This condition develops from the death of the terminal leader or the breaking off of a forked leader. When this occurs a lateral branch takes over apical dominance as shown in Figure 6.8
56	Broken Top DBH> 9.1 cm	Broken tops are recorded when the tree bole is less than 10 cm DIB (diameter inside bark) at the brea. No Crown Class.
57	Limby	A tree is recorded as limby if more than 75% of the tree has live, low sweeping branches. In general, if the majority of the trees in a plot are limby then this code is not recorded.
58	Leaning	A tree is considered leaning if it is standing greater than 20o off of vertical (see Figure 6.9). If the angle is greater than 45o to the ground, the tree has a severe lean. No crown class if severe.
59	Broken Stem	A broken stem is recorded if the tree bole is greater than 10 cm DIB at the break. No crown class.
60	Generic Wood-pecker Feeding (often smaller species)	Figure 6.19 also indicates feeding by woodpeckers. Species such as the Black-backed woodpecker and three-toed woodpeckers will often leave signs like this on old coniferous trees, and Hairy and Downy woodpeckers typically peel off scales ("scale") and "peck" the bark as do Pileated woodpeckers in

Code	Category	Description
		summer months (Conner 1979). Note the evidence of very small holes (arthropods) and holes made by the woodpeckers themselves. The appearance of tree trunks fed on in this manner is often reddish from a distance.
61	Dead or Down	A dead and down tree is one that was previously tagged and measured in a PSP plot but at the present time is now dead and no longer standing. The cause of death must be by natural causes (i.e. windfall, beavers, insect or disease, etc.). No crown class. For trees > 9.1 cm DBH.
62	Stem Insects	This code is recorded when there is evidence of an insect infestation attacking the bole of the tree. Bark beetles are the most prevalent stem insects but sawyer beetles and others are included. Bark beetles, Dendroctonus spp., are a very serious problem in Alberta. The adult female enters the bark in early summer and lays eggs in the tree's cambium. The eggs overwinter and hatch as larvae in the early spring. Damage to the tree is done by the larvae eating the cambium and usually results in death. The tree will not turn red until the next summer. Other symptoms of attack are piles of "sawdust" (frass) at the base of the tree, entry holes in the bark, and pitch tubes (the tree tries to push the beetles out with resin). The beetles also carry a blue stain that causes further deterioration of wood quality. Beetles attack all species of pines, spruce and Douglas-fir. Sawyer beetle infestations are common in burned timber.
63	Stem Disease	All diseases that infect the main stem are documented with this code. Included in this code are cankers, rusts, rotten branches and root rot. Stem cankers are caused by fungi that invade stems and branches resulting in localized areas of infection in the bark and underlying wood tissue. Cankers may be annual or perennail. In perennail cankers the infected area may be eventually exposed to the underlying wood when the deadbark sloughs off. A common stem canker on lodgepole pine is Atropellis piniphila (Figure 6.10). Exudation of resin from the bark surface is the first external symptom. They are sunken elongated on one side of the trunk and indicate resin flow. This can cause a distortion in growth and a blue-black stain on the wood. Stem rusts are also included in this condition code. Rusts are host specific parasitic fungi usually requiring two alternating living hosts. Stems and branches may be girdled resulting in large malformations or even death. In particular, Endrocronartium harknessii on young pines is a serious problem in Alberta. Spruce broom rust, Chrysomyxa arctostaphi (see Figure 6.11, can also be noted but only if the broom is no longer green (i.e. red or missing needles).
75	Spruce Spanworm	Chiefly affects aspen. Damage shows mostly as holes in the leaves. Resembles forest ten caterillar but no pupal cases or egg masses on the foliage. Caterpillars are typically light green and have one prominent and two indistinct yellowish lines along each side of the body. The head is dark-brown.
76	Spruce Cone Maggot	No external symptoms. Dissected cone shows frass-filled spiral tunnel around the central axis.
77	Spruce Cone Worm	Feeding larvae expel frass which adheres to silken webbing on cone surface.
78	Eastern Spruce Budworm	First symptoms are webbing and frass in buds or on previous year's needles. Later, webbing is spun on branch tips. By late June tree crowns appear rust brown.
79	Mountain Pine Beetle	Main host is Pl. Symptoms are standing dead trees with beetle exit boles about eye-level. Accumulations of pitch or sawdust are conspicuous around entrance holes bored into the bark of trees by adult beetles from mid-July to

Code	Category	Description
		mid-August.
80	Spruce Beetle	Host are Sw and Se. Symptoms are standing dead trees with beetle exit holes about eye-level. Conspicuous boring dust accumulates on bark below holes until the bind blows it away.
81	Yellow-headed Spruce	Feed on needles in the upper crown of the tree. Partly chewed needles and needle stubs impart a brownish colour and ragged appearance to the foliage. No webbing present. Found on all spruce.
82	Spruce Beetle Rust	Discoloration of needles. May find dotlike sexual fruiting structures on needles. Infected needles drop prematurely.
83	Large Aspen Torgrix	Affected foliage has a clumped, irregular appearance and leaves do not move as freely in the wind as uninfested leaves. Larval instars feed within rolled leaves or within 2 or more leaves pulled together and secured with silken webbing.
84	Excavations by wood- Peckers likely (Pileated woodpecker)	Feeding by Pileated woodpecker can occur on dead or scenescent deciduous and coniferous trees, and feeding holes (as indicated in the figures below) are thought to occur towards the base of the tree (Rangen and Roy 1997). Excavated holes indicate subcambial penetration (holes penetrate beneath the bark and into the sapwood) and large woodchips can be associated with excavations. Excavated feeding holes can be large (Figure 6.22). In such excavations, evidence of carpenter ants (burrows, sawdust) or other boring arthropods might also be found in the sapwood. In living trees with a sound bole, initial feeding holes might be more restricted such as that indicated in Figure 6.22. Elsewhere in North America, the Pileated woodpecker has been found to excavate holes extensively in winter and to a greater extent that other woodpeckers (Conner 1979). The Hairy woodpecker might also create deeper holes in trees, however, it is considered an opportunistic feeder (Sousa 1987) and spends a smaller portion of its time "excavating" during winter months (Conner 1979). In Iowa, it has also been found to generally feed at higher locations in trees (5-7m) (Sousa 1987). If this feeding evidence exists on a given tree, indicate in comments its extent (i.e. restricted, such as in Figure 6.22).
85	Yellow-bellied sapsucker feeding	Figure 6.20 illustrates the characteristic pattern of regularly spaced small holes left by Yellow-bellied sapsucker (also see Hiratsuka 1987 for another depiction of sapsucker feeding). These are often found on birch, however they also have been observed on willows, and have been reported on aspen and pine (Rangan and Roy 1997, Hiratsuka 1987).
86	Small mammal feeding on Tree bole (hare, porcu- Pine, squirrel, bushy- tailed woodrat	Figure 6.2 is an example of feeding by hare on small saplings. In this case the bark was bitten off. When hares feed on twigs, it is generally thought that twigs are clipped off in a characteristics razored fashion (Figure 106, Rangen and Roy, 1997). Small mammals such as porcupine, woodrat and squirrel might also feed on bark in a manner similar to that in Figures 6.21; however, if such feeding evidence occurs high in trees, one could probably rule out hare because hare do not climb trees (also see Hiratsuka 1987 for a depiction of porcupine feeding on pine). Ensure other evidence (i.e. tracks, pellets, etc.) Supports a specific determination of the agent involved. Also, refer to Rangen and Roy (1997) for more information on how to identify the specific causes of girdling and refer to Murie (1975) for assistance on identifying tracks if this is required. Evidence of squirrel feeding is common and could also be indicated, however, the value of this information is probably less valuable.
	Small Cavity	Small woodpeckers create small cavities (approximately 5 cm in diameter) in snags and stubs (Figure 6.23), however, height of the cavity above ground probably varies. Among the species which might use such cavities are smaller

