

North Coast Timber Supply Area

Vegetation Resources Inventory

Strategic Inventory Plan

PREPARED BY:
HUGH CARTER, MSc, RFT
TIMBERLINE NATURAL RESOURCE GROUP LTD.

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EXECUTIVE SUMMARY

The objective of the Vegetation Resources Inventory (VRI) Strategic Inventory Plan (VSIP) is to outline the VRI activities and products that address forest management and inventory issues within a management unit. The North Coast Timber Supply Area (TSA) stakeholders are initiating a VRI on the land base to get improved inventory information. The stakeholder group involved in the planning for the North Coast includes International Forest Products Ltd. (Interfor), B.C. Timber Sales (BCTS), Sonora Logging, Triumph Timber, Gitxaala Nation and Gitxaala Forest Products, Coast Tsimpshian Resources (represented by Brinkman) and the Ministry of Forests and Range (MFR) represented by Forest Analysis and Inventory Branch (FAIB), the North Coast Forest District, and the Coast Forest Region.

The North Coast TSA is dynamic and diverse and the stakeholder group recognizes that there are values on the land base that are as important as timber. Examples of management issues or business needs for the TSA include:

- Updated data to replace the existing inventory;
- Data needs for ecosystem based management (EBM);
- Productivity and volumes of natural stands;
- Critical wildlife habitats;
- Determination of operable areas;
- Decay in redcedar, hemlock, and balsam; and
- First Nations needs.

The North Coast Stakeholders recognized that a VRI will provide them with improved information that can contribute to addressing their management and business needs. The following VRI activities and products (with proposed target areas) are planned:

1. Conduct a Phase I photo-interpretation over the entire North Coast TSA.
2. Conduct Phase II ground sampling in the vegetated treed (VT) area > 30 yrs area of the North Coast TSA.
3. Conduct Net Volume Adjustment Factor (NVAF) destructive sampling on the VT > 30 yrs area of the North Coast TSA.
4. Consider Change Monitor Inventory (CMI) sampling in the VT < 50 yrs area of the TSA.

VRI Project Implementation Plans (VPIPs) for a Phase I VRI, Phase II VRI/NVAF and CMI will be completed following discussion and approval of this VSIP. The Phase I VPIP will provide the details for implementation of VRI photo interpretation in terms of target area, ground and air calls required, available data sources, and prioritization of areas for interpretation. For ground sampling the Phase II VPIP will provide details in terms of geographic areas, scheduling, priorities, plot location coordination, estimated inventory costs (by year if necessary), and roles and responsibilities. The Phase II VRI/NVAF and CMI VPIPs are planned to be completed after the Phase I VRI is completed.

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1. INTRODUCTION

1.1 BACKGROUND

This Vegetation Resources Inventory (VRI) Strategic Inventory Plan (VSIP) outlines the VRI activities and products needed to address forest management and inventory issues in the North Coast Timber Supply Area (TSA). The VSIP provides direction for photo interpretation, ground sampling, and statistical adjustment of the inventory. Following VSIP approval, the next steps include completion of the photo acquisition and preparation and implementation of VRI Project Implementation Plans (VPIPs).

The participating stakeholders held a meeting in September 2007 to discuss the management issues (Table 4.) within the TSA. The North Coast TSA participating stakeholders group is comprised of participants operating within the North Coast Forest District. The stakeholders are listed as follows and a list of the participants is presented in Appendix I:

- | | |
|--|----------------------------|
| • MFR (FAIB, Region, & District) | • Interfor |
| • BCTS Skeena | • Sonora Logging |
| • Ministry of Environment | • Triumph Timber |
| • BC Parks | • Gitxaala Nation & |
| • Coast Tsimshian Resources
(represented by Brinkman) | • Gitxaala Forest Products |

1.2 VRI OVERVIEW

The VRI is a vegetation inventory process approved by the former Resources Inventory Committee (RIC) to assess the quantity and quality of BC's timber and vegetation resources. The VRI estimates overall population totals and averages as well as individual polygon attributes for timber and non-timber resources. Its design is simple, reasonably efficient, statistically defensible, and addresses issues raised by the Forest Resources Commission in its 1991 report, *The Future of Our Forests*.¹

The VRI consists of five components (Appendix III):

1. Photo Interpreted Estimates (Phase I).
2. Ground Sampling (Phase II) – timber emphasis, ecology, and coarse woody debris.
3. Net Volume Adjustment Factor (NVAF) sampling.
4. Change Monitoring Inventory (CMI).
5. Statistical Adjustment.

One or more of these components can address specific forest management or inventory issues. For more detailed information, visit <http://ilmbwww.gov.bc.ca/risc/pubs/teveg/index.htm>.²

¹ Forest Resources Commission. 1991. *The Future of Our Forests – Executive Summary*. Unpublished, Victoria. 41 pp.

² <http://www.for.gov.bc.ca/hts/vri/>

2. METHODOLOGY

2.1 PHASE I – PHOTO INTERPRETATION

Prior to commencing the Phase I of a VRI project, a VPIP for photo interpretation is prepared for review and signed-off by the MFR and the lead proponent/licensee. This plan covers photo acquisition requirements, the VRI Phase I process, adherence to standards, and details the photo interpretation work that will be carried out.

Phase I is the photo interpretation phase of a VRI and entails polygon delineation and attribute estimation by certified photo interpreters through the use of traditional aerial photographs or softcopy images. The delineation identifies the location of the forest resources and the interpretation component provides estimates of attributes including land cover type, crown closure, tree species, height, age, stand structure, basal area, density, slope position, moisture and nutrient regimes, snags, shrubs, herbs, and bryoids.

Estimation of attributes from field reference points is based upon field procedures using a combination of air and ground calibration points. Any available historical data will be provided by the MFR and will be used to determine information gaps to focus field calibration to areas of need.

2.2 PHASE II – GROUND SAMPLING

Prior to commencing Phase II work, a VPIP for ground sampling the target population will be completed and approved by the MFR. These plans detail the Phase II sample selection process and adherence to standards.

Specifically the Phase II VPIP(s) will:

- Detail the Phase II project and sampling objectives;
- Identify current and past timber supply issues that should be addressed through the Phase II program;
- Identify target and sample populations, sample selection, stratification, and sample size details;
- Include discussion of the field program;
- Include a list of sample polygons and point locations;
- Discuss the proposed data compilation, analysis, and statistical adjustment;
- Identify the roles and responsibilities; and,
- Include the proposed implementation schedule.

The samples selected for the Phase II ground sampling are based on the delineated polygons and attributes estimated during Phase I. Samples are selected in an unbiased manner from the target population. The initial goal of the Phase II program will be to achieve a sampling error of +/- 10% (95% confidence). However, following consultation with the MFR and licensees, this objective may be amended to focus sampling on those components identified as key issues in timber supply analysis (i.e., emerging management issues and those strata deemed sensitive in previous TSRs). The Phase II VPIP also includes details on the proposed NVAF program including sample size and sample selection.

2.3 NET VOLUME ADJUSTMENT FACTOR

As per MFR VRI standards, all new VRI programs must include NVAF sampling, which involves detailed stem analysis of sample trees that have been randomly selected from the Phase II plots. The NVAF is used to correct estimates of net close tree utilization volume for all species. The NVAF adjusted VRI ground sample volumes are used to adjust the Variable Density Yield Prediction (VDYP) yield table model volumes.

2.4 STATISTICAL ADJUSTMENT

The final step is the statistical analysis of the data and resulting adjustments whereby the Phase II plot estimates are used to adjust the Phase I photo interpretation attribute estimates. NVAF data is used to adjust the Phase II sample estimates for hidden decay and taper equation bias. The final product is a statistically valid inventory at the management unit level.

2.5 CHANGE MONITORING INVENTORY

A Change Monitoring Inventory (CMI) program takes measurements at timed intervals with the intent of monitoring change over time of key forest inventory attributes. These change estimates can then be compared to predictions derived from growth and yield models. One of the objectives of the CMI program is to act as an early warning system if assumptions used in growth and yield models are inaccurate. The CMI will only indicate that there is a problem with the model(s); it will not give information about the source of the problem. Specific studies can be undertaken to investigate the source of any problem identified by the CMI program.

