Prince George Forest District

Timber Emphasis VRI Ground Sampling Project Implementation Plan

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MINISTRY OF FORESTS
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EXECUTIVE SUMMARY

This is a VRI Project Implementation Plan (VPIP) for the timber emphasis VRI in the Prince George Forest District. The target population is the Vegetated Treed (VT) portion of the TSA in the District, excluding private lands, Parks and other legally recognized Protected Areas, TFLs, and woodlots. Sample polygons will be selected over the entire target population using stratified probability proportional to size with replacement (PPSWR) sampling, with the strata based on forest type (leading-species groups) and total polygon volume. The inventory will be implemented in two stages. In the first stage 49 VRI sample clusters will be installed in the spruce stands (pure spruce and spruce-leading stands) in the 2000 field season (net volume adjustment factor (NVAF) is optional). In the second stage, 71 sample clusters will be installed in the remainder of the VT population in 2001 or subsequent years. The estimated total cost of the first stage (spruce stratum) is approximately $108,100. This cost includes installation of the VRI sample clusters and statistical analysis; it excludes the cost of the optional NVAF sampling ($20,400).

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1. INTRODUCTION

1.1 Background

This VRI Project Implementation Plan (VPIP) outlines ground sampling activities for the timber emphasis VRI in the Prince George Forest District (PGFD). The priority is on the spruce stands (pure spruce and spruce-leading stands). The Ministry of Forests (MOF) Resources Inventory Branch (RIB) prepared this VPIP in consultation with the Ministry of Forests Regional and District staff and other stakeholders. This VPIP is based on the PGFD VRI Strategic Inventory Plan (VSIP) completed in December, 1999. A glossary of terms is provided in Appendix A.

1.2 Rationale

This timber emphasis VRI is motivated by the 1997 PGFD portion of the Prince George TSA mature (over 60 years old) inventory volume audit that indicated that inventory volumes were over-estimated by approximately 20%. Volume bias was prevalent in spruce stands (32% over-estimation, based on 23 samples), with over-estimation of inventory heights generating most of the bias. Spruce leading stands over 60 years of age contain on average a 15% (or 5 metres) height over-estimation.[1] Ground sampling followed by statistical adjustment would correct this observed bias in this stratum. The bias in the overall inventory would likely be insignificant if the spruce problem was corrected. This is important since spruce-leading stands occupy 38% (approximately 0.9 million ha) of the forested landbase in the District and are spread throughout the District with higher concentrations east of the Fraser River.

2. SAMPLING PLAN

2.1 Overview

The information in this section is summarized from the PGFD VSIP. It is presented here for easy reference, and includes description of the landbase, inventory objectives, target population, sample size and selection, and the VRI tools to be used.

[1] Spruce, as a species tends to contain higher variability in volume than other species in the PG Forest Region (Dick Nakatsu).

2.2 Landbase

The PGFD is approximately 3,597,411 ha; this area includes the TSA (3,332,316 ha), TFL 30 (182,298 ha), and TFL 53 (82,797 ha). Approximately 2.3 million ha of the TSA area is Crown forest (Table 1). The remainder is non-forest, private land, reserves, and parks. The main tree species in the TSA is spruce (38%), pine (24%), balsam (18%), and deciduous (mostly aspen; 7%) (Table 2).

Table 1. PGFD TSA landbase.[2]

Land Classification	Area (ha)	%
Crown forest land	2,327,770	79.8
Immature	842,673	36.2
Mature	1,321,333	56.8
Non-Productive	58,212	2.5
Not Stocked	105,552	4.5
Non-Forest	587,884	20.2
No Typing Available	388	0.0
Total	*2,916,042*	*100*

2.3 Inventory Objectives

The main objective of the timber emphasis inventory is to:

> *Install an adequate number of VRI sample clusters to adjust the timber inventory in the District Vegetated Treed (VT) areas (with emphasis on spruce stands), to achieve a sampling error of ±10% (95% probability) for overall net timber volume in the VT areas and ±15% in the spruce stratum..*

Table 2. PGFD forested landbase by species

Leading Species	Area (ha)	%
Spruce	889,046	38.2
Lodgepole pine	554,262	23.8
Balsam	425,279	18.2
Aspen	168,437	7.3
Redcedar	40,312	1.7
Douglas-fir	40,091	1.7
Birch	30,037	1.3
Hemlock	24,956	1.1
Cottonwood	12,257	0.5
Other*	505	0.0
No species label	142,590	6.2
Total	*2,327,770*	*100*

*Alder, larch and white bark pine

Net timber volume is gross volume minus stumps, tops, decay, waste, and breakage. Decay and waste are normally estimated using VRI call grading/net factoring and NVAF sampling. In the absence of the NVAF adjustment, the 1976 MOF Forest Inventory Zone Decay, Waste and Breakage factors will be used to net down gross merchantable volume.

