MACKENZIE
TIMBER SUPPLY AREA

Vegetation Resources Inventory

Photo Interpretation

Project Implementation Plan

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Table of Contents

1. INTRODUCTION

1.1 Background Information

VRI Overview

The Ministry of Forests and Range (MoFR) Forest Analysis and Inventory Branch has developed a business plan to ensure the successful implementation of the Vegetation Resources Inventory (VRI) ground sampling and photo interpretation projects. The process includes the preparation of VRI Strategic Inventory plans (VSIPs) and Project Implementation Plans (VPIPs).

A VSIP provides a general strategic direction for implementing the provincial VRI. The VSIP for the Mackenzie Timber Supply Area (TSA) was revised in 2006 and should be referred to for details on background information pertaining to Vegetation Resources Inventory activities and also for products needed to address the Mackenzie District forest management issues identified by stakeholders in the District.

A VPIP is a working document that details the specific operational activities associated with the implementation and documentation of a VRI project. It identifies the target areas for new photo interpretation, fieldwork, aerial photography, format of base files and project scheduling.

The VRI is a vegetation (forest) inventory process that has been approved by the 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.*

The VRI consists of several components:

1. BC Land Cover Classification Scheme (BCLCS)
2. Photo Interpreted Estimates (Phase I)
3. Ground Sampling (Phase II) – timber emphasis, ecology, coarse woody debris
4. Net Volume Adjustment Factor (NVAF) sampling
5. Within Polygon Variation (WPV) sampling
6. Statistical Adjustment
7. Spatial products including line work (polygon boundaries) and a VRI file database.

One or more of these components can address specific forest management or inventory issues. For more information, VRI manuals are available through the Internet at
http://srmwww.gov.bc.ca/risc/pubs/teveg/index.htm.

1.1.1 VRI Planning

The VRI planning process is an important component of the overall VRI process and related activities (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.