2.6 FUNDING

Currently funding for VRI activities is provided by the Forest Investment Account (FIA) Land Base Investment Program. Future funding is expected to come from FIA or its equivalent at the time. Investigation of other funding sources will be explored as needed. Examples could include:

1. Forest Sciences Program funding for research opportunities related to the business needs that are not directly addressed by the VRI (i.e. Cedar die-back, monumental cedar and cypress, and dwarf mistletoe.)
2. First Nations Funding to augment available funds for more vigorous estimation and ground truthing in areas of interest and needs for EBM attribution that is not standard VRI.
3. Ministry of Environment to contribute funding to allow for a seamless inventory that includes parks and reserves.

3. BUSINESS CONSIDERATIONS

3.1 LAND BASE DESCRIPTION

The North Coast TSA is situated in northwestern B.C. in the Coastal Forest Region (Figure 1) and covers approximately 1.8 million hectares (Table 1). The timber harvesting land base (THLB) in Timber Supply Review (TSR) 3 was 145,808 ha (8% of the TSA).³

The North Coast TSA is bordered on the west by the Queen Charlotte TSA, which lies across Hecate Strait in the Pacific Ocean. To the east and inland lie the Nisga'a Treaty Lands, the Nass and Kalum TSAs, as well as Tree Farm Licences (TFLs) 1, and 41. To the southeast is Block 5 of TFL 25 and directly south is the Mid Coast TSA.

There are a number of parks in and adjacent to the TSA, including Tweedsmuir Provincial Park to the south, and Khutzeymateen Provincial Park which is northeast of Prince Rupert.

The TSA is diverse and contains three biogeoclimatic zones: Coastal Western Hemlock (CWH), Mountain Hemlock (MH), and Alpine Tundra (now Coastal Mountain Heather [CMH]). The major tree species in the TSA are western hemlock (Hw), western redcedar (Cw), amabilis fir (Ba), sitka spruce (Ss), and yellow cedar (Yc). Minor tree species include shore pine (Plc), red alder (Dr), and black cottonwood (Act). The diverse forests provide habitat for many wildlife species, including grizzly and black bear, black-tailed deer, wolverine, fisher, porcupine, and numerous species of birds. The ocean inlets provide habitat for whales and salmon species.

At the time of TSR3, 48% (or 875,000 ha) of the TSA land base is considered productive forest. Currently about 17% of this forested land base is considered available for harvesting (8% of the total TSA land base) (Table 1.). The species and age class distribution as percent of the entire land base are presented in Table 2.

Table 1. TSR 3 THLB net-down process.

Land Class	Area (ha)	% of TSA
Total TSA	1,830,883	100%
Non Crown Ownership	40,138	2%
Nisga'a lands	55,389	3%
Non-productive	859,454	47%
Productive Forest	875,902	48%
Productive Reductions	730,095	40%
THLB	145,808	8%

Table 2. Species and age distribution as the % of the entire land base.

Species	MFR Age Class									Total
	1	2	3	4	5	6	7	8	9	
Ac	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
B	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.3	1.4	2.0
Cw	0.0	0.0	0.0	0.0	0.1	0.1	0.3	16.2	20.4	37.1
Dr	0.0	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.5
Ep	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
H	0.4	1.2	0.4	0.6	1.2	0.4	0.4	6.1	25.7	36.3
Hm	0.0	0.0	0.0	0.4	0.5	0.1	0.1	1.5	5.1	7.8
Pl	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	1.4	6.2
S	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.3	1.1	1.8
Yc	0.0	0.0	0.0	0.0	0.0	0.1	0.1	4.0	3.7	8.1
Total	0.7	1.5	0.6	1.2	2.0	0.8	1.0	33.4	58.8	100.0

³ BC Ministry of Forests and Range. 2006. North Coast Timber Supply Area Analysis Report. Unpublished Report, April 2006. p. 7.

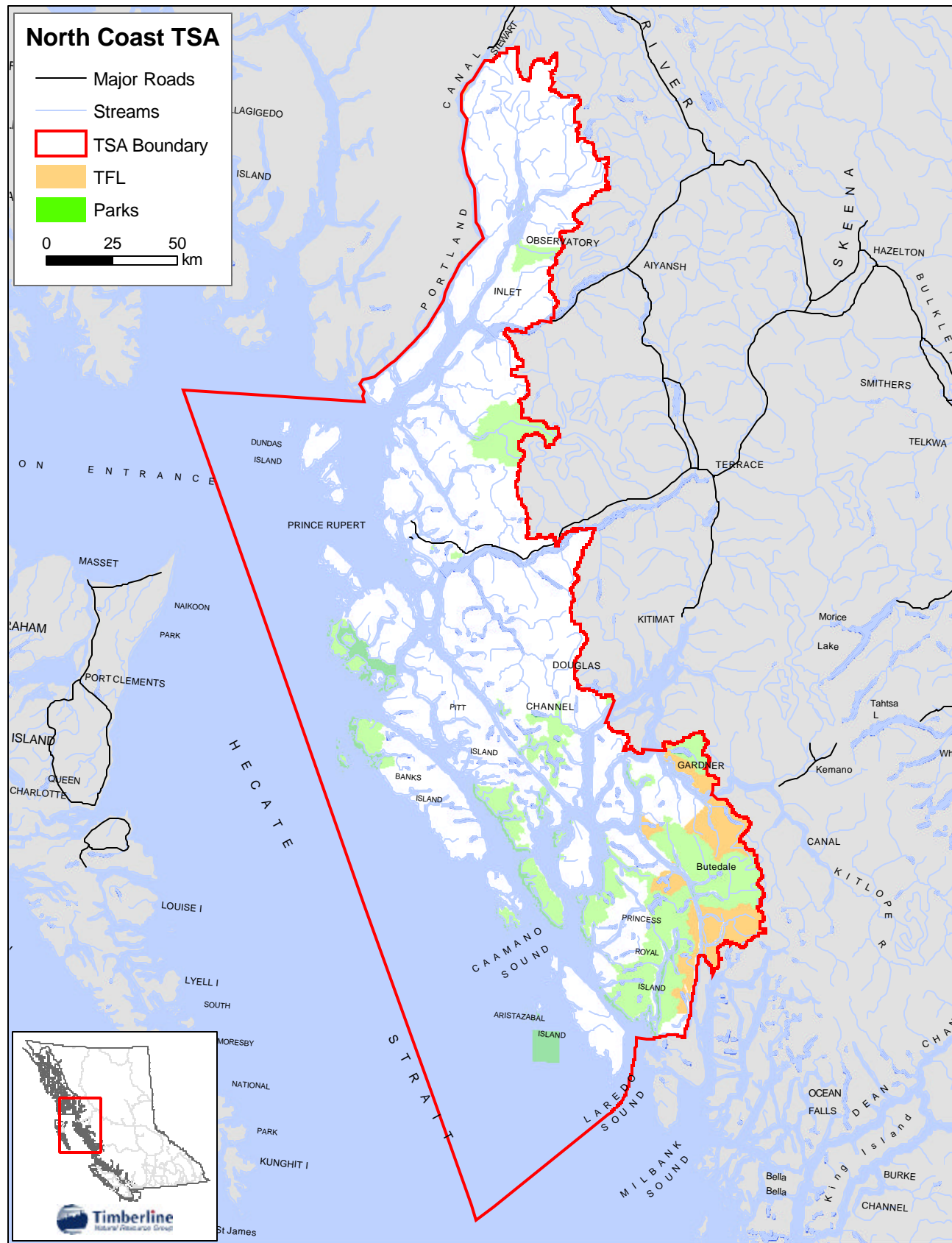


Figure 1. Overview map North Coast Timber Supply Area.

3.2 FIRST NATIONS

The majority of the North Coast TSA is within the asserted traditional lands of the Tsimshian First Nation. The Haisla also have traditional territories within the TSA, and the Heiltsuk and Gitanyow have asserted their traditional interests within the district.

The Nisga'a Final Agreement is the only treaty in the Timber Supply Area to reach Stage 6 (Implementation of the Treaty) and their treaty area has been removed from the TSA. Treaty negotiations with all other First Nations in the TSA have reached Stage 4 (Agreement in Principle).⁴ Once the treaties or related agreements have been finalized, they will be considered in a future Timber Supply Review.⁵ Refer to Appendix V for a complete list of First Nations Stakeholders within the North Coast TSA.