Code	Category	Description
		woodpeckers, kestrel, chickadee, nuthatch, swallow, wren, flycatchers, and small mammals (etc.). One could explore whether such cavities are occupied by rubbing the bark with a stick. Should a cavity be occupied the occupant (is known) should be identified in the comments section.
88	Large Cavity	A large cavity is a round/excavated opening greater than or equal to 10 cm in diameter (see Figure 6.24 for an example). The cavity in the figure was approximately 15 m high. Pileated woodpeckers have been known to excavate such cavities, however, a variety of species (birds as well as mammals) may use them as nest sites, roosting sites or dens. As in the case of smaller cavities, one could investigate the identity of the occupant by rubbing/tapping the bark of such trees with a stick. It might be possible to ascertain the identity of the tracks which are associated with the cavity, during winter, by checking surrounding snow cover and identifying tracks that appear to lead towards the cavity in the tree (see Murie 1975).
89	Hollow tree or hollow bole section	Hollow trees can be used as denning sites by bats and other birds and mammals. This condition code should be used to identify these sites.
90	Beaver (feeding/ harvesting)	Beaver girdle large trees in a characteristic fashion and evidence of their harvesting activities (i.e. cone shapped stumps) are well known to many. Refer to Rangen and Roy (1997) and Hiratsuka (1987) for more details.
91-96		Dwarf mistletoe is a parasitic flowering plant that requires a living host. Mistletoe is usually recognized by swellings on branches and stems or by witches brooms. Heavy infestation makes trees susceptible to secondary attack (such as bark beetles), lower wood quality and growth losses (can be from 30-60%). The major tree hosts in Alberta are lodgepole pine, Douglas-fir and larch.
98	Data changed by office	
99	Do not look for tree	

Appendix XII

Height Measurements Using a Clinometer

APPENDIX XII

HEIGHT MEASUREMENTS USING A CLINOMETER

The height of a tree is defined as the length between the point of germination (or at the point on the stem where the roots emerge) the tip of the terminal leader. Heights are measured using a clinometer (with a percent scale) and a 30 or 50 m measuring tape. Tree height calculations must be completed on the reverse side of the Tally Sheet (XX) and transferred to appropriate sheet (XX). All data fields are required except:

a) Only slope distance and slope % or horizontal distance is used.

b) Correction factor is only used when the bottom % reading is recorded at a different reference point other than the germination point i.e. DBH height = 1.3 m.

c) Check cruise height columns are not to be used by field crew members. This space is only filled in if there has been an actual check cruise completed.

Do not measure the height of standing dead trees. Do not measure height on dead and down trees.

All height trees (measured with a clinometer) must be marked at breast height with fluorescent orange geo-flagging tape. As well, a blue painted dot facing the direction in which the cruiser completed the height measurement shall be put on each height tree. The dot should be no larger than 5 cm in diameter and must be located between .75 m – 1.0 m from the ground. Leave the flagging on the tree after the height has been taken.

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 CSTM 249. The space allocated for correction is used when a bottom percentage reading cannot be taken for the base of the tree and a know height (i.e. 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.

It is very important that field crews understand the process of measuring heights so that data is calculated correctly.

At a distance far enough away from the tree to keep the clinometer scale below 100%, take readings for the top % of the tree (tip of the terminal leader), top % to live crown and the bottom % of the tree (germination point). This may be difficult for deciduous trees as the top of the tree may not be visible through the crown. The slope of the ground must also be measured and recorded if it is greater than 10%.

During measurement, if the present height is shorter than the past height then a second height must be taken and recorded on the tally sheet directly below the previous measurement. It is advised that the horizontal distance be increased 5 to 10 metres before taking the second reading. It will be up to the cruisers discretion to decide which is the correct height data to be used. Put a line through the height information that is not used –

never erase height information. On the front of the tally sheet record in comments ✓✓ **HT** to indicate that the height was double-checked in the field.

If live crown height is measured using a metric tape instead of a clinometer, record on the front of the tally sheet in the comments section "height to L.C. measured directly".

Also record the slope and slope distance or horizontal distance to the tree to calculate the tree height, to the nearest 0.1 m, use the following formula:

$$\text{Slope Distance} * \text{Slope Correction Factor} * \frac{\text{Top reading \% - Bottom reading \%}}{100\%} = \text{Tree height (m)}$$

OR

$$\text{Horizontal Distance} * \frac{\text{Top reading \% - Bottom reading \%}}{100\%} = \text{Tree height (m)}$$

For example, a tree is 22.8 m away on a slope of 15%. The clinometer readings are +80% and +12%. Therefore, the tree is:

$$22.8 \text{ m} * 0.989^{*} \frac{+80 - (+12)}{100} = 22.55 * 0.68 = 15.33 = 15.3 \text{ m}$$

**Obtained from table in Appendix XVII*

If slope was less than 10%, then the tree is:

$$22.8 \text{ m} * \frac{+80 - (+12)}{100} = 22.8 * 0.68 = 15.5 \text{ m}$$

There are times when the germination point cannot be seen. In this situation, breast height is often used for the bottom % reading and a correction factor of 1.3 m is added onto the calculated total height.

Trees with a lean that require a height measurement should have the slope readings taken from a location perpendicular to the lean as shown in Figure 6.2. This will prevent an erroneous measurement that could result in a shorter or taller tree because of the lean.

If at all possible, all height measurements should be taken perpendicular to the slope.

Common errors made during tree height calculations are:

- Misreading ± signs
- Bottom % reading may either read as positive or negative numbers. Bottom % reading are always subtracted from the top reading regardless of the ± sign of the number, i.e. the top % is +90 and bottom % is –3 then:

  +90 – (-3) = 93

- if the bottom % reading was +3 then:

+90 – (+3) = 87

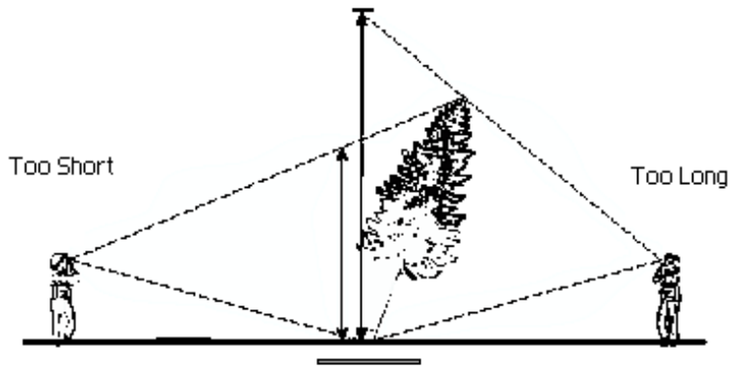
- Adding the correction factor at the wrong time:
- i.e. Top % % Bottom % Horizontal Distance Correction Factor