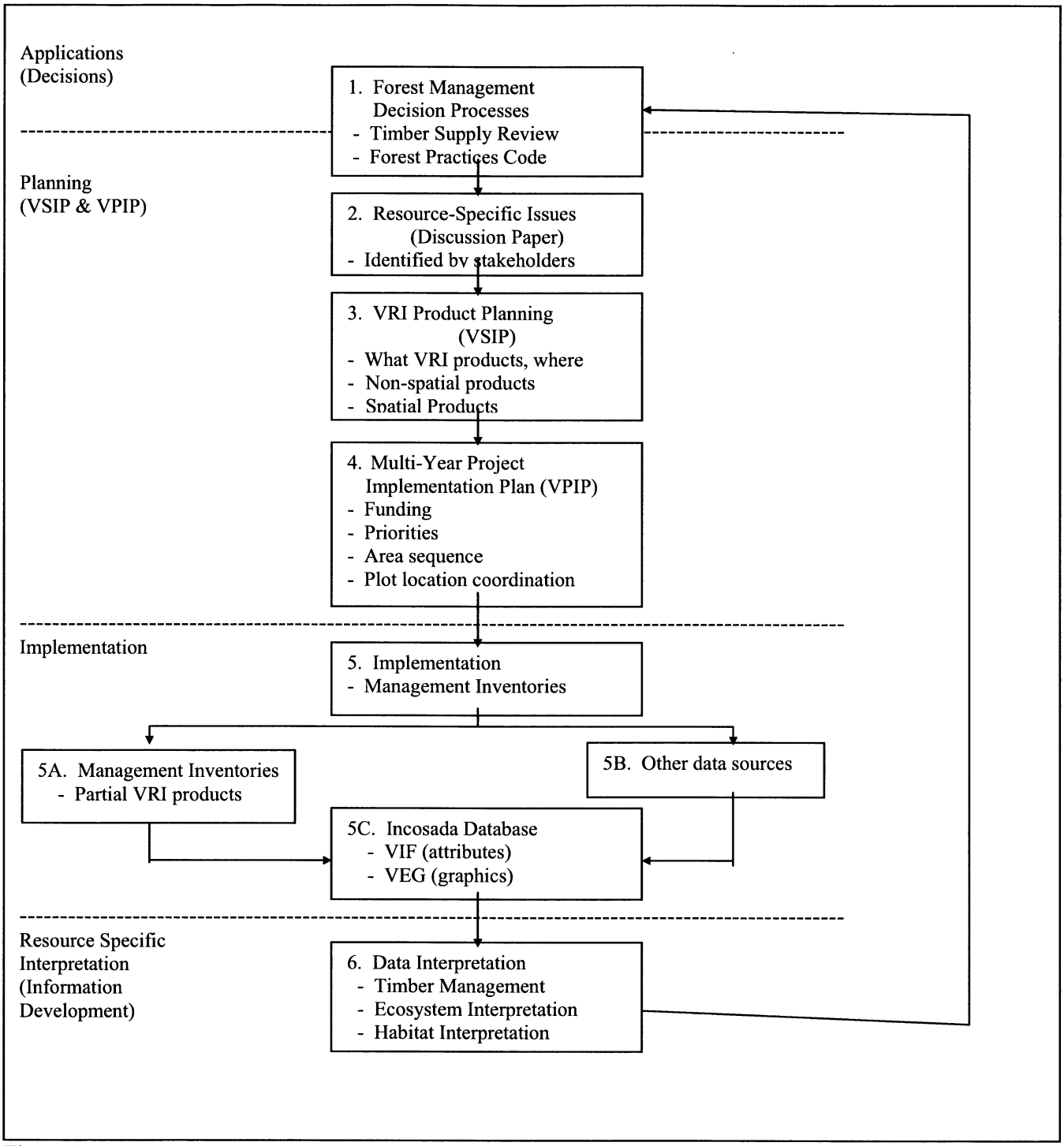

Figure 1: VRI Process and related activities.

1.2 Current Inventory Status (attached as Appendix 1)

The objective is to complete a Phase 1 VRI inventory for the entire Mackenzie TSA. The inventory in the northern most parts of the TSA dates back to the 1970s. Typing was very broad and line transfer was done via Kail plotter onto pre-TRIM base maps. The most recent inventory in the southern third of the TSA was done from 1994-96 to forest re-inventory standards. From 2001-2005, a VRI Phase 1 inventory was completed for much of the central part of the TSA using 1:40 000 TRIM II or 1:30 000 acquired in 2003. The objective is to complete the rest of the TSA to VRI standards over the next 3 to 4 years depending on funding. Priority areas include the northern third of the TSA from the top of Williston Reservoir to the northwestern boundary of the TSA and in the south on the east and the west side of the reservoir. The stakeholders will determine the methods for new photo-interpretation.

1.3 Document Objectives

The objective of this report is to outline and describe the VRI Phase 1 activities to be completed within the Mackenzie TSA. It provides some basic landbase information, background information from the previous Annual Allowable Cut Rationale document (pre-2002), and it outlines the implementation plan for the field sampling. The majority of information requested in this VPIP has already been completed in other higher-level plans and related planning documents and they are indicated as links under the appropriate headings. Please refer to the documents for the necessary information.

The VPIP provides a project implementation plan that describes scheduling, air photo type and scale, project personnel and quality assurance.

1.4 Landbase

The DMK is approximately 6.4 million ha, of which about 3.4 million ha are forested (Table 1). The main tree species in the forested landbase are Lodgepole Pine (37%), Spruce (32%), Balsam (25%), and deciduous (6%). We assume in this report that the forested landbase corresponds to the Vegetated Treed (VT) landbase (BC Landcover Classification Scheme, or BCLCS).

Table 1. DMK landbase by forest cover.