2.4 Target Population

The target population is the VT portion of the TSA, excluding private lands, parks and other officially protected areas, TFLs, and woodlots. The MOF Resources Inventory Branch official file will be sampled. According to this file, the target population VT area is 2,184,064 ha.

[2] Excludes private land, TFLs, woodlots, and parks and other protected areas. Data from the forest inventory planning (FIP) file used for TSR II provided by the District.

2.5 Sample Size

To meet the inventory objectives (section 2.3), a minimum sample size of 120 VRI sample clusters is recommended, with approximately 49 samples in the spruce stands and 71 in the remaining area of the target population (Table 3; Figure 1). [3]

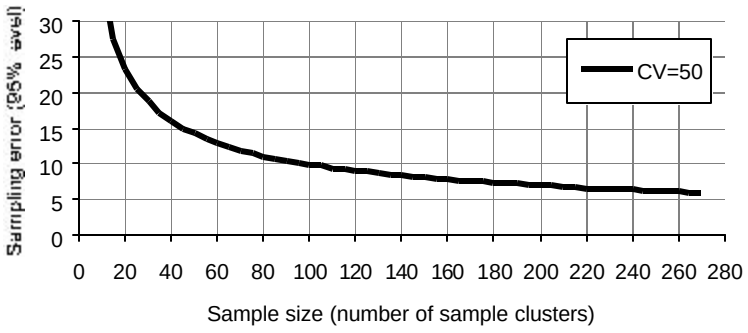

Table 3. Sample cluster distribution in the VT landbase.

Landbase	Area (%)	Number of clusters
Spruce stands	40.8	49
Remaining areas	59.1	71
Total	*100*	*120*

Figure 1. Decreasing sampling error with increasing sample size.[4]

2.6 Sample Selection

The Resources Inventory Branch selected sample polygons using the new stratified probability proportional to size with replacement (PPSWR) sample selection method and the existing official Phase I file (Appendix B). Stratification was based on leading species and polygon volume per hectare. Sample allocation to individual leading-species strata and substrata was proportional to strata or sub-strata areas. PPSWR was applied to each sub-stratum. While the priority is the spruce stands, for efficiency, samples were selected for the entire target population. Samples were selected for the spruce stratum (Appendix C) and the entire VT landbase (Appendix D). Comparison of the VT population and the sample proportions is provided in Appendix E. Additional batches were also selected in case there is a need to increase sample size or replace some of the samples.

2.7 Measurements

VRI certified crews will be used to gather data – measure timber attributes and identify site series - following the current VRI *Ground Sampling Manual*. The following Card Types will be used: 1-3, and 8-12.

[3] This sampling distribution is slightly different from that stated in the Prince George VRI Strategic Inventory Plan because the area proportions changed slightly due to differences in the database versions used.

[4]The CV, or coefficient of variation, is estimated from the inventory audit data.

2.8 Net Volume Adjustment Factor Sampling

This sampling is optional, however, the NVAF sample clusters will be identified. NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations). Sixty trees (50 live, 10 dead) selected from 15 VT polygons (selected with at random from the Phase II sample clusters) would typically selected in the VT target population and destructively sampled for NVAF. Approximately 30 trees in 6 locations would fall in the spruce stratum.[5]

2.9 Within Polygon Variation Sampling

No WPV sampling is planned at this time. WPV sampling provides information to estimate individual polygon error, assessed as the difference between adjusted polygon value and "true" value for that polygon based on intensive sampling of sample polygons.

3. IMPLEMENTATION PLAN

3.1 Overview

The stakeholders have adopted the following two-stage approach to implement the timber emphasis VRI. Stage 1 involves selecting all the sample polygons now and installing the spruce sample clusters in the 2000 field season (NVAF optional). Stage 2 involves installing sample clusters in the remainder of the target VT population in 2001 or subsequent years. The major advantage of this approach is that the high priority spruce stratum will be adjusted after the 2000 field season, thus addressing the main problem area of the inventory. The major disadvantages of this approach are:

- The spruce total volume for the District obtained in the 2000 field may be biased owing to misclassification of the spruce stands.
- It will be sometime before final inventory results (including NVAF) become available for the entire District.
- It may not be feasible to combine the spruce stratum data with that of the remaining area in the future if the interval between two the inventories is large (e.g. over 4 years) because of changes in the population (owing to growth and depletion).

[5] The sample size, distribution and selection procedures for NVAF are being revised; new procedures are expected to be released soon (April, 2000).

- The overall inventory costs will be higher than if the inventory was done in one phase, as crews may have to access the same area in each step (the spruce stands are spread all over the District).
- It is assumed that the existing loss factors are correct, if NVAF is not implemented.