3.3 CURRENT FOREST INVENTORY STATUS

The existing inventory for the North Coast has interpreted attributes from as far back as 1953 (Table 3) and the last official complete inventory dates back to the 1970's. A number of inventory activities were initiated throughout the 1990's. A reinventory was initiated in 1994 and was partially completed. This inventory data was compiled with older data to form the file used for the 1999 TSR. The 1999 iteration of the forest cover inventory was "rolled over" to the current VRI format in 2001. Major licensees' harvesting and road construction data from 1999 to 2004 was used to update the forest cover information for the 2006 timber supply analysis dataset.

Table 3. Interpretation year and associated area.⁶

Interpretation Year	Photo Year	Area (ha)	Percent of Total	Interpretation Year	Photo Year	Area (ha)	Percent of Total
1953	1953	678	0.0	1984	1984	449	0.0
1955	1955	1,029	0.1	1985	1985	609	0.0
1956	1956	1,598	0.1	1986	1986	2,343	0.1
1959	1959	4	0.0	1987	1987	2,626	0.1
1960	1960	13	0.0	1988	1988	10,430	0.6
1962	1962	0	0.0	1989	1989	2,931	0.2
1963	1963	184	0.0	1990	1990	1,777	0.1
1964	1964	16,937	0.9	1991	1991	2,024	0.1
1965	1965	8,259	0.4	1992	1992	1,107,364	59.2
1967	1967	6	0.0	1993	1993	1,652	0.1
1970	1970	1	0.0	1994	1994	465,854	24.9
1972	1972	93	0.0	1995	1995	175,399	9.4
1973	1973	39	0.0	1996	1996	14,099	0.8
1974	1974	50	0.0	1997	1997	2,763	0.1
1976	1976	2,670	0.1	1998	1998	3,550	0.2
1977	1977	29,785	1.6	1999	1999	1,891	0.1
1978	1978	228	0.0	2003	2001	48	0.0

⁴ BC Treaty Commission. <http://www.bctreaty.net/index.php>

⁵ BC Ministry of Forests. 2001. North Coast Timber Supply Area Rationale for Allowable Annual Cut (AAC) Determination. Unpublished Report, January 1, 2001. p. 59.

⁶ The data used for this summary is the VRI data available from the LRDW obtained in April 2008.

Interpretation Year	Photo Year	Area (ha)	Percent of Total	Interpretation Year	Photo Year	Area (ha)	Percent of Total
1979	1979	4,400	0.2	2003	2002	585	0.0
1980	1980	5,172	0.3	2003	2003	24	0.0
1981	1981	260	0.0	2005	2004	892	0.0
1982	1982	380	0.0	2005	2005	586	0.0
1983	1983	74	0.0	2006	2006	350	0.0

An inventory audit was completed in 1996 using both the original inventory and the 1994 re-inventory data. The audit of the original inventory indicated an overestimation of mature volumes on the TSA. When the re-inventory information was analyzed no significant difference in mature volume was observed and the inventory was considered statistically valid.⁷

In his 2007 AAC determination the Chief Forester recognized that there was uncertainty associated with the quality of the forest inventory and lack of continuous updates for forest cover delineation since the previous timber supply review.⁸ New inventory data derived from the VRI will provide more confidence in the data used for future timber supply reviews.

New aerial photography has been completed for approximately 60% (approx. 149 of 249 map sheets) of the TSA in the 2007/2008 fiscal year with the remainder being in the Northern portion of the TSA. This photography is 1:20,000 colour, scanned mostly to 12 micron with some scanned to 14 micron. The imagery obtained thus far has all been scanned, the aerial triangulation (AT) completed, with DIAP models made. The remainder of the photography is planned to be completed to the same specifications in the 2008/2009 fiscal year depending on available funds, flight times, and weather. All remaining photography is tentatively scheduled to be acquired, scanned, and digitized with AT within the 2008/2009 fiscal year.

3.4 FOREST MANAGEMENT CONSIDERATIONS

The critical management considerations were determined in the September, 2007 stakeholders meeting. The current inventory contains interpreted attributes from as far back as 1953 with the majority of observation being completed in the early 1990's (Table 3). The inventory is outdated and inadequate for planning. Volumes, heights, ages, and species compositions have been identified as erroneous and need to be improved. Portions of the North Coast TSA have undergone land use changes which are not currently reflected in the inventory. These factors are contributing to uncertainty and concerns around allocations of volumes to small licencees and First Nations which have the potential to result in legal or financial ramifications to the MFR.

Forest health issues have been identified within the TSA and stakeholders would like better information on the amount and extent of yellow cedar decline and dwarf mistletoe. Ecosystem Based management (EBM) information needs are substantial and improved inventory information will provide better decision support for forest managers within the TSA. Critical wildlife habitat is an extremely important aspect of forest management and the vegetation inventory provides valuable information to better manage this resource.

⁷ North Coast TSA inventory Audit – MFR Resources Inventory Branch, 1996.

⁸ North Coast Timber Supply Area Rationale for Allowable Annual Cut (AAC) Determination – MFR Jim Snetsinger, 2007.

Site productivity estimates are understated as a result of the unreliable heights and ages. Timber supply estimates are closely linked to productivity and currently the available information is unreliable for future planning. Currently there is no monitoring program in place for the North Coast TSA which means that assumptions around growth and yield for timber cannot be validated.

A well implemented and accurate inventory will help mitigate or address the issues that are prevalent on the North Coast TSA. All management issues identified by the stakeholders and the impact of Phase I and Phase II have been assessed (Table 4):

Table 4. Forest Management Issues.

1.	ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
	<i>Updated inventory</i>	High	High	<p>The last official complete inventory on the North Coast TSA was done in the 1970's. The existing inventory has interpreted attributes from as far back as 1953.</p> <p>A new VRI will replace the existing inventory with improved information that complies with the current MFR standards and has a known precision.</p>
2.	<i>Species composition, age and height</i>	High	High	<p>The stakeholders are concerned with erroneous species compositions on large areas of merchantable stands throughout the current inventory. The stakeholders require improved species composition estimates which better differentiation between Cw and Yc.</p> <p>The chief forester recognized the uncertainty in species, age, and height in his 2007 AAC determination. The VRI should provide more reliable estimates of species composition, age and height.</p>
3.	<i>Site index of the old growth cedar and immature hemlock stands</i>	High	High	<p>The stakeholders are concerned with the site index of old growth cedar and immature hemlock stands. Inaccuracy in height and age has resulted in understated site indices, and generally old growth heights and ages are not useful or accurate in calculating site productivity.</p> <p>Adjusted Phase I heights and ages will be used to derive a new site index in all stands. Site Index Adjustment (SIA) or SIBEC programs are other options that could address the concerns around site index in immature stands.</p>
4.	<i>Volume estimates for existing natural stands</i>	High	High	<p>The existing inventory is perceived to overestimate the timber volumes as found by both the District and Licencees. Overestimated volumes have contributed to issues around volume allocation to both First Nations and small licencees,</p>

ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
			<p>which have the possibility of legal or financial ramifications to the MFR.</p> <p>The Phase I, Phase II, NVAF, and statistical adjustment will provide improved estimates of volume for natural stands with known precision. This improved information could potentially alleviate the concerns around volume allocation</p>
5. <i>First Nations treaty negotiations</i>	High	High	<p>There are several First Nations at Stage 4 (Agreement in Principle) of the Treaty Negotiation process⁶. Although treaty negotiations are not complete, the impact and stage of negotiation need to be considered in upcoming timber supply reviews.</p> <p>An improved inventory will provide the provincial chief forester with confidence in TSR.</p>
6. <i>Estimates of partially cut stands</i>	Med	Low	<p>The stakeholders have identified the need to better identify residual stands and stands where selective harvesting has occurred. A more accurate description of partial cut stands will better reflect available timber volumes. The use of RESULTS data should be considered to help identify partially cut stands in the inventory.</p>
7. <i>Ecosystem Based Management (EBM)</i>	High	High	<p>EBM is the management of human activities in a way that allows ecosystems (and their components) to continue development at appropriate temporal and spatial levels.⁹ The government has committed to fully implement EBM by March 2009. The timber supply impact associated with EBM could change considerably as better data becomes</p>

