North Coast LRMP

Review of the Woodshed Analysis Input Data And Results Used For The North Coast Land & Resource Management Plan

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Executive Summary

Lynx Forest Management (Lynx) was contracted by the Ministry of Sustainable Resource Management to review the Woodshed Model's appropriateness for ranking woodshed timber values and assessing potential Timber Harvesting Land Base (THLB) changes based on log market changes. Lynx was also asked to review the appropriateness of Woodshed Model data inputs developed by the industry groups participating in the North Coast Land and Resource Management Planning (NCLRMP) and to research potential linkages of the Coast Information Team timber valuation process with that of the NCLRMP

The Woodshed analysis methodology and data inputs appear to be appropriate at the strategic level for valuation of the North Coast TSA standing stock timber volumes. Although the THLB information used in the last Woodshed analysis reviewed by Lynx did not match the NCLRMP timber supply review THLB, it is our understanding that a later analysis was completed by the industry group that did match area and volumes to the NCLRMP timber supplpy review. The Woodshed model is a relatively low cost strategic planning tool that can help decision makers rank woodsheds according to their relative gross or net timber values and to help assess potential changes to the THLB given different log market conditions.

The Woodshed Model does not consider changes in inventory, markets, labour and capital costs, and harvesting technology. The model is only designed to provide an assessment of timber values for a snapshot in time.

It is important to remember that the model's value is completely dependent on the quality of the data inputs. In particular, the reliability of the model results is most dependent upon three significant sets of data: the quality and resolution of forest cover inventory information, log grade distribution data, and the key delivered wood cost drivers of projected logging systems and road development cost estimates. While the reliability of the Woodshed model results is affected by the quality of the data inputs, the utility of the Woodshed analysis tool is not (Timberline Forest Inventory Consultants Ltd, Final Report: Assessing Current Timber Harvesting Value in the Central Coast, August 2000).

Linkages do exist between the Coast Information Team (CIT) and NCLRMP processes with respect to timber valuation. While there are a number of key similarities such as landbase, timber inventory data, timber value and operating cost data, there are fundamental differences related to the analysis period and valuation methodologies. Despite the potential to strengthen linkages, without a thorough explanation of the CIT and NCLRMP timber analyses to the table members, there will likely be significant confusion created over the roles and objectives of each process for land use planning. A number of recommendations are presented in section 5.0 of this report to address potential linkages between the CIT and

NCLRMP timber analysis processes and suggest possible improvements to the Woodshed analysis.

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Lynx Forest Management (Lynx) was requested by the Ministry of Sustainable Resource Management to complete a review of the data inputs used in the Woodshed Analysis for the North Coast Land and Resource Management Plan (NCLRMP). The following report describes the scope of this review, the research, interviews, analysis, recommendations and conclusions made as a result of the review.

1.0 Scope of Assessment

The scope of the project was to broadly assess the suitability of the Woodshed model for the following intended purposes:

- ranking of areas to identify high medium and low areas for timber value;
- assessing where the timber harvesting land base might expand under different market conditions;

More specifically, Lynx was asked to:

- assess all assumptions and methods that have been incorporated into the model including (but not limited to);
    - calculation of timber volumes and values
    - calculation of costs (both fixed and variable) associated with roads and other infrastructure
    - the affects of variable retention,
    - the model suitability to account for current operating constraints
    - the model ability to incorporate different management regimes (e.g. increased Old Growth Management Areas (OGMA), reduced greenup requirement, etc.)

- determine how the product of this model relates to, or differs from, the current definition of the Timber Harvesting Land Base (THLB);
- work with Inventory branch to assess how accuracy of forest cover affects model outcomes, specifically for the above noted intended purposes;
- prepare a report outlining key findings and recommendations on how to adjust or proceed with running of model;
- meet with Coast Information Team (CIT) contacts at the beginning of the project to identify key areas, project similarities and differences and gain a basic understanding of similar work the CIT may be doing.

2.0 Project Limitations

The scope was limited to reviewing the data inputs and methodology assumptions used to determine representative operating costs and timber values for the specified woodshed areas and to research linkages with the CIT Economic Gain Spatial Analysis – Timber (EGSA) process. Due to the time frame, scope of the project, and limited expertise with the custom software application, Lynx was unable to run the Woodshed-TMP 2000 Models independently. Therefore, Lynx comments are provided based solely on the summary of model inputs provided by the industry group and the interviews conducted to explore the model functions and limitations as well as the reasonableness of the data inputs and assumptions.