3.2 Schedule – Spruce stands

The VRI will be implemented in the spruce stands in 2000 as follows:

1. Select the sample polygons (April) (Resources Inventory Branch).
2. Prepare and submit a VPIP (this Plan) for approval by the stakeholders (April) (District).
3. Select sample locations in polygons using GIS (April) (Resources Inventory Branch).
4. Prepare sample packages; each to include photo stereo-pair for access, document photo photocopies, sample cluster location map (1:10,000), and access maps (1:20,000) (April) (PG Forest Region/District).
5. Decide whether NVAF sampling is to take place (April) (stakeholders).
6. Tender and select contract crews, and award contracts (April) (PG Forest Region).
7. *Optional*: Select at random a sub-sample of sample polygons for NVAF sampling from the 45 sample clusters; identify these NVAF sample polygons and ensure they are sampled early in the field season, to enable sample tree selection (May) (PG Forest Region).
8. Locate and measure the sample clusters in the first batch; enter and edit the data (June-September) (Field contract crew). The PG Forest region will spot-check the data (compare field card data to the entered data).
9. Conduct quality assurance (10% check) (June-September) (PG Forest Region).
10. *Optional*: Sample NVAF sample clusters (June) (Expert Cruiser)
11. *Optional*: Complete stem analysis (July - August) (Contract crew).
12. Validate and compile data from completed sample clusters and prepare inventory summary reports (October) (Resources Inventory Branch).
13. Conduct statistical analysis and adjust inventory files (if necessary) prior to timber supply analysis (December) (Resources Inventory Branch).

3.3 Schedule – Remaining Area

The VRI in the Remaining Area will be implemented in 2001 or later.

3.4 Sample Packages

Field sample packages should include most current photo stereo-pairs for access, copy of document photo (where possible), sample cluster location maps (1:10,000), and access maps (1:20,000) clearly indicating sample cluster location and polygon boundaries; and overview maps (1:250,000) for general polygon location. Maps will be plotted showing the VRI grid overlays and selected sample locations. Sample locations within a polygon will be selected using GIS.

3.5 Project Support

The MOF will provide aluminum stakes, field maps, photos, and field cards to the contract crews. Provision of other equipment such as GPS will be the responsibility of the contract crews.

3.6 Fieldwork

Fieldwork will be completed using VRI measurement protocols and VRI certified crews (timber and ecology). The VRI Card Types 1-3 and 8-12 will be completed according the VRI Ground Sampling version 4 or later. MOF Region and District will manage the fieldwork contracts and ensure data quality. Note that the collection of site series data (Card Type 12) will also require VRI certified (ecology) crew.

3.7 Quality Assurance

Quality assurance must be conducted. The VRI quality assurance standards require inspection of at least 10% of the samples. The field crews are responsible for the quality control of their own work.

3.8 Data Compilation, Analysis, and Adjustment

The Resources Inventory Branch will complete data compilation; contract field crews will do data entry. The Resources Inventory Branch will also complete the statistical analysis and database adjustment.

3.9 Roles and Responsibilities

Ministry of Forests

The MOF will:

- Select the sample polygons (Resources Inventory Branch).
- Select sample locations within polygons (Resources Inventory Branch).
- Prepare all sample packages (PG Forest Region/District)

- Mentor NVAF crews (Resources Inventory Branch) (Optional).
- Conduct NVAF quality assurance (Resources Inventory Branch) (Optional)
- Conduct sample cluster quality assurance (PG Forest Region)
- Check data after initial compilation (PG Forest Region).
- Validate and compile data (Resources Inventory Branch).
- Provide attribute files and minimum standards for statistical analysis (Resources Inventory Branch).
- Prepare and sign-off Standards Agreement and Schedule A (Agreement between Canadian Forest Products Ltd.) and the MOF Prince George Regional Office)(PG Forest Region).
- Award fieldwork contracts (PG Forest Region)
- Provide mentor for field crews at the start of fieldwork. (PG Forest Region).
- Coordinate project activities, and ensure all contractors are qualified and certified; and tender and manage fieldwork contracts (PG Forest Region).
- Assess access and coordinate the use of helicopters (PG Forest Region).
- Identify access routes and potential tie points (PG Forest District/Region).
- Ensure sample packages are assembled and complete (PG Forest Region)
- Ensure quality assurance (QA) is complete (PG Forest Region).

Field work contractors

- Complete field sampling.
- Conduct internal quality control.
- Enter the sample data.

Check-cruiser (PG Forest Region)

- Complete QA work for 10% of the VRI samples, and issue quality certificates.
- Complete call grading/net factoring of the NVAF samples (contractor) (*optional*).
- Enter the sample data.
- Prepare the QA report.