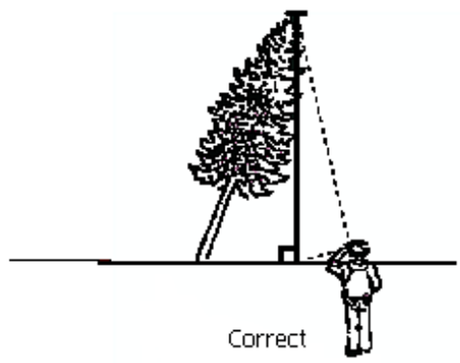
  +90 -3 20 +1.3

  Incorrect ([90 – (-3)] + 1.3) * .20 = 18.86 = 18.9

  Correct ([90 – (-3)] * .20) + 1.3 = 19.0 = 19.9

- Miscalculating total height through standard arithmetic errors. Refer to Appendix 6.8 for rounding off procedures.
- Total height information recorded with no calculations.
- <u>All</u> tree height calculations must be recorded for each sample tree in the space provided otherwise the data will be considered invalid and deleted.





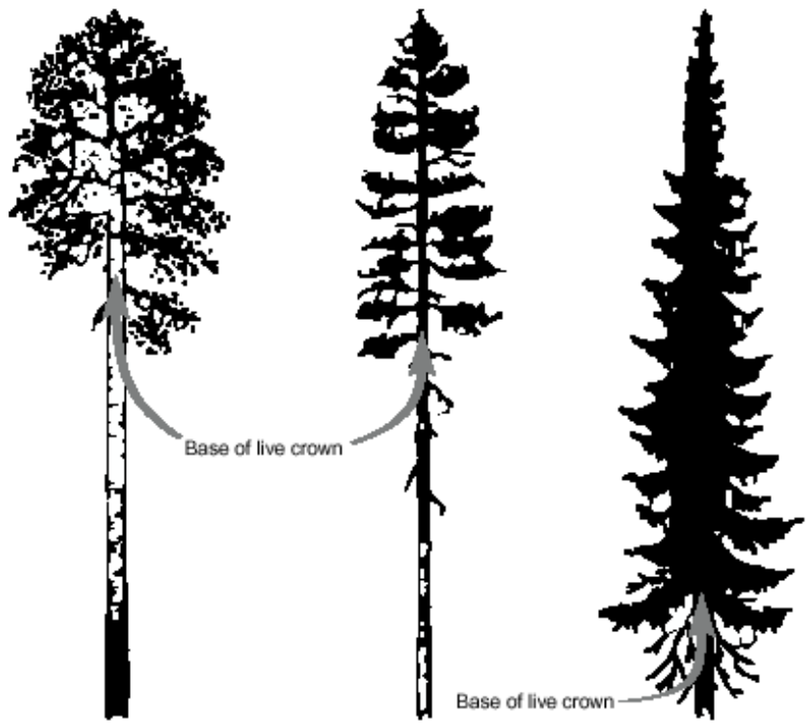
Appendix XIII

Height to Live Crown Base

APPENDIX XIII

HEIGHT TO LIVE CROWN BASE

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 live branch. Measure all heights to live crown from breast height to the base of the live crown and add 1.3 metres for total height to live crown.



Appendix XIV

Measuring DBH

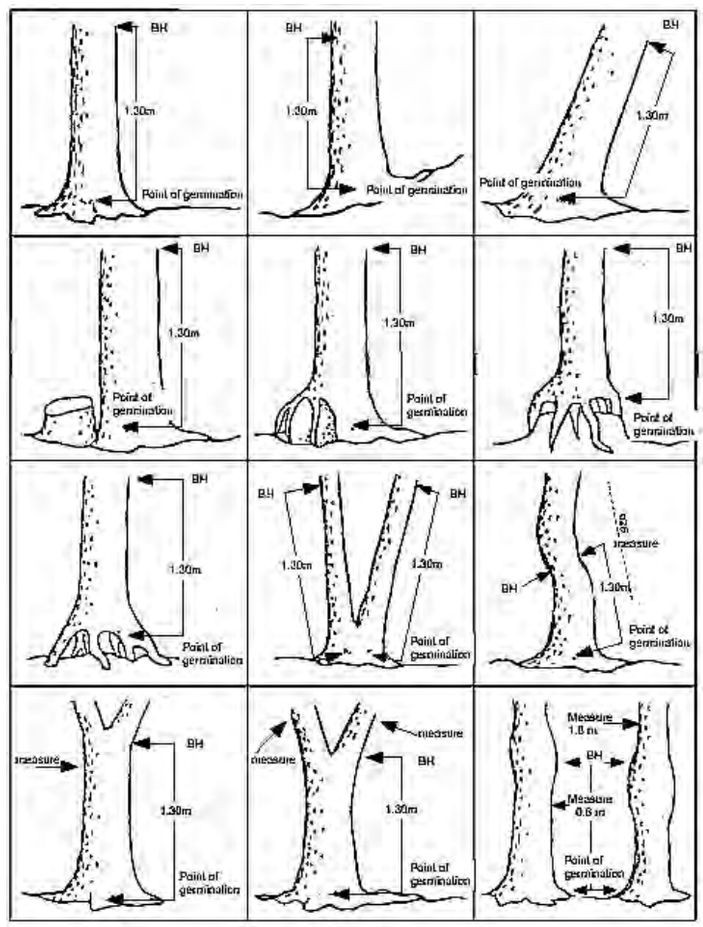
APPENDIX XIV

MEASURING DBH

Breast height is 1.3 metres from the point of germination.

Breast height is determined using a straight stick 1.3 m 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 or at the blue stripe unless there are large branches or swellings 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 on the tally sheet in the shaded comments section (e.g. DBH taken above swell).

Trees forked below 1.3 m are treated as <u>two</u> separate stems and are tagged and tallied as such.



Appendix XV

Access Codes

APPENDIX XV

ACCESS CODES

0	Inaccessible	Deemed by the crew to be inaccessible for safety reasons or plot centre falls with a secured area or private property.
1	All Weather Road	All roads in this category are paved or are well travelled gravel roads. These roads are well drained with little possibility of washing out or flooding in heavy rain situations. In the winter these roads are plowed on a regular basis.
2	Dry Weather Road	This type of road tends to be quite slippery in the spring and fall and becomes heavily rutted when wet. The shoulder on these roads are generally quite soft most of the year. Slopes on these roads should not exceed 10% as they are difficult to drive up or down when wet, even in a four-wheel drive vehicle. Minor flooding or washouts can occur but the roads can still be travelled in a four-wheel drive vehicle as the roads have solid bottoms.
3	Deteriorating Road	These roads are not used very often and are starting to grow over with grass, small shrubs, or small trees. During heavy rains they can be easily washed out or heavily rutted. It may be very difficult to travel on these roads even with a four wheel drive and the use of an all terrain vehicle should be considered.
4	All Terrain Vehicles Only	Included in this category are seismic lines, old trails and any roads inaccessible using a four-wheel drive vehicle. If a plot is more than 750 m along a seismic line or trail, this access is to be indicated. If the distance is less than this, the re-measurement crew can walk to the plot.
5	Helicopter Access	This access code should be used only when there is no other way into the plot (i.e. can not cross river, too far off roads to feasibly drive all terrain vehicle to, etc.). It is important to remember to have a suitable location for a helicopter to land and take off from. Keep in mind that openings used for a landing may grow over within 10 years preventing a helicopter to land in the future.
6	Unknown	This code is for office use only and is used when access has not been verified and maps do not provide any assistance.