⁹ Coast Zone Strategic Plan http://ilmbwww.gov.bc.ca/lup/lrmp/coast/cencoast/docs/AIP_coastal_zone_plan.pdf

ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
			<p>available¹⁰.</p> <p>EBM information needs are substantial and there is a need to identify ecological factors such as riparian forest types (i.e. active fluvial units, wet flood plains, and marine interface zones), forested swamps, high value fish habitat, wildlife (grizzly, moose, goat and marbled murrelet) habitat/forage zones, estuaries and fens. VRI data will provide a base line of information for EBM needs. In most cases the standard attributes available in VRI will provide the information needed to predict and/or identify areas of interest. If there are additional attributes of interest that are not standard VRI, a variance in the standards would be required and the funding mechanism, standards, procedures, and data management costs would need to be determined.</p> <p>Data obtained through the Phase I and Phase II in conjunction with possible input from the Ministry of Environment will provide improved decision support for management of the forest resource.</p>
8. Long-term timber supply (2060+)	High	High	<p>Improved information about long-term timber supply is required to support strategic planning initiatives. An accurate Phase I and well implemented Phase II program will provide greater confidence in long term timber supply predictions.</p> <p>Results from a CMI program can help develop, validate, or modify yield curves. The CMI is an effective way of quantifying attributes in managed or post harvest regenerated stands.</p>

¹⁰ AAC Rationale for North Coast TSA – November 2007 (November 6, 2007).
<http://www.for.gov.bc.ca/hts/tsa/tsa21/tsr3/21ts07ra.pdf>

ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
9. Representation of operable versus inoperable lands	High	Medium	<p>The Ministry of Forests and Range (District) has found misrepresentation of operable versus inoperable land areas. Stands labeled as inoperable are being actively harvested. In the area north of the Nass River, the chief forester recommends in his 2007 AAC determination that an operability assessment be completed.</p> <p>The VRI will provide better information on the distribution and types of merchantable timber in the TSA. This improved information could be used in the algorithms used to determine operability lines.</p>
10. Protected land inventory	High	Low	<p>Park land and conservancies have been partitioned within the North Coast TSA in recent years.</p> <p>The Phase I VPIP will identify parks and portions of the land base that will be considered part of the target population.</p>
11. Volume estimates and decay	Low	High	<p>The stakeholders require more accurate decay estimates and volumes in Cw, H and B. In his 2007 rationale the Chief Forester instructed the stakeholders to collect more data for decay waste and breakage.</p> <p>A well implemented NVAF program with appropriate sample sizes for species of interest will be important. This should provide insight into decay and net volume issues.</p>
12. Deciduous and other non-merchantable forest types	Medium	Medium	<p>Some areas within the TSA were classified as non-merchantable or problem forest types in the 2001 AAC determination.¹¹ In his 2007 AAC determination, the chief forester agreed</p>

¹¹ BC Ministry of Forests. 2001. North Coast Timber Supply Area Rationale for Allowable Annual Cut (AAC) Determination. Unpublished Report, January 1, 2001. p. 20.

ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
			with the inclusion of some Dr and Ac stands in the THLB but recommends that their harvest levels need to be monitored for subsequent decisions on timber supply analyses.
13. Critical wildlife habitat	High	Medium	Habitat prediction requires accurate polygon vegetation estimates and delineation provided through a Phase I VRI. This information can be used in habitat models. Specific habitat attributes could also be collected or derived from Phase II field sampling to validate or monitor the performance of the models. An improved inventory will provide forest managers with better information to manage habitat and identify sensitive areas.
14. Historical and archaeological	Medium	Low	There is potential to use specific VRI data in modeling to determine probabilities of areas having archaeological significance.
15. Visual quality objectives	Medium	Low	VRI will provide updated spatial information useful in effectively assessing visual impact of timber harvesting activities. An improved and updated Phase I will provide information to assist in making accurate assessments of visual quality objectives.
16. Site productivity	Low – Med	Low -Med	In the 2007 AAC determination, the chief forester found that site productivity assumed in the 2006 timber supply base case might be underestimated for managed stands. PEM and SIBEC programs have been completed on the TSA. The accuracy of the PEM requires improvement before it can be used to provide information on site productivity. Phase I and Phase II VRI programs establish improved estimates of height and age from managed stands which are used to calculate estimates of site index.

ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
17. <i>Stand & landscape level biodiversity</i>	Low	High	Biodiversity estimates are an important component of Forest Stewardship Plans. Spatial data derived from the photo interpretation and ground sampling (specifically coarse woody debris and succession sampling) may provide additional information used in delineating stand attributes related to biodiversity. The Phase II program should provide improved estimates of these attributes; however the utility of this information should be assessed to ensure it is consistent with the stakeholders' information needs.
18. <i>Yellow cedar decline</i>	Low	Medium	<p>Yellow cedar decline has occurred over the past few years and stakeholders need information on the extent of the decline to determine affected cedar volumes.</p> <p>If the portion of the land base could be spatially identified and is significant enough to warrant a Phase II strata the plots established in these areas could be used to assess change over time. This issue may be best addressed through an independent study and not through the VRI process. Options for identifying large tracks of dead yellow cedar will be examined in the Phase I VPIP.</p>

ISSUE	PHASE I IMPACT	PHASE II IMPACT	COMMENT
19. <i>Hemlock dwarf mistletoe</i>	Low	Medium	<p>Hemlock dwarf mistletoe has been found in the TSA and the extent of effected hemlock needs to be captured.</p> <p>Forest health data is collected in the Phase II field sampling. Phase II data will provide information related to the presence or absence of the dwarf mistletoe although it will not provide spatial information regarding the extent of this forest health issue. An independent study may provide more suitable information related to the spatial distribution of dwarf mistletoe.</p>
20. <i>Monumental trees for First Nations</i>	Low	Low	<p>First Nations are interested in the locations of monumental cedars, cypress and spruce which are used for medicinal and/or traditional purposes. There is strong support from the First Nations to include protected areas in the inventory.</p> <p>Phase I data could be used to develop or feed into prediction models to determine potential sites for monumental trees. An independent study may be more effective for determining the location and amount of these rare and important monumental species.</p>

3.5 VRI ACTIVITIES AND PRODUCTS

The following VRI activities and products are needed to address the forest management issues identified for the North Coast TSA. These recommendations address the issues identified in Section 3.4 and Table 2:

1. Complete new photo interpretation (Phase 1) to bring inventory attributes up to VRI standards and provide more accurate, reliable and up-to-date spatial attribute data.
2. Conduct Phase II ground sampling and NVAF of selected areas (determined in VPIPs) of the TSA area to adjust Phase I estimates. This will provide statistically valid timber and individual polygon volumes and other tree attributes to support timber supply review.

3. Conduct VRI ground sampling and consider collecting timber, ecological, range and coarse woody debris data for select areas of the TSA. The extent of the Phase II measurements will be identified in the Phase II VPIP. This will provide spatial and non-spatial baseline data for EBM and other purposes.
4. Consider a CMI program to monitor the midterm timber supply, improve the input data into yield curves, and monitor the areas of high sensitivity and/or priority in EBM terms.

4. STRATEGIC INVENTORY PLAN IMPLEMENTATION

4.1 OVERVIEW

This section outlines the strategic inventory plan to develop the VRI program. The main product of the VRI program is a statistically unbiased vegetation inventory. For the North Coast TSA this requires Phase I photo estimation, Phase II Ground Sampling, NVAF, and Statistical Adjustment. In addition, a CMI program will be considered to monitor second-growth stand performance (in stands <50 yrs) and validate models and yield curves.

4.2 PHASE I – PHOTO INTERPRETATION

4.2.1 Objective

The objective of a VRI Phase I is to use softcopy technology to improve TSA polygon information, especially in areas with specific management issues (e.g. species delineation, operable vs. inoperable areas, etc.). The VRI product is a spatial database consisting of unadjusted photo-interpreted estimates. Ground sampling (VRI Phase II), is used to check and adjust the photo-interpreted estimates. This process is outlined in a separate part of this document (see Section 4.3 – Phase II Ground Sampling).