This review was not intended to critique the CIT planning process or to quantify the impacts of the timber supply management on other resources, industries, social values or First Nations Traditional Territories or interests. Similarly, this review was not intended to compare timber values to other resource or social values.

The review did not include any field verification of forest cover information, timber quality or formal audit of operating cost information provided. Lynx made its best efforts to review data provided for its reasonableness in accordance with source documents available, information collected from those people that were interviewed and our knowledge of the coastal forest industry.

At the request of the industry groups that completed the woodshed analysis, Lynx was permitted to review the detailed cost and revenue data used in the model.

See Appendix I for the list of documents reviewed and interviewees.

3.0 Summary of Woodshed Analysis Review Findings

3.1 Woodshed Analysis Timber Volumes and Values

Model Design and Outputs

The Woodshed Model was originally designed to assess the current value of timber harvesting opportunities within the Vancouver Forest Region. Subsequently, the model was further developed and used by Timberline Forest Inventory Consultants Ltd. to assess timber harvesting values in woodsheds of the central coast area of the Vancouver Region.

The Woodshed Model is a combination of GIS (TMP 2000) and analytical models (ACCESS) that create a strategic planning tool for forestry planners. The model integrates forest cover, forest management and operating costs, and log market value input data to produce maps and data tables for the study area.

Individual woodshed reports can be generated which include tabular summaries of inputs into both the cost and value models, as well as a breakdown of the costs and values, which determine the woodshed "current value index" (Timberline Forest Inventory Consultants Ltd, Final Report: Assessing Current Timber Harvesting Value in the Central Coast, August 2000). The current value index is defined as the difference between the average woodshed timber value and the average woodshed delivered wood cost to realize the timber value.

Volumes

The Woodshed model uses the 1996 Forest Cover information without any modifications.

The NCLRMP Woodshed analysis aggregates the polygon forest cover inventory attribute data up to the woodshed unit to derive volume by species. Volumes are summed by species for each polygon, and all polygons within the woodshed are aggregated to create the woodshed total volume by species.

Lynx completed a review of the volumes used in the NCLRMP Woodshed analysis by comparing the mature operable volume of the woodshed analysis inputs to the NCLRMP timber supply analysis to ensure that the same (or similar) volumes were used.

This methodology appears to be correct in order to derive the most accurate volume by species based on the inventory information available.

Values

The volume for each species is then linked to log grade information to create a timber quality profile (coastal log grade distribution) for each species. Coast log market values are then attached to the species and log grade information to derive a polygon and woodshed gross value. The Woodshed Model inputs for grade distribution and log sales values are described in detail on pages16 to 24 of this report.

Lynx reviewed the backup information from the industry regarding log grade distribution from all timber marks used to allocate the grade distributions by species. **This information appears to have been summarized correctly for each species based on the data provided to Lynx.**

Lynx completed a review of the woodshed log value by species and log grade by obtaining an independent report from the MOF Revenue Branch for the coast log market values for the same ten year period (1992-2003). In a few cases there were insignificant minor differences (up or down within pennies per cubic meter) between the MOF report and the woodshed input data. No bias was observed and Lynx confirms the data is accurate. **The NCLRMP Woodshed analysis methodology appears to correctly derive an accurate value by species.**

Lynx concerns regarding log sales values used in the NCLRMP Woodshed analysis are outlined in detail on page 19 of this report. **Lynx recommends using the absolute highest and lowest log sales values recorded by species within the ten year period reviewed, and also recommends using a weighted average (by volume) for the same period in the log value sensitivity analysis.** See Appendix III.

3.2 Woodshed Analysis Fixed and Variable Operating Cost Assumptions

Lynx reviewed the operating cost data used in the NCLRMP Woodshed analysis to verify that all costs were consistent with the most current Coast Appraisal Manual timber pricing policy, and that all phase costs were included in the NCLRMP Woodshed analysis.

It is important to recognize that the Coast Appraisal Manual (CAM) costs are based on a coast-wide industry cost survey and they represent average costs experienced by an "average efficient operator". The degree to which their application to individual woodsheds reflects actual operating costs will vary. In addition, the CAM costs are updated with new manual editions annually to reflect new industry survey data, therefore, the NCLRMP Woodshed analysis would need to be updated from time to time to reflect those CAM changes.