Appendix XVI

Slope Correction Factors and Tables

Appendix XVI

Slope Correction Factors And Tables

To convert slope distance (S.D.) horizontal distance (H.D.)

H.D. = S.D. X slope distance factor

To convert horizontal distance (H.D.) to slope Distance (S.D.)

$$SD = \frac{H.D.}{\text{Slope distance factor}}$$

SLOPE DISTANCE FACTORS

% Slope	Correction Factor	% Slope	Correction Factor	% Slope	Correction Factor
10	0.995	40	0.928	70	0.819
11	0.994	41	0.925	71	0.815
12	0.993	42	0.922	72	0.812
13	0.992	43	0.919	73	0.808
14	0.990	44	0.915	74	0.804
15	0.989	45	0.912	75	0.800
16	0.987	46	0.908	76	0.796
17	0.986	47	0.905	77	0.792
18	0.984	48	0.902	78	0.789
19	0.982	49	0.898	79	0.785
20	0.980	50	0.894	80	0.781
21	0.979	51	0.891	81	0.777
22	0.977	52	0.887	82	0.773
23	0.974	53	0.883	83	0.769
24	0.972	54	0.880	84	0.766
25	0.970	55	0.876	85	0.762
26	0.968	56	0.872	86	0.758
27	0.965	57	0.869	87	0.754
28	0.963	58	0.865	88	0.751
29	0.960	69	0.861	89	0.747
30	0.958	60	0.857	90	0.743
31	0.955	61	0.854	91	0.740
32	0.952	62	0.850	92	0.736
33	0.950	63	0.846	93	0.732
34	0.947	64	0.842	94	0.729
35	0.944	65	0.838	95	0.725

% Slope	Correction Factor
36	0.942
37	0.938
38	0.935
39	0.936

% Slope	Correction Factor
66	0.835
67	0.831
68	0.827
69	0.823

% Slope	Correction Factor
96	0.721
97	0.718
98	0.714
99	0.711

Appendix XVII

Legal Survey System of Alberta

APPENDIX XVII

LEGAL SURVEY SYSTEM OF ALBERTA

The province of Alberta has been surveyed using a system based on a grid framework. The largest divisions in this system are called meridians. In Alberta there are three meridians numbered 4, 5 and 6. The fourth meridian corresponds to the Alberta Saskatchewan border.

Each meridian has been divided into parcels of land, called townships, 36 square miles in size. At six mile intervals, in a north-south direction, are divisions also called townships and are numbered 1 to 126 starting from the United States border and extending to the Northwest Territories border. The east-west six mile intervals are called "ranges" and are numbered westward from each meridian. The numbering of townships begins in the southeast corner of the province.

The grid system is further refined by taking each township and dividing it into 36-one square mile parcels of land called "sections".

The last division in the survey system takes each section and divides it into 16 equal parts called "legal subdivisions" (LS's).

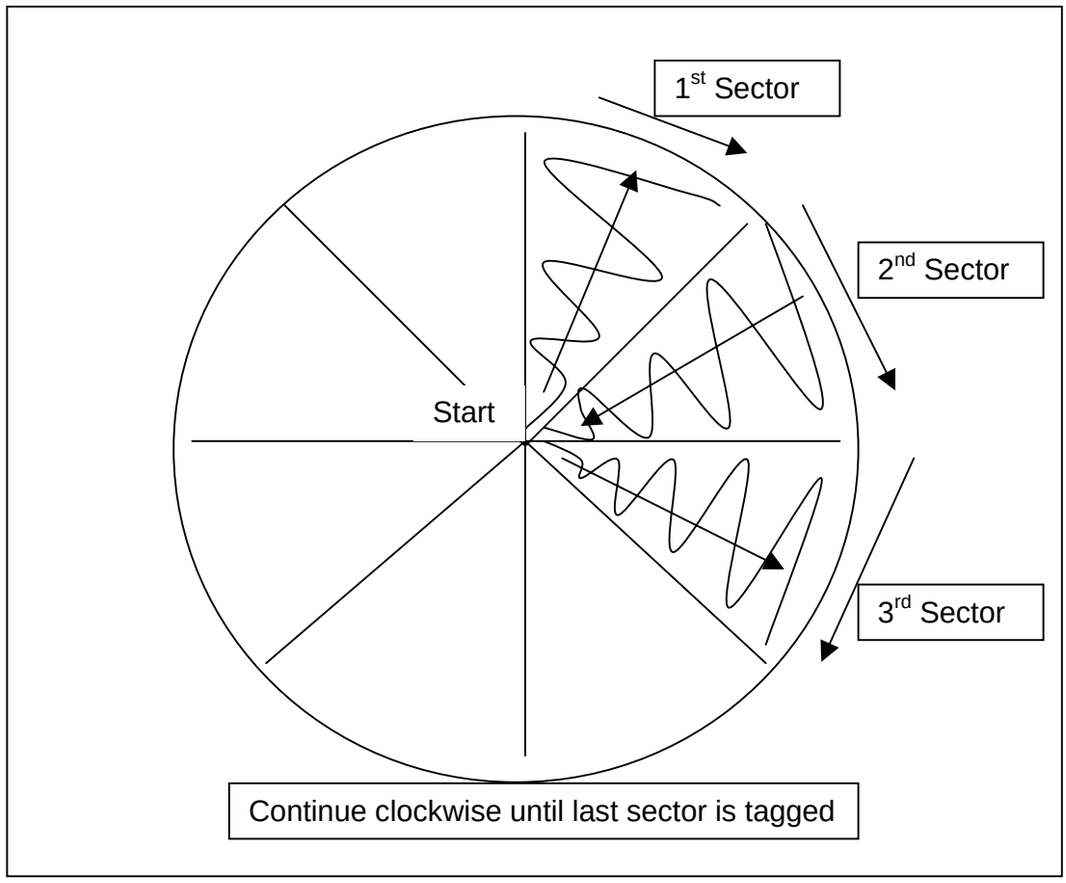
13-1-87-18-4 translates to legal Subdivison 13 of Section 1 in Township 87, Range 18, West of the Fourth Meridian.