3.10 Approximate Costs

Estimated sample sizes and costs for the spruce stratum are listed in Table 4. The estimated total cost for sampling the spruce stratum, excluding the NVAF sampling, is $108,100.

Table 4. Estimated minimum sample sizes and costs for the timber emphasis VRI in the *spruce stratum* in the PGFD.

VRI Activity	Sample size (clusters)	Unit Cost($)	Total Cost ($)
Sample Clusters	49	1,900	93,100
NVAF cruising (Optional)[6]	6	400	2,400
NVAF destructive sampling (Optional)[5]	30	600	18,000
Statistical analysis [7]			10,000
Quality assurance[8]			5,000
Total			*128,500*

3.11 Monitoring

The RIB is responsible for monitoring this VPIP and its approval (Appendix F).

[6] This NVAF sampling will contribute to calculation of an overall NVAF for the entire VT population. If stand-alone NVAF factors are needed for the spruce stratum, then additional sampling may be required.

[7] The Region and District should allow contingency funds in the budget to cover this project item. The Resources Inventory Branch is committed to doing the statistical analysis in-house or on contract (although the 2000/01 budget is uncertain at this time).

[8] The PG Regional Office staff will conduct the quality assurance.

4. APPENDIX A – GLOSSARY OF TERMS

District-wide VRI

This is synonymous with provincial VRI; see Provincial VRI.

Ground Sampling

Ground sampling is the field measurement of timber, ecology, range, and/or coarse woody debris values at one or more locations within each sample polygon. Sample polygons are selected proportional to their area from a sorted list. To accommodate a wide variety of resources, various types and sizes of sampling units (e.g., fixed and variable plots, transects) are used to make the measurements.

Inventory Unit

An inventory unit is the target population from which the samples are chosen. For the provincial VRI, the inventory unit is the Forest District, which includes the timber harvesting landbase, parks, recreational areas, private, and federal lands. For management inventories, the inventory unit is a subset of the provincial VRI inventory unit that focuses on a geographic area or specific attribute set, depending upon sampling objectives.

Landcover Classification

The BC Land Cover Classification Scheme (BCLCS) was designed specifically to meet VRI requirements, in addition to providing general information useful for "global vegetation accounting" and "integrated resource management." The BCLCS is hierarchical and reflects the current state of the landcover (e.g., presence or absence of vegetation, type and density of vegetation) and such fixed characteristics as landscape position (i.e., wetland, upland, alpine). There are two main classes of polygons: Vegetated and Non-Vegetated.

Management VRI

Management VRI are specialized inventories that provide detailed information required for specific resource management, i.e., day-to-day forest management. One or more VRI sampling procedures may be used for management inventories. Management inventories may focus on specific resource types (e.g., timber, range, ecology), geographic areas (e.g., landscape unit, TFL), attribute sets (e.g., Douglas-fir

leading stands, age class 4+). They may use one or more of the following tools (e.g., photo-interpretation, ground sampling, NVAF sampling).

National Forest Inventory (NFI)

The NFI provides information on Canada's resources across all provinces and allows the Federal Government a consistent framework for reporting on Canada's inventory. The inventory unit for the NFI is the entire country, although it is implemented province-by-province.

Net Volume Adjustment Factor (NVAF) Sampling

NVAF sampling provides factors to adjust net tree volume estimated from net factoring and taper equations. The adjustment accounts for hidden decay and possible taper equation bias. NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations).

Photo-Interpretation

Photo-interpretation involves subjective delineation of polygons and photo estimation of attributes for all polygons in an inventory unit. Medium scale aerial photographs (1:15,000) are most often used in photo-interpretation. However, if existing photo-based inventory is acceptable, the database can be translated into VRI format and upgraded to include the additional VRI attributes.

Post-Stratification

Post-stratification involves dividing inventory unit into mutually exclusive sub-populations (strata) *after* ground sampling has been completed. Samples that fall in each post-stratum are analyzed separately and the results are applied to the corresponding population post-strata to improve the precision of the inventory's overall averages and totals.

Pre-Stratification

Pre-stratification divides an inventory unit into mutually exclusive sub-populations (strata) *before* ground sampling to provide estimates for specific areas, or to increase the confidence in the overall estimates by considering special characteristics of each stratum.

PPSWR (Probability Proportional to Size With Replacement)

This is a sample selection method in which samples (polygons) are selected with probability proportional to their size. That is, the larger polygons have a higher chance of being included in the sample.

Provincial VRI

The provincial VRI provides baseline data for provincial inventory reporting, monitoring, and research. All sampling procedures from the VRI toolbox are used for this inventory at the Forest District level. The databases generated from each District inventory will be compiled to create the provincial VRI database. The provincial VRI has also been referred to in the past as the District VRI.