4.2.2 Target Area

The target area for the Phase I VRI is the entire North Coast TSA land base including woodlots, parks, and potentially private land. Currently the funding needed to include protected areas in the inventory is uncertain and the responsibility for inventorying these areas needs to be determined. In an adjacent TSA (Mid Coast) an area and designation (i.e. Conservancy, Park, Ecological Reserve, etc.) based approach was used to determine whether a protected area would be included in the Phase I delineation and attribution. A summary of protected areas (on land only) with their associated percentage of all protected areas is presented in Table 5. The inclusion of protected areas in the inventory will be finalized in the Phase I VPIP.

Table 5. Protected areas summary.

Protected Area	Area (ha)	Percent of Total
Alty Conservancy	3,970	2.1
Banks Nii Luutiksm Conservancy	12,147	6.4
Bishop Bay - Monkey Beach Conservancy	2,374	1.3
Byers/Conroy/Harvey/Sinnett Islands Ecological Reserve	176	0.1
Dewdney and Glide Islands Ecological Reserve	2,773	1.5
Diana Lake Park	130	0.1
Gamble Creek Ecological Reserve	3,414	1.8
Gitnadoiks River Protected Area	26	0.0
Gitxaala Nii Luutiksm/Kitkatla Conservancy	12,362	6.6
K'distsausk/Turtle Point Conservancy	6	0.0
Khutzeymateen Park	25,599	13.6
Kitasoo Spirit Bear Conservancy	33,962	18.0
Kitson Island Marine Park	12	0.0
Klewnuggit Inlet Marine Park	1,353	0.7
K'Mooda/Lowe-Gamble Conservancy	10,484	5.6
K'nabiyaaxl/Ashdown Conservancy	454	0.2

Protected Area	Area (ha)	Percent of Total
K'ootz/Khutze Conservancy	-	0.0
Ksi Xts'at'kw/Stagoo Conservancy	8,550	4.5
Kt'ii/Racey Conservancy	825	0.4
Ktisgaidz/MacDonald Bay Conservancy	207	0.1
K'waal Conservancy	2,668	1.4
Larcom Lagoon Conservancy	35	0.0
Lax Ka'Gass/Campania Conservancy	17,019	9.0
Lax Kul Nii Luutiksm/Bonilla Conservancy	763	0.4
Lax Kwil Dziidz/Fin Conservancy	1,231	0.7
Lowe Inlet Marine Park	350	0.2
Lower Skeena River Park	193	0.1
Maxtaktsm'aa/Union Passage Conservancy	2,031	1.1
Moksgm'ol/Chapple-Cornwall Conservancy	23,846	12.7
Monckton Nii Luutiksm Conservancy	20,084	10.7
Moore/McKenny/Whitmore Islands Ecological Reserve	16	0.0
Simpson Lake East Conservancy	1	0.0
Skeena River Ecological Reserve	-	0.0
Smithers Island Conservancy	17	0.0
Stair Creek Conservancy	508	0.3
Union Passage Marine Park	791	0.4
Total	188,380	100

4.2.3 Target Attributes

All attributes listed on the VRI photo interpretation attribute form will be targeted. These attributes will be interpreted to current VRI photo interpretation standards utilizing as much information as possible from the historical data sources to decrease the cost of field work.

4.2.4 Photo Interpretation Approach

The photo interpretation objectives will be achieved with the use of VRI-certified photo interpreters using aerial photography in a softcopy environment. The photo interpreters will use a variety of existing and new information sources to enable them to produce more detailed and accurate estimates. These data sources will include:

1. Any historical data available from the MFR and licencees, including old document photos, ground samples, ground calls/observations and air calls;
2. New field calibration data (ground calls and air calls) collected by the interpreters to fill in data gaps especially in second-growth stands and problem forest types;
3. RESULTS data for young stands, partially cut stands, and recently disturbed areas;
4. Historical silviculture records held by licencees and the MFR;
5. PEM data if it has acceptable accuracy;
6. Suitable cruise data; and,
7. Any other valid data source.

A Photo interpretation VPIP will be developed following the MFR guidelines in the Vegetation Resources Inventory Guidelines for Preparing a Project Implementation Plan for Photo

Interpretation. The VIP preparation involves identifying attributes to be improved (attributes or delineation) and identifying where and how to improve them.

4.3 PHASE II - GROUND SAMPLING

4.3.1 Ground Sampling Objective

The primary objective of the Phase II ground sampling program is to provide ground estimates to adjust the volume, age, and height of the existing inventory with a $\pm 10\%$ sampling error at a 95% confidence level. A secondary objective of Phase II ground sampling is to facilitate collection of other stand attributes that cannot be estimated through the Phase I.

4.3.2 Target Population

The proposed target population is the Vegetated Treed (VT) area within the TSA, 30 years or older. If the BC Land Classification Scheme (BCLCS) information is unavailable, VT will be defined as polygons where a leading species exists and crown closure is greater than or equal to 10%. Inclusion of non-contributing areas in the target population will be discussed during development of the Phase II VIP. Both the operable and inoperable areas will be sampled for the Phase II program. The intensity of sampling in the operable vs. inoperable areas will be discussed and finalized during the development of the Phase II VIP.

4.3.3 Sample Size

The coefficient of variation (CV) for the ratio of means calculated from the inventory audit for mature volume was 40%.¹² The MFR recommends increasing the CV by 10% to 50%, meaning that approximately 100 samples are required to achieve the target sampling error of $\pm 10\%$.

A probable stratification scheme would be leading species based strata distributed by age groupings. The following table shows a likely stratification, however this should be re-examined and potentially modified when the Phase II VIP is created, to ensure the business needs at the time are being addressed.

Table 6. Probable stratification and sample size for Phase II sampling.

Stratum	Sub-stratum	% of Total Land base	Estimated number of samples
H	= 140 years	6%	6
	141 – 250 years	8%	8
	250+ years	31%	31
<i>Subtotal</i>		<i>45%</i>	<i>45</i>
Cw/Yc	= 140 years	1%	1
	141 – 250 years	20%	20
	250+ years	24%	24
<i>Subtotal</i>		<i>45%</i>	<i>45</i>
Other	= 140 years	1%	1
	141 – 250 years	5%	5
	250+ years	4%	4
<i>Subtotal</i>		<i>10%</i>	<i>10</i>
<i>Total</i>		<i>100%</i>	<i>100</i>

¹² The CV of the ratio of means was calculated using the 1996 North Coast inventory audit results for the analysis of mature volumes for the new inventory.

4.3.4 Sampling Approach

Phase II certified samplers will install all VRI Timber Emphasis Plots (TEPs), plus CWD.¹³ Sampling will follow a two-stage approach. The first stage will be focused on installing a minimum number of TEPs (approximately 40)¹⁴ to support the information needs of the NVAF program, as well as providing enough information to allow for an interim analysis to assess the remaining plot requirements to achieve the target sampling error. The second stage will be to install enough TEPs to achieve a target sampling error of $\pm 10\%$ at a 95% confidence level. This approach will be refined and updated in the Phase II VPIP. If the information needs are satisfied for the NVAF enhancement early in the field season, the NVAF tree selection and destructive sampling could run concurrently with the establishment of the remaining VRI plots.

4.3.5 Sample Selection

Sample locations will be selected according to MFR standards (Sample Selection Procedures for Ground Sampling version 3.3). First, polygons will be selected using the probability proportional to size with replacement (PPSWR) method. Second, a random point will be selected within the selected polygon using the provincial 100m grid. If no 100m grid point falls within the selected polygon, the grid will be halved until at least one point falls within the polygon.

4.4 NET VOLUME ADJUSTMENT FACTOR

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. This ratio is used to statistically adjust the estimate of net merchantable volume of VRI ground samples.

4.4.1 Objective

The objective of the NVAF component is to estimate NVAF ratios with a sampling error of $\pm 7.5\%$ at a 95% confidence level. A NVAF program will provide improved information that could be used for estimates of dead wood volumes, and taper.