Appendix XVIII

Tree Tagging Pattern

APPENDIX XVIII

TREE TAGGING PATTERN



Appendix XIX

Field Assessment Forms

PLOT HEADER PAGE 1 OF 2

Manning Diversified Volume Sampling Program

CARD TYPE	PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW		FMU	L.S.
									PERSON #1	PERSON #2		
1												

AIR PHOTO NUMBER: _____

LINE NUMBER: _____

TIE POINT: _____

GPS FILE NAME: _____

TREE PLOT SIZE (M)	SAPLING PLOT SIZE (M)	REGEN PLOT SIZE (M)	% SLOPE	ASPECT	ACCESS

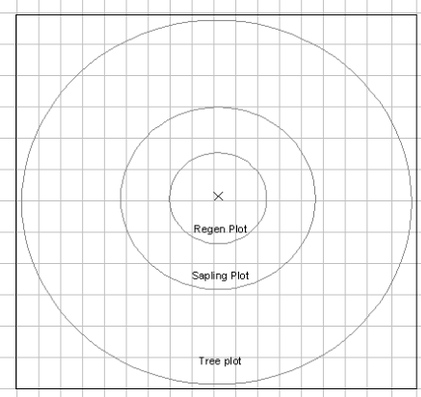
ACCESS CODES	DESCRIPTION
1	ALL WEATHER ROAD
2	DRY WEATHER ROAD
3	DETERIORATING ROAD
4	ALL TERRAIN VEHICLES ONLY
5	HELICOPTER ACCESS ONLY
0	INACCESSIBLE

MAP AVI TYPE

	POLYGON NO	MOIS.	C.C.	HEIGHT	SP1	SP1%	SP2	SP2%	SP3	SP3%	SP4	SP4%	SP5	SP5%	TPR
Overstorey															
Understorey															
Layer 3															

COVER TYPE 1 (Plot Center) - FIELD AVI TYPE

	POLYGON NO	MOIS.	C.C.	HEIGHT	SP1	SP1%	SP2	SP2%	SP3	SP3%	SP4	SP4%	SP5	SP5%	TOT. AGE
Overstorey															
Understorey															
Layer 3															



COVER TYPE 2 - FIELD AVI TYPE

	POLYGON NO	MOIS.	C.C.	HEIGHT	SP1	SP1%	SP2	SP2%	SP3	SP3%	SP4	SP4%	SP5	SP5%	TOT. AGE
Overstorey															
Understorey															
Layer 3															

COVER TYPE 3 - FIELD AVI TYPE

	POLYGON NO	MOIS.	C.C.	HEIGHT	SP1	SP1%	SP2	SP2%	SP3	SP3%	SP4	SP4%	SP5	SP5%	TOT. AGE
Overstorey															
Understorey															
Layer 3															

FIELD NOTES

PLOT HEADER PAGE 2 OF 2

DIAGRAM OF ACCESS/ TIE POINT

COMMENTS: Access notes, directions to tie point and plot, etc

REGENERATION HEIGHT CLASS TALLY SHEET

CARD TYPE	PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW	
									PERSON #1	PERSON #2
3										

Comments

COVER TYPE 1 (PLOT CENTER)

DECIDUOUS			CONIFEROUS		
SPECIES	HEIGHT CLASSES (cm)		SPECIES	HEIGHT CLASSES (cm)	
	30 - 80	81 - 130		30 - 80	81 - 130
AW			FB		
BW			PL		
PB			SW		
			SB		

COVER TYPE 2 (if present in plot)

DECIDUOUS			CONIFEROUS		
SPECIES	HEIGHT CLASSES (cm)		SPECIES	HEIGHT CLASSES (cm)	
	30 - 80	81 - 130		30 - 80	81 - 130
AW			FB		
BW			PL		
PB			SW		
			SB		

Manning Diversified Volume Sampling Program PAGE____OF ___

TREE AND SAPLING TALLY SHEET

CARD TYPE	PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW	
									PERSON #1	PERSON #2
2										

TREE NUMBER	COVER TYPE	SPECIES	D.B.H. (cm)	CONDITION CODES			C.C.	TOTAL HEIGHT (m)	HEIGHT TO LIVE CROWN (m)	CROWN WIDTH (m) N - S	CROWN WIDTH (m) E - W	DBH AGE	SITE TREE?	REMARKS
				1	2	3								

Manning Diversified Volume Sampling Program PAGE____OF __

TREE AND SAPLING TALLY SHEET - Continued Plot No.

TREE NUMBER	COVER TYPE	SPECIES	D.B.H. (cm)	CONDITION CODES 1	2	3	C.C.	TOTAL HEIGHT (m)	HEIGHT TO LIVE CROWN (m)	CROWN WIDTH (m) N - S	CROWN WIDTH (m) E - W	DBH AGE	SITE TREE?	REMARKS

Manning Diversified Volume Sampling Program

COARSE WOODY DEBRIS TALLY

CARD TYPE	PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW	
									PERSON #1	PERSON #2
4										

Total Transect Length (m)	3	0	Bearings of transect radii			

PIECE NUMBER	SPECIES	DIAMETER CLASS	DECAY CLASS	COVER TYPE
0 1				
0 2				
0 3				
0 4				
0 5				
0 6				
0 7				
0 8				
0 9				
1 0				
1 1				
1 2				
1 3				
1 4				
1 5				
1 6				
1 7				
1 8				
1 9				
2 0				
2 1				
2 2				
2 3				
2 4				
2 5				
2 6				
2 7				
2 8				
2 9				
3 0				
3 1				
3 2				
3 3				
3 4				
3 5				
3 6				
3 7				
3 8				
3 9				
4 0				
4 1				
4 2				
4 3				
4 4				
4 5				
4 6				
4 7				
4 8				
4 9				
5 0				
5 1				
5 2				
5 3				
5 4				
5 5				
5 6				
5 7				
5 8				
5 9				
6 0				
6 1				
6 2				
6 3				
6 4				
6 5				
6 6				
6 7				
6 8				
6 9				
7 0				
7 1				
7 2				
7 3				
7 4				
7 5				

	DECAY CLASS				
ATTRIBUTES	Class 1	Class 2	Class 3	Class 4	Class 5
Texture/ Shape	intact, hard/ round	intact, hard to partly decaying/ round	hard, large pcs., partly decaying/ round	small blocky pieces/ round to oval	many small pieces; soft portions/ oval
Twigs< 3 cm	Present	Absent	Absent	Absent	Absent
Bark/ Invading Roots	Intact/ none	Intact or partly missing/ none	Trace/ in sapwood	Absent/ in heartwood	Absent/ in heartwood
Portion on Ground	Elevated on support points	Elevated but sagging slightly	Sagging near ground, or broken	All of log on ground, sinking	All of log on ground, partly sunken

Diameter class	
1	6 - 15 cm
2	16 - 25 cm
3	26 - 35 cm
4	36 - 45 cm
5	46 - 55 cm
6	>= 56 cm

Comments

OPTIONAL TREE HEIGHT CALCULATION WORKSHEET - Manning Diversified Volume Sampling Program

PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW	
								PERSON #1	PERSON #2

Horizontal Distance Calculation -- if BOTTOM % > 10%
Sight and tape to DBH (or other bottom shot point of reference)

Height to Crown Base Calculation
Apply Height Correction if "bottom" shot is not at base of tree, e.g., 1.3m for DBH

Tree Height Calculation
Apply Height Correction if "bottom" shot is not at base of tree, e.g., 1.3m for DBH

TREE NO.	SPP	BOTTOM %	SLOPE CORR. FACTOR	MULTIPLY	SLOPE DIST.		HORIZ. DIST.	CROWN BASE%		HT. CORR		HT TO CROWN BASE	TOP %			TOTAL HT
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	
			0.	x		=			- BOT % x HZ DIST / 100 +		=			- BOT % x HZ DIST / 100 + HT. CORRECTION	=	