Resource-Specific Interpretations

Resource-Specific Interpretations (RSI) use the Resource Inventory Committee (RIC) standard VRI baseline data products (provincial VRI or management inventory), in combination with other data sets and analysis (outside of that required to produce VRI), to produce information to address specific-resource management issues (e.g., TSR review, important ecosystems, important habitats). These interpretations include ecosystem interpretations and habitat interpretations.

Retrofit

Retrofitting is the process of translating and upgrading an existing photo-based inventory to VRI standards. If the polygon linework and attributes are of acceptable quality, the existing FIP (Forest Inventory Planning) databases are translated to VIF (Vegetation Inventory Files) databases and the additional attributes required by the VRI are re-estimated from aerial photographs.

Sample Size

The sample size for an inventory is the minimum number of ground samples to be established in an inventory unit to meet the target precision.

Statistical Analysis

Statistical analysis is the process of adjusting the values of the photo-interpretation variables using ground sampling observations. For each sampled polygon, ground observations are compared to photo-estimated values to develop an adjustment factor. This factor is then applied to all polygons in the photo interpretation database to produce the final adjusted database.

Sub-unit

Sub-unit describes the inventory unit of a management inventory (i.e., the management inventory target population is a subset of the provincial VRI inventory unit). A sub-unit may be defined by a specific geographic area (e.g., operable landbase) or stand type (e.g., problem forest types) within the Forest District.

Target Precision

Target precision expresses the amount of variation in key attributes (e.g., timber volume) desired in the final results. Target precision, usually expressed as the coefficient of variation (CV), is used to calculate the minimum sample size for subsequent ground sampling.

Vegetation Resources Inventory (VRI)

VRI is an improved vegetation inventory process for assessing quantity and quality of BC's vegetation resources. The VRI process is designed to include a flexible set of sampling procedures for collecting vegetation resource information. The VRI is essentially a toolbox of procedures, which include:

- *Photo-interpretation*: the delineation of polygons from aerial photography and the estimation of resource attributes.
- *Ground sampling*: the establishment of plot clusters in selected polygons to measure timber, ecological, and/or range attributes.
- *NVAF Sampling*: stem analysis sampling of individual trees for net volume adjustment.
- *WPV Sampling*: intensive sampling of selected polygons to determine the error between the estimated attribute values and the "true" attribute values.
- *Statistical Adjustment*: the adjustment of the photo-interpreted estimates for all polygons in an inventory unit or management unit using the values measured during ground sampling.

The VRI can be deployed over the entire province (provincial VRI) measuring timber and non-timber resources, or over a large management unit (management VRI) measuring selected resources in specific portions of the landbase. The VRI sampling process produces spatial and non-spatial databases that can be used in multiple resource management applications including timber, ecosystem, and wildlife habitat management.

Within Polygon Variation Sampling

WPV sampling provides information for expressing the true individual polygon error, assessed as the difference between the adjusted polygon value and the “true” value for that polygon. The “true” value for the polygon is an estimate derived from a small sample of polygons that are intensively sampled on the ground.

5. APPENDIX B - SAMPLE SELECTION

[Dr. Sam Otukol, MOF Resources Inventory Branch, provided the text in this appendix.]

The data inventory data (population list) for Prince George District is now ready for sample selection. The VRI sampling plan for this district has unique characteristics. It calls for the implementation of the district VRI (full VRI), and 60 samples are allocated to this task. Then it requires the implementation of a timber-emphasis sample, using 120 samples. The plan identifies spruce as a stratum of special interest, and requires that 45 samples be established there.

The following steps should be followed in the sample selection process:

1. Assemble all polygons constituting the population eligible for sample selection.
2. Classify the population list into the following strata and substrata:
   a) non vegetated polygons(N_V)
   b) vegetated non-treed polygons (V_N_T)
   c) vegetated tree polygons (V_T)
      i) within the V_T stratum stratify by leading species
      ii) within each leading species, sub-stratify polygons by size of average volume/ha
3. Compute total area of all polygons belonging to each of the strata, and sub-strata specified above.
4. Determine sample allocation for the 60 district VRI samples for all strata
5. For the V_T stratum, determine sample allocation for 120 TEP samples.
6. For the spruce stratum, sum the allocations based on the district VRI and the allocation based on the TEP sample. Determine how many additional samples are required to make up the required 45 samples.
7. For the other species, sum the district VRI and the TEP sample allocations.
8. After obtaining total allocations, select the specified samples from each of the strata listed in 2 above. This can be accomplished in one SAS run. Alternatively, it can be accomplished in two SAS runs, one for the Non Vegetated and vegetated non-treed, and the second for the vegetated treed.
9. After the selection, a random selection process should be used to determine district VRI samples in among the TEP samples.
10. Within the spruce stratum, a random selection process should be used to identify the additional samples that were required to make up the allocated 45 samples.