Forest Cover	Area (ha)	%
Forested	3,391,447.30	52.9
Mature	2,305,845.70	35.9
Immature	943,419.90	14.7
NSR	97,601.80	1.5
Non commercial	44,579.40	0.7
No typing available	0.4	0.0
Non productive	3,022,875.10	47.10
Grand Total	**6,414,311.40**	**100.0**

2. PHOTO INTERPRETATION PLAN

2.1 Project Objectives

The objective is to improve TSA polygon information – especially in areas where specific management issues occur – using photo interpretation. The main issues are;

- The existing inventory is out of date or not to current standards
- Individual polygon areas are too large. The average polygon size in the Mackenzie TSA needs to be approximately 14 hectares to achieve management objectives. Large polygons tend to have inconsistencies not common in smaller polygons. Objectives such as VRI, PEM, TEM or terrain mapping.
- Silviculture and free growing information in many landscape units needs significant improvement
- Dramatic increase in development in response to the growing pine beetle epidemic.

Ground sampling, used to check and adjust the photo-interpreted estimates, is discussed as a separate process in the Mackenzie District VSIP.

For details on the forest management issues and inventory product needs identified by the stakeholders, please refer to:

- Mackenzie Forest District VRI Strategic Inventory Plan (VSIP), March 2006.

2.2 Target Area (attached as Appendix 1)

All TSA lands outside of parks and protected areas will be updated to VRI standards through new photo interpretation (including woodlots). Some small protected areas found within larger TSA parcels will be mapped for completeness.

2.3 Polygon Delineation

Certified VRI photo interpreters will delineate the landbase in a softcopy environment using scanned 1:30 000 scale black and white photo. To achieve management objectives (such as PEM, TEM, VRI) within the TSA, delineation will be done to an intensity of approximately 1000 polygons per mapsheet (14 ha average). Final VRI delineation will be based on the BC Land Cover Classification Scheme and will be done to current VRI standards.

For silviculture openings, external boundaries will be delineated as per new photos. (Internal and external boundaries will be created for free growing openings) Silviculture opening numbers will be maintained. Silviculture information provided by Abitibi, Canfor or MoFR will be used as reference material to assigning the most appropriate polygon attributes.

Abitibi, Canfor and MoFR will provide a list of free growing polygons and these areas will re-delineated with the free growing information utilized as reference material for polygon descriptions.

All new roads and landings will be digitized and kept on a separate layer and provided to BMGS for updating the TRIM II base.

All delineation will be quality control checked and audited to ensure adherence to project objectives and MoFR Standards.

2.4 Calibration Data Sources

Calibration data sources are field data reference points established across the land base such as ground calls, air calls, ground observations, ground samples and cruise plots. Field data measurements or estimates at these points are used to assist in the delineation and interpretation of forest vegetation and terrain types. Previous or historical data sources will also be reviewed and considered by the photo interpreters for their potential to be added to the project reference points.

All pertinent historical data sources must be considered during the fieldwork planning stage to facilitate the most efficient use of new fieldwork.

It is the intention for classifiers to complete the delineation, fieldwork and final attributing of the mapsheets assigned to them. In the Mackenzie TSA, calibration fieldwork will be completed in the form of ground calls, ground observations and air calls in priority areas such as:

- stands having complex species composition
- second growth types
- height class 2-3 lodgepole pine stands
- deciduous-coniferous mixes
- deciduous stands with possible coniferous in-growth
- stands not previously sampled
- polygons larger than 20 ha in size
- multi-layered or uneven aged stands
- a cross-section of stand stages of development
- all significant terrain types
- some vegetated treed and non-treed wetland types

For more information on this topic please refer to the following;

- VRI Air Calibration Data Collection Procedures and Standards (2003)
- VRI Ground Calibration Data Collection Procedures and Standards (2004)

Or, use the following links:

- http://srmwww.gov.bc.ca/risc/pubs/teveg/aircalibration2k3/air_call_procedures2k3.pdf
- http://srmwww.gov.bc.ca/risc/pubs/teveg/vri_ground_call_2k4/vri_ground_call_2k4.pdf

2.5 Attribute Estimation

All attribute estimation will be to MoFR VRI standards and it is expected that the same interpreters will complete all phases of work for a particular set of mapsheets. Initial delineation will be re-assessed during the final classification phase to ensure consistency and that VRI standards are met.