SLOPE CORRECTION TABLE — Horizontal Distance = Slope Distance Factor x Slope Distance

Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Fact.	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor	Slope %	Slope Dist. Factor
11	0.994	21	0.979	31	0.955	41	0.925	51	0.891	61	0.854	71	0.815	81	0.777	91	0.74	101	0.704
12	0.993	22	0.977	32	0.952	42	0.922	52	0.887	62	0.85	72	0.812	82	0.773	92	0.736	102	0.7
13	0.992	23	0.975	33	0.95	43	0.919	53	0.884	63	0.846	73	0.808	83	0.769	93	0.732	103	0.697
14	0.99	24	0.972	34	0.947	44	0.915	54	0.88	64	0.842	74	0.804	84	0.766	94	0.729	104	0.693
15	0.989	25	0.97	35	0.944	45	0.912	55	0.876	65	0.838	75	0.8	85	0.762	95	0.725	105	0.69
16	0.987	26	0.968	36	0.941	46	0.908	56	0.873	66	0.835	76	0.796	86	0.758	96	0.721	106	0.686
17	0.986	27	0.965	37	0.938	47	0.905	57	0.869	67	0.831	77	0.792	87	0.754	97	0.718	107	0.683
18	0.984	28	0.963	38	0.935	48	0.902	58	0.865	68	0.827	78	0.789	88	0.751	98	0.714	108	0.679
19	0.982	29	0.96	39	0.932	49	0.898	59	0.861	69	0.823	79	0.785	89	0.747	99	0.711	109	0.676
20	0.981	30	0.958	40	0.928	50	0.894	60	0.857	70	0.819	80	0.781	90	0.743	100	0.707	110	0.673

Manning Diversified Volume Sampling Program

PAGE____ OF ____

VEGETATION COVER TALLY

CARD TYPE	PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW	
									PERSON #1	PERSON #2
5										

		VEGETATION STRATA - COVER ABUNDANCE						
NO.	SPECIES CODE	MAIN CANOPY	SECOND CANOPY	TALL SHRUB	LOW SHRUB	HERB	GRASS	MOSS/ LICHEN
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
TOTAL STRATUM COVER								

STRATA	
MAIN CANOPY	Trees/ shrubs >=5 m
SECONDARY CANOPY	Trees/ shrubs >= 5 m tall, and at least 3 m lower than main canopy
TALL SHRUB	2.5-5.0 m height
LOW SHRUB	< 2.5 m height

DOMIN-KRAJINA COVER ABUNDANCE SCALE			
CLASS	COVER	CLASS	COVER
X	100%	**4**	5-10%
9	>75%	**3**	1-5%
8	50-75%	**2**	<1%, very scattere
7	33-50%	**1**	<1%, seldom, insignif. Cover
6	25-33%	**+**	<1%, solitary, insignif. Cover
5	10-25%		

Comments

COVER OF OTHER SUBSTRATES	CLASS
LITTER	
DEADFALL	
BARE SOIL	
ROCK	
WATER	

Lichen Cover Classes: 0 = Absent 1 = Scarce 2= Present 3 = Abundant

ABOREAL LICHEN ABUNDANCE	TREE SPECIES				
LICHEN SPECIES					
	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3
	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3	0 1 2 3

VEGETATION COVER TALLY - Continued

PAGE_____ OF _____

Plot No.

NO.	SPECIES CODE	VEGETATION STRATA - COVER ABUNDANCE						
		MAIN CANOPY	SECOND CANOPY	TALL SHRUB	LOW SHRUB	HERB	GRASS	MOSS/ LICHEN
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								
51								
52								
53								
54								
55								
56								
57								
58								
59								
60								
61								
62								
63								
64								
65								
TOTAL STRATUM COVER								

STRATA	
MAIN CANOPY	Trees/ shrubs >=5 m
SECONDARY CANOPY	Trees/ shrubs >= 5 m tall, and at least 3 m lower than main canopy
TALL SHRUB	2.5-5.0 m height
LOW SHRUB	< 2.5 m height

DOMIN-KRAJINA COVER ABUNDANCE SCALE			
CLASS	COVER	CLASS	COVER
X	100%	4	5-10%
9	>75%	3	1-5%
8	50-75%	2	1%, very scattere
7	33-50%	1	<1%, seldom, insignif. Cover
6	25-33%	+	<1%, solitary, insignif. Cover
5	10-25%		

Comments

Manning Diversified Volume Sampling Program PAGE 1 OF 2

ECOLOGICAL ASSESSMENT FORM

CARD TYPE	PLOT NO.	YEAR	MONTH	DAY	SECTION	TOWNSHIP	RANGE	MERIDIAN	CREW		35 MM PHOTOS		
									PERSON #1	PERSON #2	START	END	ROLL NO.
6													

SITE CHARACTERISTICS			
SLOPE (%)		SLOPE POSITION	C U M L T E D
ASPECT (DEGREES)		MOISTURE REGIME	1 2 3 4 5 6 7 8 9
SURFACE EXPRESSION		NUTRIENT REGIME	A B C D E

ECOLOGICAL CLASSIFICATION			
GUIDE	WC N	PHASE	
NATURAL SUBREGION		COMMUNITY	
ECOSECTION		SOIL TYPE	
ECOSITE			

LANDSCAPE PROFILE DIAGRAM

Draw a cross-section of the plot and surrounding topography. Indicate landform, seepages, drainage, parent materials, *etc.*

Direction →

SLOPE POSITION CODES

Code	Description
C	Crest
U	Upper-slope
M	Mid-slope
L	Lower slope
T	Toe
E	Flat
D	Depression

Comments

ECOLOGICAL ASSESSMENT FORM - Continued

PAGE 2 OF 2

Plot No.

SOIL CHARACTERISTICS								
HUMUS FORM		N/A	P	R	W	D	U	
SEEPAGE			Y	N	Susp.			
DRAINAGE	1	2	3	4	5	6	7	
PARENT MATERIAL								

DEPTH TO:	
WATER TABLE	
POTENTIAL ROOT RESTRICTIVE LAYER	
CARBONATES	
MOTTLES	
GLEYING	
BEDROCK	
ROOTING DEPTH	

SOIL LAYERS

LAYER	HORIZON	DEPTH (cm) Distance from Zero	COARSE FRAGMENTS > 2 mm		TEXTURE =< 2 mm
			% TOTAL	TYPE	
	L				
	F				
	H				
ZERO					
1					
2					
3					
4					
	DEPTH OF PIT				

Comments

HUMUS FORMS	
Code	**Description**
P	Peaty mor
R	Mor
W	Raw Moder
D	Moder
U	Mull
N/A	No humus

COARSE FRAGMENT TYPES	
Code	**Description**
G	Gravel (0.2-7.6 cm)
C	Cobbles (7.6-25 cm)
S	Stones (26-60 cm)
B	Boulders (> 60 cm)
N/A	No coarse fragments

DRAINAGE	
Code	**Description**
1	Very Rapid
2	Rapid
3	Well
4	Moderately Well
5	Imperfect
6	Poor
7	Very Poor

Appendix XX

Volume Sampling Project Overview

Manning Diversified Forest Products

Volume Sampling Project for P6 & P9

Overview, September 2000

RELATED BACKGROUND:
At the start of this volume sampling project (VSP), Olympic had already completed an aerial photo-based Alberta Vegetation Inventory (AVI) for Manning on P6 and is beginning the AVI on P9.