In step #8 the selection of samples should be proportional to polygon area. The process takes place as follows:

a) create a new attribute in the population data to contain accumulated polygon areas.
    i) For the N_V and V_N_T strata, the accumulation should be undertaken separately for each of the two strata. The accumulation should be from the first to the last polygon in the stratum.
    ii) For the V_T, the accumulation should be by "volume class" within each leading species.
b) Using the sample allocations determined in step 7 above, generate random numbers between 0 and the total area of a volume class of interest. The number of random numbers should be equal to the number of allocated samples.
c) The random numbers and the accumulated polygon areas will identify the sample polygons. A polygon is selected if a generated random number is larger than the accumulated area of the polygon preceding it, but is smaller or equal to its own accumulated area.
d) A file of selected polygons is created.

These steps describe the complete process for sample selection for Prince George District. Please contact me (Sam Otukol) if there are steps that need clarification.

6. APPENDIX C - LIST OF SAMPLE POLYGONS (SPRUCE) FOR 2000

Sample # -	Leading Species	Area (ha)	BCLCS	MAP_NO	POLYGON
254	S	85.88	VTUTCOP	093i016	0255
250	S	30.44	VTUTCOP	093j006	0857
55	S	67.80	VTUTCSP	093j076	0083
256	S	41.72	VTUTCOP	093h086	0234
271	S	22.36	VTUTCOP	093g060	0669
246	S	67.20	VTUTMSP	093h051	0489
248	SB	20.20	VTWTCOP	093j067	0347
258	S	29.76	VTUTCOP	093h096	0280
261	SW	79.68	VTUTCSP	093j059	0489
255	S	47.32	VTUTCOP	093o010	0309
67	S	144.48	VTUTCOP	093h035	0163
56	S	114.80	VTUTCSP	093i004	0278
266	S	44.80	VTUTCOP	093h044	0381
252	S	293.76	VTUTCSP	093h054	0243
272	S	5.20	VTUTCOP	093j097	0698
243	S	10.48	VTUTCSP	093j080	0328
247	S	34.16	VTUTCSP	093i024	0529
60	SW	2.32	VTUTCOP	093j086	0061
257	SW	22.36	VTUTCOP	093j048	0829
62	S	218.76	VTUTCOP	093i044	0336
57	SW	9.36	VTUTCSP	093j063	0273
270	S	28.76	VTUTCOP	093g058	0535
265	SW	7.08	VTUTCOP	093j068	0175
262	S	18.00	VTUTCOP	093h062	0444
251	S	47.88	VTUTCSP	093h042	0340
66	S	7.64	VTUTCOP	093j016	0392
65	S	59.88	VTUTCOP	093i033	0417
61	S	8.04	VTUTCDE	093j073	0184
69	SW	14.96	VTUTMOP	093j047	0627
58	S	279.12	VTUTCOP	093i051	0263
68	SW	21.88	VTUTCOP	093j096	0224
53	S	35.64	VTUTCSP	093i014	0729
245	S	157.40	VTUTCSP	093o019	0322
267	S	21.60	VTUTCOP	093g089	0090

Sample # -	Leading Species	Area (ha)	BCLCS	MAP_NO	POLYGON
51	S	23.88	VTUTCSP	093i014	0030
264	S	31.16	VTUTCOP	093h085	0526
63	S	90.12	VTUTCOP	093h062	0214
54	S	184.52	VTUTCSP	093i033	0140
253	S	121.52	VTUTCOP	093h055	0195
259	S	55.40	VTUTCSP	093j083	0181
269	S	21.92	VTUTCOP	093h094	0389
52	SW	33.76	VTUTCSP	093i007	0301
244	S	6.52	VTUTCSP	093j067	0806
263	S	53.48	VTUTCOP	093h032	0202
260	S	39.24	VTUTCOP	093h081	0380
70	S	146.84	VTUTCOP	093i061	0254
249	S	67.24	VTUTCSP	093j036	0942
59	S	46.88	VTUTCOP	093o018	0376
268	S	24.72	VTUTCOP	093g084	0142