Softcopy technology facilitates the measurement of tree heights from the scanned photos. Therefore, tree heights will be measured in 50% of the polygons to assist in the interpretation of stand height. In polygons where there is a significant difference in height (3+ m) between the first and second species, a second height on the next leading species will be taken.

All VRI attribute files will be validated through VEGCAPS and delivered to licensees and MoFR in a format consistent with Ministry standards.

2.6 Digital Map Procedures

All VRI mapping will be done to provincial mapping standards and specifications (TRIM II will be used as the base). The graphic file will be checked for the integrity of the file structure to guarantee that no corrupt elements or missing pointers internally are present. A check on the parameters entered in each layer or theme will be done. This will confirm that the

data meets the criteria defined in the Ministry standards and specifications. A log report will indicate the type of errors found on each level.

The Ministry of Forests and Range is in the process of creating a revised format for the submission and storage of spatial and attribute data for the VRI program. VRI photo interpretation projects initiated after March 31st, 2006 will be completed to this new standard.

2.7 Inventory Documentation and Archive, and Progress Status

Inventory for the Mackenzie TSA originated in the late 1970's. It was only in the late stages of the FRBC program that the Mackenzie TSA began inventory collection.

Data collection was concentrated in the northern third of the District beginning with Phase I in 2001 in the Buffalohead and Ospika RMZ's. With the introduction of the Forest Investment Account in April of 2002 and the availability of large sums of money, inventory in other parts of the north began in earnest.

Large Phase I inventory projects were undertaken in the northern RMZ's including Buffalohead, Fox, Obo, Firesteel, Ospika and McCusker among others. The data was compiled using black and white 1:30,000 photography collected in 1999. All classification was completed in softcopy. The remaining RMZ's in the northern third of the TSA are in various stages of completion and are completed as funding and demand increase. New photography will be acquired for the remaining RMZ's beginning in summer 2006. New photography was collected in 2003 for the Osilinka, Omineca, Mesilinka and Chunamon RMZ's and inventory work in these units has been completed. This data is in 1:30,000 black and white format.

The southern portion of the TSA remains un-inventoried since 1993 and 1995. These areas are of highest priority due to the level of development in the last decade and the increased harvesting and road building in response to the Mountain Pine Beetle epidemic. (Philip, Tudyah, Misinchinka, Morfee, Kennedy, Blackwater to name a few, refer to Appendix 1) It is anticipated that priorities may change as the epidemic moves through the TSA, and it is likely that more photography for the southern half of the District will have to be flown sooner rather than later to assess development.

3. PROJECT IMPLEMENTATION

3.1 Scheduling

We propose to complete the phase 1 component of the vegetation resources inventory of the Mackenzie TSA over several seasons. (All remaining mapsheets in the TSA) Activities will include:

- Photo preparation;
- Polygon delineation;
- Analysis of data sources (Gap analysis); and,
- Sample Plan design.

The fieldwork for the project area (all remaining mapsheets in the TSA) will include;

- Field Data Collection;
- Polygon Descriptions;
- Final Digital Mapping; and,
- Final Deliverables.

Table 1: Scheduling (the table below includes all remaining mapsheets in the TSA)

Priority (Mapsheets)	Project Area	Photo Collection	Polygon Delineation	Field Data Collection	Deliverables
1 (42)	Williston East	Summer 2006	Winter 06/07	Summer 2007	Winter 2007
(19)	Kechika River	Complete	Complete	Summer 2006	Spring 2007
2 (49)	Williston West	Summer 2006	2007	Summer 2007	Spring 2008
(20)	Thutade Lake	Complete	Complete	Summer 2007	Winter 2007
3 (52)	Williston North	Summer 2006	Winter 07/08	Summer 2007	Spring 2009
4 (32)	Peace	Summer 2007	2008	2008	2009 or 2010
5 (25)	Frog River	Unknown	Unknown	Unknown	Unknown