4.4.2 Sample Size

The MFR recommends a minimum sample size of 100 NVAF trees of which 90 are live and 10 dead.¹⁵ The final sample size and distribution by species will be determined during development of the Phase II VPIP. The relative species distribution (in terms of net merchantable volume) will be estimated and the actual sample size for each species group determined based on the species distribution.

¹³ http://ilmbwww.gov.bc.ca/risc/pubs/teveg/vri_gs_2k4/vri_gs_2k4.pdf

¹⁴ It is likely that only 30 plots (1 plot for every 3 trees sampled) will be NVAF enhanced, however for logistical purposes and to determine a more reliable volume distribution it is suggested that a least 40 Phase II plots including the NVAF enhanced plots be measured for use in creating the NVAF program.

¹⁵ Based on an email provided by Will Smith (Feb. 8, 2007) suggesting that the sample size requirements for live and dead trees will change to 10 dead and 90 live for the 2007/2008 fiscal year.

The VRI committee specifically noted that tree decay in Cw, Hw, and B is an area of uncertainty and believe that decay estimates do not adequately reflect these species in the North Coast TSA. A well-designed NVAF program will correct the Phase II estimates of decay which are then used to adjust the Phase I estimates.

Based on the need for improved information on decay in Cw, Hw, and B the following is a probable sample stratification and allocation scheme. This scenario should be re-evaluated when the Phase II VPIP is created to ensure the business needs are still relevant at the time of sampling.

Table 7. Probable stratification and samples size for NVAF.

Stratum	Species-Group	% of Total land base area	Estimated sample size
Dead	All		10
Immature	All	7	10
Mature	H	39	25
	Cw	37	25
	B	2	10
	Yc	8	10
	Other	7	10
Total		100	100

4.4.3 Sample Selection

The number of VRI Phase II plots that will be enhanced for NVAF sampling will be determined following discussion with the MFR and will be updated in the VRI Phase II VPIP. Typically, the MFR recommends enhancing one plot for every three trees destructively sampled. Following completion of the first stage of the Phase II ground sampling program, a tree matrix will be built with trees measured from the NVAF-enhanced samples. The sample in each matrix cell will be selected systematically with a random start after the tree list is sorted by species and diameter at breast height (dbh).¹⁶

4.5 CHANGE MONITORING INVENTORY

4.5.1 Objective

CMI is an important tool for tracking growth performance and improving the modeling assumptions for second-growth stands. CMI should be considered to monitor and validate models predicting mid-term timber supply, develop or modify current yield curves, and quantify attributes in stands < 50 years.

4.5.2 Target Population

The stakeholders intend to consider a CMI program to provide improved information on their mid- to long-term timber supply. Typically the target population for these programs would include only areas that have been harvested in the last 50 years. Modification of the target area,

¹⁶ Net Volume Adjustment Factor Sampling Standards and Procedures, Version v4.2, June 2007.

should be considered before implementing the CMI ground sampling program, to address any relevant information needs.

4.5.3 Sample Size

An effective sample size for CMI would be a minimum of 50 plots as it must be both cost-effective and large enough to allow for post-stratification. It is expected that the sample size will increase as the number of stands coming into the target population increases over time.

4.5.4 Sample Selection

Sample selection will follow the CMI standards at the time of selection. For continuity and consistency, it is recommended that the Phase II VPIP and CMI VPIP be completed concurrently; however funding limitations may require that the two plans be completed independently.

4.6 ESTIMATED COSTS

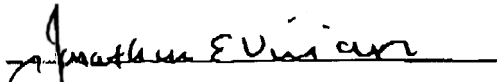
Table 8. Estimated costs for VRI activities in the North Coast TSA.

VRI Activity	Units	Unit Cost (\$/Unit)	Total Cost (\$)	Estimated Projected Fiscal Year
PHOTO ACQUISITION				
Photo Acquisition, scan, AT, and digital models - 2006/2007			\$410,678	Complete
Photo Acquisition, scan, AT, and digital models - 2007/2008			\$374,005	Complete
Photo Acquisition, scan, AT, and digital models – 2008/2009			\$400,000	Completion in 2008/2009
<i>Sub-Total</i>			\$1,184,683	
PHASE I (INTERPRETATION)				
Phase I VPIP	1		\$10,000	Completion in 2008/2009
Phase I – estimation incl. field calibration	Approx. 1.8 million ha.	~\$1.25/ha	\$2,250,000	Completion in 2011/2012
Quality Assurance			\$50,000	Ongoing
<i>Sub-Total</i>			\$2,310,000	
PHASE II (GROUND SAMPLING)				
Phase II VPIP	1	\$10,000	\$10,000	2011/2012
Prep of sample packages			\$8,000	2011/2012
Full VRI Plots	100	\$1,800/sample	\$180,000	2012-2013
Helicopter*	100	\$2,000/sample	\$200,000	2012-2013
Interim Analysis			\$10,000	2012/2013
Quality Assurance (including helicopter*)	10	\$1,500/sample	\$15,000	Ongoing
<i>Sub-Total</i>			\$423,000	
STATISTICAL ADJUSTMENT				
Data Compilation	1	\$1,000	\$1,000	2013/2014
Adjustment & Report	1	\$20,000	\$20,000	2013/2014
<i>Sub-Total</i>			\$21,000	
NVAF				
VPIP Update / Tree Selection	1	\$5,000	\$5,000	2012/2013
Destructive Sampling	100	\$1,000/tree	\$100,000	2012/2013
Helicopter*	100	\$1,000/tree	\$100,000	2012/2013
NVAF Analysis and Reporting	1	\$6,000	\$6,000	2012/2013
Quality Assurance (including helicopter*)	10	\$12,000	\$12,000	Ongoing
<i>Sub-Total</i>			\$223,000	
<i>Estimated Photo Acquisition Cost</i>			1,184,683	2008/2009
<i>Estimated Phase I Cost</i>			2,310,000	2011/2012
<i>Estimated Phase II Cost</i>			667,000	2013/2014
<i>Estimated Total Cost</i>			4,161,683	

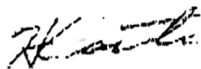
*All helicopter costs are estimates, and are based on previous projects completed on the coast.

5. SIGN-OFF SHEET

I have read and concur that the North Coast TSA VRI Strategic Inventory Plan dated May, 2008 meets current VRI standards. 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.


Jon Vivian, RPF Manager,
Vegetation Resources Inventory Section,
Forest Analysis and Inventory Branch,
Ministry of Forests and Range

08.07.15



June 18, 2008

Hugh Carter, MSc, RFT,
Timberline Natural Resource Group Ltd.



July 14, 2008

Gerald Sommers, RPF

Date

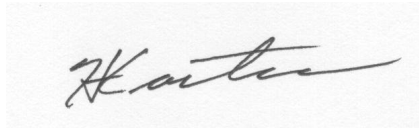
International Forest Products Ltd. (North Coast TSA lead proponent)

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*Jon Vivian, RPF Manager,
Vegetation Resources Inventory Section,
Forest Analysis and Inventory Branch,
Ministry of Forests and Range*

Date



June 18, 2008

*Hugh Carter, MSc, RFT,
Timberline Natural Resource Group Ltd.*

Date

North Coast TSA (lead proponent)

Date

APPENDIX I – VRI COMMITTEE

Table 9. List of the VRI committee participants for the North Coast TSA.

Agencies	Participant
MFR Coast Forest Region	Derek Challenger
MFR Coast Forest Region	Cathy Martineau
MFR Forest Analysis and Inventory Branch	Gary Johansen
MFR Forest Analysis and Inventory Branch	Will Smith
District of the North Coast	Vicky Grainger
District of the North Coast	Czeslaw Koziol
District of the North Coast	Dave Bewick
District of the North Coast	Mike Grainger
District of the North Coast	Bob Cuthbert
District of the North Coast	John Scott
District of the North Coast	Donna Fraser
Licencees	Participant
BCTS Skeena	Les Pawlak
Gitxaala	Murray Watkinson
Gitxaala Nation	Melvin Tolmie
Gitxaala Forest Products	Bill Crocker
Brinkman (CTR)	Remko Engelbertink
Triumph Timber	Shannon Pearce
Triumph Timber	Gwen Blandov
International Forest Products (Interfor)	Gerry Sommers
Facilitator	Participant
District of the North Coast	Vicky Grainger
Minutes Taker	Participant
District of the North Coast	Donna Fraser

APPENDIX II – GLOSSARY OF TERMS

Ground Sampling

VRI ground sampling (Phase I) is the field measurement of timber, ecology, range, and/or coarse woody debris values at one or more locations within each sample polygon. To accommodate the wide variety of resources, various types and sizes of sampling units (e.g., fixed and variable plots, transects) are used to make the measurements.