7. APPENDIX D: LIST OF ALL SAMPLES IN THE VT LANDBASE

Observ. #	Map#	Poly. #	Stratum
1	093g034	0485	vt pine vol.cls 2
2	093g042	0151	TEP Pine Vol.cls 2
3	093g043	0449	TEP Pine Vol.cls 2
4	093g044	0141	vt pine vol.cls 2
5	093g044	0178	TEP Pine Vol.cls 2
6	093g044	0965	TEP Pine Vol.cls 2
7	093g045	0406	TEP Pine Vol.cls 2
8	093g054	0332	TEP Pine Vol.cls 2
9	093g055	0642	TEP Pine Vol.cls 0
10	093g058	0535	TEP Spruce Vol.cls 2
11	093g059	0147	TEP Balsam Vol.cls 1
12	093g060	0669	TEP Spruce Vol.cls 2
13	093g060	0825	TEP Balsam Vol.cls 0
14	093g064	0614	vt pine vol.cls 2
15	093g069	0122	TEP Balsam Vol.cls 0
16	093g074	0694	vt pine vol.cls 1
17	093g075	1055	TEP Pine Vol.cls 1
18	093g080	0047	TEP Pine Vol.cls 1
19	093g080	0300	TEP Pine Vol.cls 0
20	093g084	0142	TEP Spruce Vol.cls 2
21	093g086	0301	TEP Pine Vol.cls 1
22	093g089	0090	TEP Spruce Vol.cls 2
23	093g089	0848	TEP Pine Vol.cls 0
24	093g090	0740	vt pine vol.cls 2
25	093g096	0196	vt Decid vol.cls 0
26	093g097	0430	TEP Decid Vol.cls 0
27	093g098	0214	vt Decid vol.cls 2
28	093g100	0680	TEP Decid Vol.cls 0
29	093h032	0202	TEP Spruce Vol.cls 2
30	093h035	0163	vt spruce vol.cls 2
31	093h042	0340	TEP Spruce Vol.cls 0
32	093h044	0381	TEP Spruce Vol.cls 2
33	093h045	0267	vt balsam vol.cls 2
34	093h051	0489	TEP Spruce Vol.cls 0
35	093h052	0203	TEP Balsam Vol.cls 1
36	093h054	0243	TEP Spruce Vol.cls 0
37	093h055	0195	TEP Spruce Vol.cls 1
38	093h062	0214	vt spruce vol.cls 2
39	093h062	0444	TEP Spruce Vol.cls 2

Observ. #	Map#	Poly. #	Stratum
40	093h064	0209	vt balsam vol.cls 2
41	093h065	0440	TEP Balsam Vol.cls 2
42	093h071	0027	vt balsam vol.cls 2
43	093h071	0890	TEP Balsam Vol.cls 2
44	093h072	0406	vt pine vol.cls 0
45	093h079	0471	TEP Balsam Vol.cls 1
46	093h081	0380	TEP Spruce Vol.cls 1
47	093h082	0585	vt balsam vol.cls 2
48	093h085	0526	TEP Spruce Vol.cls 2
49	093h086	0234	TEP Spruce Vol.cls 1
50	093h086	0369	TEP Balsam Vol.cls 2
51	093h087	0112	TEP Balsam Vol.cls 2
52	093h089	0301	vt balsam vol.cls 1
53	093h092	0784	TEP Decid Vol.cls 2
54	093h094	0068	vt balsam vol.cls 2
55	093h094	0389	TEP Spruce Vol.cls 2
56	093h096	0280	TEP Spruce Vol.cls 1
57	093i004	0278	vt spruce vol.cls 0
58	093i005	0462	vt pine vol.cls 1
59	093i006	0104	vt balsam vol.cls 0
60	093i007	0301	vt spruce vol.cls 0
61	093i014	0030	vt spruce vol.cls 0
62	093i014	0729	vt spruce vol.cls 0
63	093i016	0255	TEP Spruce Vol.cls 1
64	093i017	0224	TEP Balsam Vol.cls 0
65	093i024	0529	TEP Spruce Vol.cls 0
66	093i031	0218	TEP Balsam Vol.cls 2
67	093i032	0084	TEP Balsam Vol.cls 2
68	093i033	0140	vt spruce vol.cls 0
69	093i033	0417	vt spruce vol.cls 2
70	093i035	0306	TEP Balsam Vol.cls 1
71	093i044	0336	vt spruce vol.cls 1
72	093i046	0143	vt balsam vol.cls 1
73	093i051	0263	vt spruce vol.cls 1
74	093i061	0254	vt spruce vol.cls 2
75	093i062	0032	vt balsam vol.cls 0
76	093i063	0144	TEP Balsam Vol.cls 0
77	093i072	0140	TEP Balsam Vol.cls 1
78	093j006	0857	TEP Spruce Vol.cls 0
79	093j013	0663	vt pine vol.cls 1
80	093j014	0122	TEP Pine Vol.cls 1