Table 2: Costs (the table below includes all remaining mapsheets in the TSA)

Project Area	Photo Collection	Polygon Delineation	Field Data Collection	Quality Assurance	Total (excluding air photo)
Williston East	$232,000.00	$798,000	$105,000	$2,000	$905,000
Williston North	Incl above	$988,000	$130,000	$2,000	$1,120,000
Williston West	incl above	$931,000	$122,500	$2,000	$1,055,500
Peace	incl above	$608,000	$80,000	$2,000	$690,000
Kechika River	$0	$177,500	$47,500.00	$2,000	$227,000
Thutade Lake	$0	$210,000	$50,000.00	$2,000	$262,000
Frog River	$0	$237,500	$62,500.00	$2,000	$302,000

3.2 Project Coordination

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3.3 Quality Assurance

A comprehensive quality control program will be completed to ensure that a consistent and reliable product is produced. The objective is to complete a seamless database where the work produced by any one photo interpreter is indistinguishable from the work produced by another.

A VRI contractor will be responsible to complete all VRI mapping to current provincial standards. A certified photo interpreter having at least 5 years of photo interpretation experience in BC and 3 years of softcopy experience will conduct proper quality control on 2-5% of each phase of the project. Documentation of all quality control checks will be maintained in a format acceptable to MoFR and made available to the Project Coordinator and MoFR. An independent and comprehensive quality assurance program will be conducted by an independent contractor to ensure the VRI contractor produces a consistent and reliable product. The third party Quality Assurance Contractor will have a minimum of 5 years' VRI delineation, fieldwork and final attributing experience in northern BC and will check all phases of the VRI as follows:

- Delineation – approximately 2% check of polygons for 80% of mapsheets
- Fieldwork – approximately 7.5% check of ground calls, GIF ground calls and air calls representative of the projects area
- Final Attributing – approximately 2% check of polygons for 80% of mapsheets

The project coordinator will ensure the inventory contractor(s) conducting the inventory provides adequate and ongoing internal quality assurance (QA) of all deliverables. The results of all quality control and quality assurance will be recorded on approved QA/QC forms, as a record for both the individuals performing the work in addition to the Licensees and the Ministry.

For more information, VRI QA guidelines are available through the Internet at

- http://srmwww.gov.bc.ca/risc/pubs/teveg/vri_qa_pi_2k4/vri_qa_pi_2k4.pdf

3.4 Reference Material

The following material is readily available for the project:

- Mackenzie TSA VRI Strategic Inventory Plan (2006);
- VRI BC Land Cover Classification Scheme (2002);
- VRI Photo Interpretation Procedures (2002);
- VRI Quality Assurance Procedures for Photo Interpretation (1998);
- VRI Photo Interpretation Standards (1998);
- VRI Air Calibration Data Collection Procedures and Standards (2003);
- VRI Ground Calibration Data Collection Procedures and Standards (2004);
- ILMB Vector Cleaning Specifications (1997);
- BC Ministry of Forests' Inventory Manual;
- BC Ministry of Forests' Biodiversity Guidebook;
- BC Ministry of Forests; Color Stereogram Handbook;
- BC Ministry of Forests' Black and White Stereogram Handbook;
- Several tree and plant identification field guides;
- Forest District Silviculture Opening History records (provided by ILMB 2004)

3.5 Approval/Sign-off of VPIP

It is the intention of the proponent to implement the Mackenzie Timber Supply Area Vegetation Resources Inventory Project Implementation Plan (VPIP) as described. As a key stakeholder in the inventory, Ministry of Forest and Range (MOFR) VRI staff has been consulted throughout the development of this plan.

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I have reviewed the Mackenzie Timber Supply Area Vegetation Resources Inventory Project Implementation Plan. I will be advising Pricewaterhouse Coopers that the work proposed in this plan meets Vegetation Resources Inventory standards and MOFR business needs.

Jon Vivian, R.P.F. date_____
Manager,
Vegetation Resources Inventory Section
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Ministry of Forests and Range

Appendix 1