All phase cost inputs were reviewed against the appropriate CAM phase costs for the North Coast area. Phase costs reviewed included:

- Bridge;
- Road construction (subgrade and ballast);
- Road maintenance;
- Tree-to-truck;
- Loading / hauling;
- Booming and barging;
- Dump / sort / scale;
- Crew transportation;
- Camp / accommodation;
- Silviculture, and;
- Management and Administration Overhead.

The NCLRMP Woodshed analysis fixed and variable operating cost inputs were consistent with the values used in the Coast Appraisal Manual (April 2003 Effective Date).

A detailed operational Access Management Plan was developed by Timberline Inventory Consultants and industry engineers that summarized the area of helicopter and conventional logging, existing road and bridge infrastructure as well as the projected road and bridge infrastructure required to develop remaining mature timber for each woodshed.

Projected bridge and road costs were based on historic cutting permit appraisal data for the period 1998 to 2001 for each woodshed. Timberline staff summarized the historic appraisal data into an average cost per kilometre for both tabular and engineered road sections and used these costs and same ratio of tabular and engineered road to project future road development costs for each woodshed (ie: total dollars of tabular road divided by total length of tabular road = the average $/km tabular). Bridge costs were totalled for each watershed (where applicable) and added to road subgrade and ballasting costs to arrive at the overall average cost per kilometer.

In some cases, individual cutting permit appraisal data was not used because it was not believed to be representative of the average road costs within the woodshed. In other cases, borrowed road development costs were used for woodsheds where either no road development, or no recent road development had occurred to develop a reasonable historic average. Where exclusion or borrowing of data occurred, it was based on advice from industry representatives familiar with the woodsheds. Overall, the road development costs appear to be reasonable based on industry averages for the North Coast (Stu Grundison, pers. comm.). The AMP also identified the average haul distance from the geographic center of the remaining timber in the woodshed to the log dump site.

Average road development costs are supported by past appraisal cost averages for the woodsheds queried by Lynx (Whalen and Triumph woodsheds were spot checked). Engineered road costs per kilometre appear to be significantly influenced by whether or not bridges are included in the historic data. To eliminate any potential of over-estimating engineered road costs due to the inclusion of bridges, Lynx suggests separating engineered bridge costs from the average engineered cost per kilometre. Applying an average bridge cost ($/lineal meter of bridge) for each projected bridge would perhaps produce a better estimate of engineered road costs.

No costs were estimated for road reactivation because no cost recognition exists within the current CAM for this reactivation (the agreed upon cost reference). Although the Coast Appraisal Manual road maintenance cost estimates do include all costs to deactivate, they do not explicitly specify costs to re-open roads. These costs may be significant where helicopter volume is projected to be yarded to deactivated roadside. Deactivated roads may have to be re-opened to allow the shortest helicopter yarding distances and minimize helicopter yarding costs. The licensees assert that they experience significant savings compared to the CAM road maintenance costs by deactivating roads as quickly as possible to minimize ongoing maintenance costs to maintain ditches, culverts and road surfaces, and that these savings more than offset any projected costs to reactivate a portion of their roads for future helicopter use. **Lynx confirms that the CAM does not provide for any reactivation costs and that the industry rationale is reasonable. Therefore, Lynx does not recommend any additional cost be estimated for reactivation.**

Lynx found that average helicopter tree-to-truck costs were originally overestimated due to the use of an older CAM formula within the woodshed model. **These were subsequently revised and now accurately reflect the current CAM tree-to-truck costs estimates for the helicopter volumes in each woodshed.**

The average haul distance was used to calculate average haul costs for all remaining mature timber within each woodshed. Lynx found that average haul costs were originally underestimated due to the use of an older CAM formula within the woodshed model. **These were subsequently revised and now more accurately reflect the current CAM haul costs estimates for each woodshed.**