Observ. #	Map#	Poly. #	Stratum
81	093j014	0800	vt pine vol.cls 0
82	093j015	0694	vt Decid vol.cls 0
83	093j016	0392	vt spruce vol.cls 2
84	093j023	0800	vt Decid vol.cls 1
85	093j025	0856	TEP Pine Vol.cls 0
86	093j035	0771	TEP Pine Vol.cls 0
87	093j035	0886	vt pine vol.cls 1
88	093j036	0942	TEP Spruce Vol.cls 0
89	093j037	0221	vt pine vol.cls 2
90	093j045	0981	vt pine vol.cls 0
91	093j047	0627	vt spruce vol.cls 2
92	093j047	0729	TEP Pine Vol.cls 1
93	093j047	0769	TEP Pine Vol.cls 0
94	093j048	0829	TEP Spruce Vol.cls 1
95	093j052	0423	TEP Pine Vol.cls 2
96	093j056	0549	TEP Balsam Vol.cls 0
97	093j059	0489	TEP Spruce Vol.cls 1
98	093j063	0273	vt spruce vol.cls 1
99	093j067	0347	TEP Spruce Vol.cls 0
100	093j067	0806	TEP Spruce Vol.cls 0
101	093j068	0175	TEP Spruce Vol.cls 2
102	093j073	0184	vt spruce vol.cls 1
103	093j074	0465	TEP Pine Vol.cls 1
104	093j076	0083	vt spruce vol.cls 0
105	093j076	0338	TEP Decid Vol.cls 1
106	093j080	0328	TEP Spruce Vol.cls 0
107	093j080	0659	TEP Balsam Vol.cls 2
108	093j083	0181	TEP Spruce Vol.cls 1
109	093j086	0061	vt spruce vol.cls 1
110	093j088	0640	TEP Decid Vol.cls 1
111	093j096	0224	vt spruce vol.cls 2
112	093j097	0698	TEP Spruce Vol.cls 2
113	093j098	0230	vt pine vol.cls 0
114	093o010	0309	TEP Spruce Vol.cls 1
115	093o018	0109	vt balsam vol.cls 1
116	093o018	0376	vt spruce vol.cls 1
117	093o018	0421	vt balsam vol.cls 0
118	093o018	0551	TEP Balsam Vol.cls 1
119	093o019	0109	vt balsam vol.cls 1
120	093o019	0322	TEP Spruce Vol.cls

8. APPENDIX E - COMPARISON BETWEEN THE POPULATION AND THE SAMPLE POLYGONS

This comparison is for the entire VT sample (Appendix D). The sample (% number of sample polygons) appears representative of the target VT population (% area) in terms of site index and age class profiles (Figure 2). The total number of sample polygons is 120 and the total area of the population is 2,184,046 ha.

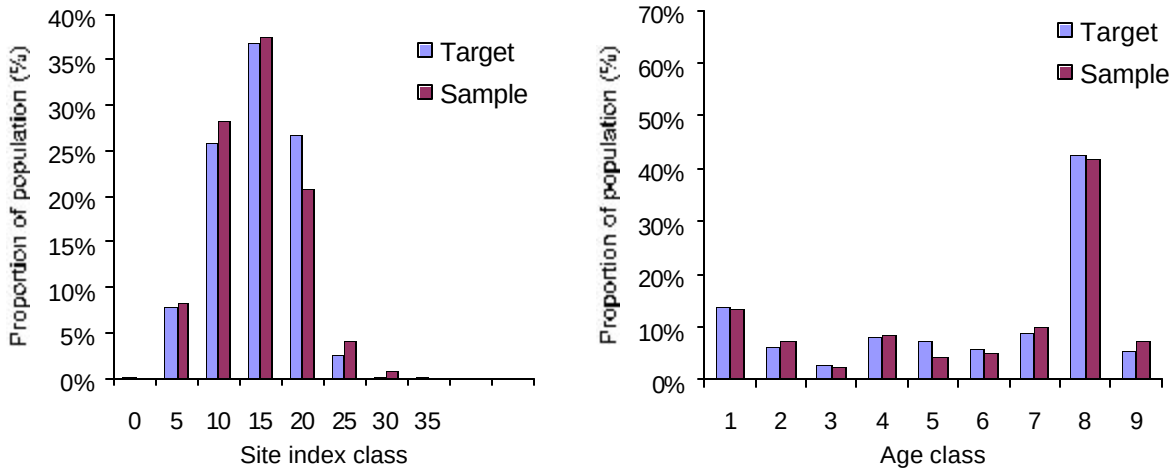

Figure 2. Distribution of target and sample populations by site index class and age class.

9. APPENDIX F – APPROVAL/SIGNING

I have read and concur with the Prince George Forest District timber emphasis VRI Project Implementation Plan, dated 12 April 2000. It is understood that this is an agreement-in-principle and does not commit the signatories to completing the inventory activities outlined within the plan. Modifications to this plan or more detailed plans need to be reviewed and approved by the signatories.

_____

District Manager
Prince George Forest District

_____

Regional Manager
Prince George Forest Region

_____

Director
Ministry of Environment, Lands and Parks, Resources Inventory Branch

_____

Director
Ministry of Forests, Resources Inventory Branch

_____

Dunkley Lumber Ltd.

_____

Canadian Forest Products Ltd.

The Pas Lumber Company Ltd.