Landcover Classification

The BC Landcover Classification Scheme (BCLCS) was designed specifically to meet the requirements of the VRI, 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.

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 estimate net volume is obtained from net factoring and taper equations).

Photo Interpretation (Phase I)

Photo interpretation (Phase I) involves the subjective delineation of polygons and the photo estimation of attributes for all polygons in an inventory unit. Medium scale aerial photographs (1:15,000) are most often used in the photo-interpreted estimates inventory.

Post-Stratification

Post-stratification involves the division of an 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.

Pre-Stratification

Pre-stratification involves the division of 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 the special characteristics of each stratum.

Sample Size

The sample size for an inventory is the minimum number of ground samples to be established in an inventory unit to meet specified target precision or cost. Calculation of a theoretical target sample size requires an estimate of the CV of the key attributes of interest under the proposed sampling procedures and a statement of the precision desired in these attributes.

The formal process for determining sample size for an inventory unit is to anticipate the results (e.g., target sampling error for timber volume) and then determine the approximate sample size corresponding to this desired result. This process would, for example, involve the following steps:

1. Set the target accuracy for the overall inventory unit accuracy to E for timber volume (i.e., the sampling error, or half the confidence interval associated with a given probability, e.g., $\pm 15\%$ at the 95% probability level). The number of samples should be adequate to meet the target precision.
2. Estimate the population coefficient of variation (CV_{sample}) of the attribute of interest based on a small sample. This CV_{sample} is defined as a relative measure of the average difference between a polygon ground measurement (assumed the true value) and its corresponding estimate from the inventory.
3. The following formula would then be used to estimate sample size:

$$n = \left[\frac{t * CV_{\text{sample}}}{E} \right]^2$$

where t is the “ t -value” associated with a given probability and degrees of freedom, and CV_{sample} is a sample-based estimate of the population CV.

The sample size calculations suggested here are general guidelines, not exact requirements. The sample size used in practice is usually a trade-off between the calculated sample size and the expected cost, timing, credibility, flexibility, and comparability of the inventory. The size of the population is usually large enough that it does not affect sample size. The calculated sample size may be increased arbitrarily to allow for post-stratification, increased credibility, more flexibility, and a better starting point for growth projections.

Statistical Adjustment

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

Sub-unit

The term sub-unit describes the inventory unit within a management unit. A sub-unit may be defined by a specific geographic area (e.g., operable land base) or stand type (e.g., problem forest types) within the management unit.

Target Population

The target population is the unit from which the samples are chosen. For management inventories, the inventory unit is a TSA, TFL or other geographic area or specific attribute set, depending upon the sampling objectives.

Target sampling error

Target sampling error expresses the desired accuracy of the attribute of interest (e.g., timber volume). It is usually expressed as a percentage value at a given probability level (e.g., ± 10 at the 95% probability level). This means that 95% of the time we are confident that the volume estimates are within 10% of the actual volume. Target sampling error is used to calculate the minimum sample size for subsequent ground sampling; see *Sample Size*.

Vegetation Resources Inventory (VRI)

The VRI is an improved vegetation inventory process for assessing the 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:

- BC Landcover classification scheme (BCLCS).
- *Photo-interpreted estimates (Phase I)*: the delineation of polygons from aerial photography and the estimation of resource attributes.
- *Ground sampling (Phase II)*: the establishment of plot clusters in selected polygons to measure timber, ecological, and/or range attributes. The data are used for the adjustment of the photo-interpreted estimates for all polygons in an inventory unit or management unit.
- *NVAF Sampling*: Stem analysis sampling of individual trees for net volume adjustment.
- *Change Monitoring Inventory (CMI)*: Assessing performance of existing models and acts as an early detection system for issues in managed stands.

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 land base. 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.

APPENDIX III – VRI PLANNING PROCESS

The VRI planning process requires that a VSIP and VPIPs are developed for defined units (e.g. TSA, Tree Farm Licence [TFL]). A VSIP outlines VRI products to address forest management issues and provides strategic direction for implementing the inventory activities. A VPIP details the operational activities identified in the VSIP (e.g., ground sampling or photo interpretation projects) and identifies project areas, priorities, and roles and responsibilities.

The VRI planning process is an important component of the overall VRI process and related activities (see Figure 1). The intent of the VRI planning process is to ensure that baseline products meet a range of applications and they are efficiently implemented. These processes and activities include:

1. Forest management decision processes (land integration planning);
2. Identifying forest management issues;
3. VRI strategic planning (prepare a VSIP);
4. VRI operational planning (prepare VPIPs); and,
5. Implementation, including development and maintenance of procedures and standards
 - a) Management inventories;
 - b) Data base management; and,
 - c) Data interpretation.

The steps for preparing a VSIP include:

1. Licensee VRI committee work with MFR staff to develop issue statements related to VRI.
2. The North Coast licensees, including all agencies and the VRI committee, meet to refine issues and discuss why these issues need to be considered fundable. The purpose of this meeting is to:
 1. Introduce the VRI tools and process;
 2. Table new issues and revisit existing issues;
 3. Discuss issues to fund (under current funding mechanisms) and provide general direction for developing the VSIP. This discussion also affects the extent of photo interpretation and the number and type of VRI plots; and,
 4. Suggest the VRI tools to address currently fundable issues as well as those issues that may be funded in the future.
3. Meeting minutes are prepared and circulated to all participants for review and feedback. A final VSIP is prepared incorporating items agreed to in Steps 2 and 3 and is signed off by the lead proponent and the Manager of the VRI Forest Analysis and Inventory Branch.
4. VPIP process begins.

The VPIP details the activities under the VSIP (Phase I Photo Interpretation or Phase II Ground Sampling) by providing project areas, priorities, scheduling, identifying the population and strata for sampling, and sample size. The steps for preparing the VRI Phase I & Phase II/NVAF VPIPs include:

1. Review and update VSIP recommendations.
2. Secure funding.
3. Identify project activities, geographic areas, and costs.
4. Specify roles and responsibilities for project implementation.
5. Prepare VPIP.