PRIMARY GOAL:
This project will generate standing volume estimates for the AVIs on P6 and P9. Although outside the scope of this project, these estimates will eventually form the basis for yield predictions used to develop Manning's Detailed Forest Management Plan (DFMP). Within a DFMP, yield predictions drive the determination of the FMA's annual allowable cut (AAC).

SECONDARY GOAL:
The sampling design preserves the option for future conversion of VSP plots to permanent sample plots (PSPs). PSPs provide re-measurement data for growth and yield model development and change monitoring. Monitoring is becoming a key factor in DFMP approval and it will also play an increasingly important role in certification and international environmental agreements. Monitoring designs most frequently resemble ground-based, continuous forest inventory (CFI) designs.

DESIGN CHARACTERISTICS:

1. Plots located on a 2.8km systematic grid.
   - Allows volume sampling prior to completion of P9's AVI.
   - Provides flexibility for post-stratification into yield groups.
   - Characterizes the entire landbase, similar to a CFI.

2. Approximately 750 plots total.
   - Enough to adequately sample most yield groups.
   - Non-forested, no-tally plots (~15%) may be re-allocated to under-represented yield strata, if needed.

3. 0.08 hectare, concentric, circular fixed-area plots.
   - Produces strong standing volume estimates.
   - All size classes measured; trees <1.3m dot tallied.
   - Supports optional conversion to PSPs.
   - Plots large enough to capture stand dynamics over time.

4. Additional non-timber sampling on all plots.
   - Coarse-woody debris (CWD) for habitat and biodiversity estimates.
   - Vegetation and soil characterization for ecological classification and stratification.

Appendix XXI

Random Bearings for Coarse Woody Debris Transect

Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing
1	108	49	209	97	145	145	21	193	313	241	187
2	271	50	94	98	13	146	334	194	15	242	45
3	130	51	338	99	235	147	163	195	238	243	261
4	281	52	24	100	141	148	230	196	157	244	78
5	209	53	101	101	354	149	335	197	23	245	119
6	283	54	22	102	55	150	30	198	226	246	91
7	134	55	181	103	349	151	285	199	23	247	121
8	63	56	21	104	94	152	263	200	291	248	6
9	224	57	347	105	98	153	20	201	30	249	189
10	178	58	291	106	76	154	76	202	98	250	217
11	11	59	82	107	220	155	242	203	78	251	223
12	231	60	220	108	63	156	250	204	107	252	70
13	282	61	255	109	237	157	193	205	308	253	326
14	32	62	37	110	170	158	150	206	105	254	119
15	180	63	218	111	116	159	321	207	51	255	65
16	177	64	172	112	308	160	299	208	129	256	91
17	54	65	271	113	102	161	256	209	145	257	153
18	159	66	185	114	228	162	86	210	118	258	298
19	217	67	58	115	223	163	191	211	124	259	229
20	15	68	95	116	183	164	7	212	30	260	178
21	224	69	18	117	180	165	267	213	208	261	24
22	256	70	251	118	114	166	82	214	175	262	344
23	209	71	228	119	75	167	335	215	228	263	313
24	330	72	184	120	272	168	182	216	186	264	347
25	31	73	111	121	178	169	323	217	257	265	191
26	138	74	264	122	2	170	278	218	152	266	189
27	257	75	204	123	220	171	151	219	325	267	290
28	145	76	82	124	87	172	65	220	73	268	359
29	332	77	307	125	213	173	348	221	152	269	253
30	0	78	145	126	260	174	78	222	133	270	320
31	113	79	53	127	181	175	179	223	142	271	79
32	308	80	9	128	136	176	167	224	79	272	147
33	356	81	350	129	221	177	337	225	170	273	43
34	45	82	75	130	305	178	186	226	136	274	180
35	134	83	82	131	327	179	51	227	359	275	25
36	209	84	110	132	287	180	324	228	193	276	137
37	106	85	112	133	2	181	69	229	170	277	341
38	244	86	157	134	320	182	2	230	8	278	244
39	10	87	0	135	299	183	208	231	95	279	300
40	264	88	56	136	32	184	240	232	84	280	308
41	26	89	62	137	292	185	55	233	132	281	182
42	18	90	227	138	272	186	341	234	136	282	97
43	355	91	163	139	41	187	101	235	309	283	186
44	300	92	33	140	275	188	218	236	42	284	249
45	141	93	139	141	275	189	266	237	223	285	325
46	232	94	358	142	258	190	311	238	359	286	213
47	4	95	245	143	352	191	216	239	153	287	100
48	126	96	149	144	282	192	335	240	113	288	275

Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing
289	290	338	84	387	290	549	348	598	339	647	78
290	201	339	254	501	217	550	18	599	285	648	175
291	257	340	86	502	57	551	266	600	283	649	27
292	89	341	17	503	353	552	304	601	304	650	12
293	52	342	275	504	255	553	273	602	179	651	57
294	291	343	329	505	210	554	86	603	89	652	331
295	185	344	61	506	285	555	38	604	163	653	135
296	266	345	308	507	101	556	162	605	215	654	33
297	75	346	326	508	188	557	124	606	65	655	310
298	30	347	125	509	225	558	179	607	315	656	81
299	169	348	246	510	232	559	208	608	145	657	35
300	178	349	36	511	340	560	207	609	94	658	297
301	255	350	219	512	196	561	235	610	280	659	165
302	195	351	161	513	253	562	276	611	17	660	253
303	288	352	211	514	12	563	153	612	30	661	245
304	129	353	116	515	116	564	33	613	136	662	18
305	77	354	238	516	164	565	312	614	13	663	129
306	300	355	18	517	24	566	70	615	255	664	147
307	201	356	217	518	255	567	119	616	345	665	62
308	124	357	285	519	90	568	225	617	19	666	284
309	275	358	115	520	47	569	348	618	322	667	296
310	344	359	119	521	159	570	161	619	247	668	148
311	118	360	56	522	302	571	335	620	286	669	103
312	148	361	86	523	71	572	135	621	288	670	323
313	241	362	265	524	31	573	234	622	89	671	296
314	227	363	42	525	38	574	130	623	339	672	347
315	227	364	340	526	89	575	179	624	336	673	283
316	123	365	275	527	21	576	126	625	229	674	3
317	279	366	69	528	157	577	107	626	102	675	264
318	96	367	160	529	319	578	85	627	290	676	67
319	245	368	42	530	277	579	199	628	66	677	54
320	272	369	39	531	264	580	10	629	209	678	290
321	308	370	111	532	120	581	319	630	326	679	116
322	16	371	130	533	171	582	252	631	335	680	99
323	130	372	30	534	53	583	216	632	3	681	163
324	192	373	345	535	264	584	329	633	7	682	355
325	295	374	349	536	28	585	337	634	284	683	314
326	194	375	114	537	115	586	11	635	47	684	292
327	213	376	277	538	304	587	210	636	45	685	234
328	269	377	256	539	304	588	148	637	329	686	6
329	338	378	289	540	117	589	100	638	227	687	360
330	252	379	134	541	250	590	290	639	159	688	157
331	248	380	232	542	135	591	359	640	351	689	207
332	2	381	12	543	61	592	288	641	20	690	294
333	101	382	196	544	354	593	70	642	162	691	325
334	86	383	41	545	214	594	231	643	300	692	306
335	135	384	18	546	310	595	345	644	234	693	166
336	51	385	108	547	154	596	62	645	254	694	260
337	186	386	155	548	249	597	150	646	256	695	44

Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing	Plot	Bearing
696	317	745	346	794	77	843	271				
697	63	746	178	795	133	844	201				
698	113	747	198	796	257	845	204				
699	293	748	5	797	276	846	156				
700	300	749	240	798	84	847	117				
701	152	750	20	799	223	848	122				
702	77	751	106	800	7	849	12				
703	106	752	60	801	169	850	16				
704	244	753	10	802	169	851	115				
705	94	754	27	803	323	852	58				
706	99	755	159	804	233	853	149				
707	139	756	142	805	28	854	15				
708	68	757	341	806	23	855	327				
709	110	758	357	807	305	856	138				
710	241	759	263	808	26	857	138				
711	4	760	136	809	61	858	103				
712	233	761	172	810	81	859	13				
713	247	762	297	811	81	860	87				
714	277	763	95	812	117	861	208				
715	240	764	61	813	341	862	360				
716	142	765	246	814	49	863	257				
717	163	766	31	815	287	864	7				
718	166	767	8	816	303	865	338				
719	127	768	350	817	162	866	338				
720	104	769	259	818	278	867	155				
721	311	770	300	819	117	868	56				
722	199	771	144	820	193	869	30				
723	209	772	15	821	315	870	317				
724	101	773	228	822	220						
725	186	774	73	823	107						
726	37	775	43	824	57						
727	2	776	103	825	280						
728	200	777	195	826	0						
729	181	778	114	827	4						
730	216	779	87	828	246						
731	153	780	314	829	138						
732	59	781	102	830	161						
733	104	782	165	831	139						
734	279	783	224	832	31						
735	244	784	156	833	33						
736	324	785	154	834	295						
737	17	786	341	835	71						
738	70	787	249	836	60						
739	169	788	343	837	264						
740	145	789	22	838	21						
741	167	790	264	839	156						
742	105	791	163	840	18						
743	176	792	283	841	327						
744	101	793	23	842	298						

Appendix XXII

Alberta Vegetation Inventory Standards (AVI) Version 2.2
Short Data Dictionary

APPENDIX XXII

ALBERTA VEGETATION INVENTORY STANDARDS (AVI) VERSION 2.2
SHORT DATA DICTIONARY

This document is designed to provide a list and brief explanation for the common AVI codes used. For definitions and more detailed explanations please refer to the AVI Version 2.2 Standards Manual.

The Field Assigned AVI label for the Volume Sampling Project is composed of the following 5 components:

- Ecological moisture regime
- Crown closure
- Height
- Species composition
- Total Age

1. Ecological Moisture Regime

The hygrotope signifies the moisture available for plant growth. This is recorded as a numeric label.

Moisture Regime	Database Numeric Label
Very Xeric	0
Xeric	1
Subxeric	2
Submesic	3
Mesic	4
Subhygric	5
Hygric	6
Subhydric	7
Hydric	8

2. Crown Closure

Crown closure of forested and non-forested land refers to the percentage of ground area covered by a vertical projection of tree (or other vegetation) crown areas onto the ground.

Crown Closure Class (%)	Database Numeric Label
01 – 05	V
06 – 10	0
11 – 20	1
21 – 30	2
31 – 40	3
41 – 50	4
51 – 60	5
61 – 70	6
71 – 80	7
81 - 90	8
91 - 100	9

3. Height

Stand height is the average height in metres of the dominant and codominant trees of the leading species in a stand.

4. Tree Species Composition

The amount expressed in percent crown closure that an individual species contributes to the overall species composition of a polygon. See Appendix II for tree species codes used.

5. Total Age

This can also be expressed as origin age. Sample tree age is determined by obtaining an increment core at 1.3 meters or through extrapolation from adjacent stands. An adjustment factor to account for the number of years that the tree required to grow to breast height is applied to obtain total age. This factor varies depending on Natural Subregion. The following is a list of the Natural Subregions of Alberta and the corresponding codes.

Natural Subregion	Code
Central Mixedwood	1
Dry Mixedwood	2
Wetland Mixedwood	3
Sub-Arctic	4
Peace River Lowlands	5
Boreal Highlands	6
Alpine	7
Sub-Alpine	8
Montane	9
Upper Foothills	10
Lower Foothills	11
Athabasca Plain	12
Kazan Upland	13
Foothills Parkland	14
Peace River Parkland	15
Central Parkland	16
Dry Mixedgrass	17
Foothills Fescue	18
Northern Fescue	19
Mixedgrass	20

The following lists the adjustment factors to be used depending on Natural Subregion.

Species	Natural Subregion	Total Age (Years)
Sw/Se/Lt	1 – 6 and 12 - 16	Bhage + 15
	7 - 10	Bhage + 17
	11	Bhage + 14
	Provincial (combined)	Bhage + 15
Pl/Pj	1 – 6 and 12 - 16	Bhage + 9
	7 - 9	Bhage + 12
	10	Bhage + 11
	11	Bhage + 9
	Provincial (combined)	Bhage + 10
Sb	1 – 6 and 12 - 16	Bhage + 17
	7 - 10	Bhage + 21
	11	Bhage + 18
	Provincial (combined)	Bhage + 19
Aw/Pb/Bw	1 – 6 and 12 - 16	Bhage + 4
	7 - 10	Bhage + 7
	11	Bhage + 6
	Provincial (combined)	Bhage + 5
Fb/Fa	Provincial (combined)	Bhage + 19
Fd	Provincial (combined)	Bhage + 15

6. Timber Productivity Rating (TPR)

It is not necessary to include this in the Field AVI assessments. This section is included as extra information only. TPR is an estimate of the potential productivity of forestland and non-vegetated land to grow trees based on the height and age of the leading species in the AVI label. It is determined through the application of the equations found in Appendix 2 of the AVI Standards Manual. TPR is specific to individual Natural Subregions and can differ between the different layers of a single stand. This is the case even if each storey has the same leading species.

TPR	Database Label
Good	G
Medium	M
Fair	F
Unproductive	U

7. Interpreted TPR

The TPR for forest land polygons may be interpreted when the formulas, in the experienced opinion of the interpreter, reflect a TPR which is appropriate to the site. Use the code “I” to signify an interpreted TPR and include this information in the comments section of the plot header card along with support for the recommendation. TPR is interpreted based on site information. It may be interpreted for forest stands < 20 years old and for suppressed stands released through the removal of the overstorey.

Appendix XXIII

FMU P6 Plot List (Overstorey Information Only)

Appendix XXIV

FMU P9 Plot List (Phase 3 Overstorey Information Only)