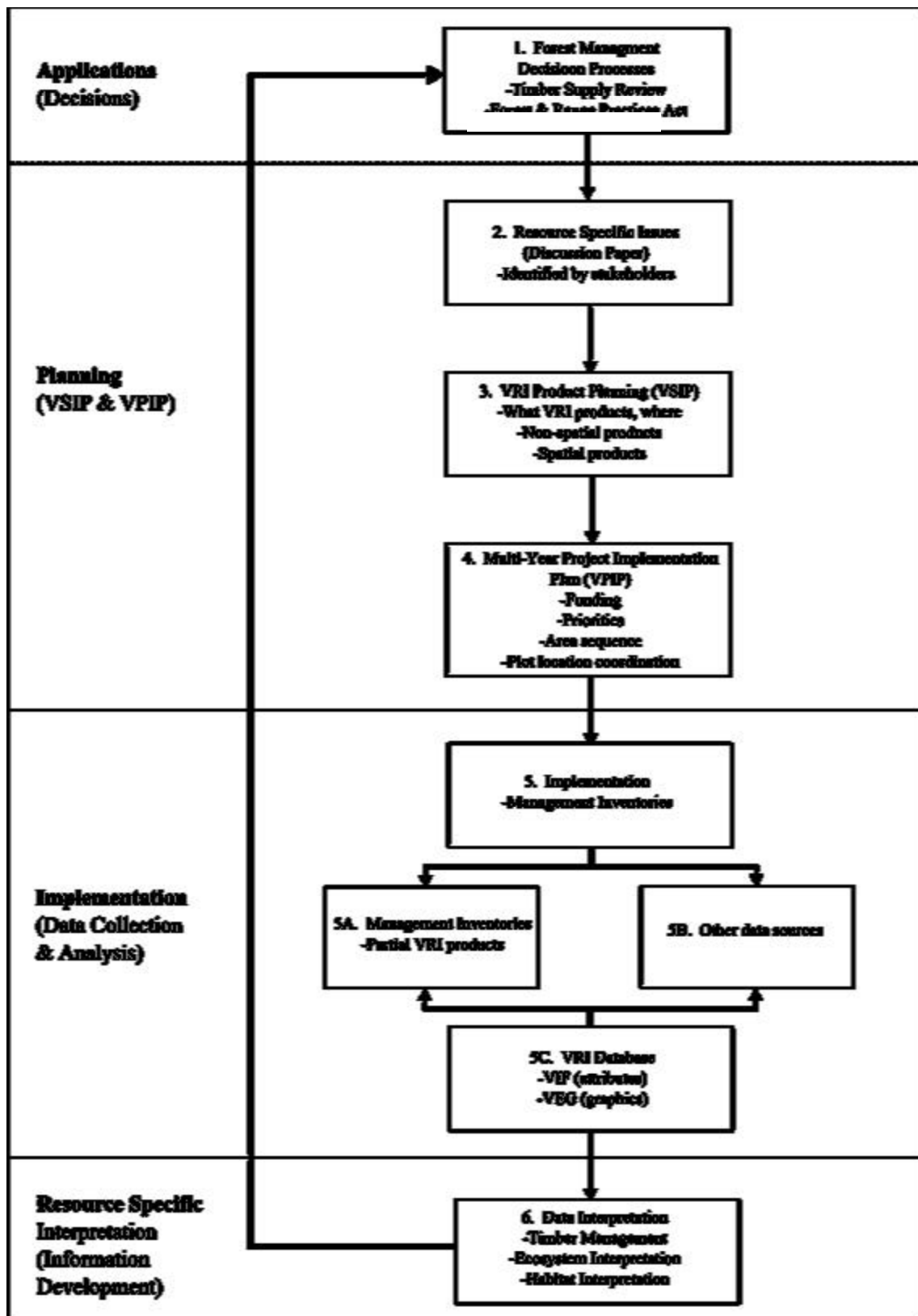


Figure 2. The VRI management inventory process.

APPENDIX IV – MAP OF THE NORTH COAST TSA WITH A MAPSHEET GRID

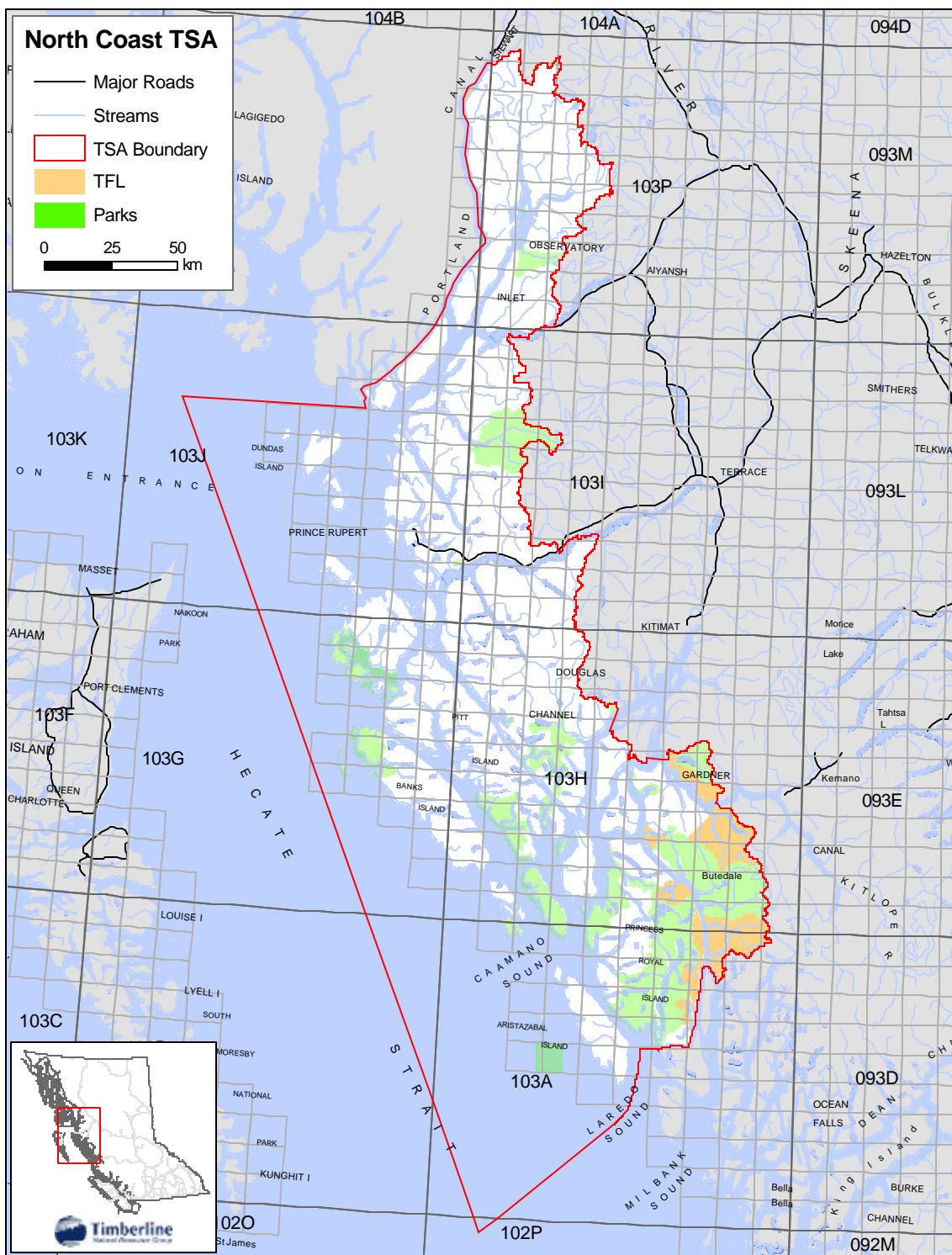


Figure 3. Overview map of the North Coast TSA with a map sheet grid.

APPENDIX V – NORTH COAST TSA FIRST NATIONS

Nisga'a Lisims Government President: <i>Nelson Leeson</i> e-mail: nisgaa@ntc.bc.ca Forestry Contact: <i>Warren Fekete, RPF</i> e-mail: warrenf@nisgaa.net	Metlakatla Band Council Chief Councillor: <i>Harold Leighton Jr.</i> e-mail: franmbc@citytel.net Forestry Contact: <i>Ron Smith</i> e-mail: ron.smith@triumphtimber.com
Lax Kw'alaams Band Council Chief Councillor: <i>John Helin</i> e-mail: council@citytel.net Forestry contact; <i>Remko Engelbertink RPF</i> e-mail: Remko.Engelbertink@brinkman.ca	Galdmalgyax: Cultural Ambassador: <i>James Bryant</i> e-mail: atta@citytel.net
Kitasoo Band Council Chief Councillor: <i>Ross Neasloss</i> Forestry Contact: <i>Ross Neasloss</i> e-mail: kxadmin@direcway.com	Hartley Bay Band Council Chief Councillor: <i>Jack Clifton</i> e-mail: dancardinall@shaw.net
Kitkatla Band Council (Gitxaala) Chief Councillor: <i>Elmer Moody</i> e-mail: vji@gitxaalanation.com Forestry Contact: <i>Clarence Innis</i> e-mail: clarence.innis@gitxaalanation.com	Kitselas Band Council Chief Councillor: <i>Glenn Bennett</i> E-Mail: g.bennett@telus.net
Kitsumkalum Band Council Chief Councillor: <i>Steve Roberts</i> E-Mail: abolton@kitsumkalum.bc.ca	Haisla First Nation Kitamaat Village Council Chief: <i>Steve Wilson</i> Forest Consultant: <i>Whitney Lukuku</i> E-Mail: whitneylukuku@uniserve.com
Heiltsuk Nation Chief Councillor, <i>William Gladstone</i> WilliamGladstone@bellabella.net Forest Consultant: <i>Rene Gemeinhardt</i>	