The NCLRMP Woodshed analysis does not specifically attempt to estimate the haul cost on the helicopter volume logged to roadside. The analysis does not include any unique haul distance to transport helicopter volume from its landing location to the point used for the weighted average haul distance of the conventional volume for each woodshed. In some cases, the helicopter volume may be "farther up the valley" and require an additive distance beyond the average distance used for conventional volume, and in some cases the helicopter haul distance may reduce the average haul distance if it is closer to the sort yard than the average haul distance used for conventional volume. **Review of the woodshed plot files confirmed that there are no consistent biases regarding the haul cost for helicopter "roadside" volume. Therefore, any difference yielded by changing calculation methodology is likely negligible. Lynx believes that the haul costs are reasonable and recommends no change to analysis methodology.**

Booming and barging cost estimates within the NCLRMP Woodshed analysis are taken directly from tabular values within the CAM, where possible, based on the distance from the specific woodshed to a common appraisal timber marshalling point at Gambier Island. Other woodshed locations not specifically listed in the CAM table were interpolated to approximate the relative change in costs associated with distance between CAM listed points. Lynx reviewed 100% of the CAM listed points and checked the remaining interpolated values for reasonableness. **All values reviewed were correct and in accordance with the CAM.**

Camp cost allowances for all woodsheds reflect a higher "isolated" CAM cost with the exceptions of the Kaien and Khyex which are accessible by road. **The NCLRMP Woodshed analysis values were correct and in accordance with the CAM.**

All other phase costs (dump/sort/scale, silviculture, management overheads) included in the NCLRMP Woodshed analysis input was consistent with the CAM. No phase costs were omitted. **The NCLRMP Woodshed analysis**

inputs accurately reflect average woodshed development and operating costs according to the CAM timber pricing policy effective April 2003.

3.3 Them Relationship Between Woodshed Model Outputs And The Current Timber Harvesting Land Base (THLB)

The Woodshed Model is designed to assess the operating cost and sales value of timber, for strategic level planning purposes, at any given point in time within a woodshed. To complete this assessment, the woodshed model requires the original Timber Harvesting Land Base (THLB) to be defined. The Woodshed model can not redefine the THLB (Davide Cuzner, Erik Wang, pers. comm.), but can be used to analyse various different scenarios if provided with the desired THLB netdown theme as the start point for each "snap shot in time" analysis.

Definition of the THLB is currently completed using an Arcview extension with a set of supporting resource files. The application is called TMP2000 Timber Market Potential. TMP2000 can apply spatial netdowns (ie: for environmentally sensitive areas, ownership classes, slope, roads, rivers and riparian buffer areas, etc.) and can apply non-spatial netdowns through yield curve reductions. Once the THLB has been defined within the TMP2000 application, the woodshed data tables are populated with the TMP2000 data.

According to the last analysis reviewed by Lynx, it appears that the NCLRMP Woodshed analysis THLB area, and corresponding mature operable timber volume are both larger than the NCLRMP Timber Supply Analysis. The database provided to the industry may not have had the non-spatial volume reductions (deciduous volumes, riparian management zones, identified wildlife management species, etc.) applied to the THLB data, therefore the NCLRMP Woodshed analysis has a correspondingly higher area and volume. **Although it was not available for review at the time of the Lynx report completion, it is understood that a later analysis completed by industry has corrected this THLB problem, and that the data now matches the NCLRMP Timber supply analysis.**

If this is the case, the current NCLRMP Woodshed analysis would be overstating available volume for each woodshed, therefore understating the fixed cost per m3 (road and bridge development), therefore overstating the residual value of the woodshed. It is also possible that by including the deciduous volumes, some of the polygon average market values may be understated, therefore understating the residual value of the watershed.

Table 1

THLB Landbase Comparison: Woodshed vs NCLRMP Analysis

NCLRMP Analysis		**Woodshed**		**Difference**	
THLB ha:	**137,323**	**THLB ha:**	**167,726**	**THLB ha:**	**30,403**
Mature m3:	**67,612,698**	**Mature m3:**	**76,962,616**	**Mature m3:**	**9,349,918**

The TMP 2000 model (the spatial analysis component of the Woodshed analysis) is a very useful tool at the strategic planning level to assess potential expansion areas to the current THLB. For THLB analysis purposes, it would be possible to remove all operability constraints except for known inoperable areas (like parks, ESA's, riparian reserves, etc.) then apply the average operating costs to the remaining land base. New THLB areas could be defined using varied sales prices to illustrate THLB sensitivity to market changes (Eric Wang, pers. comm.).

3.4 The Affects of Variable Retention on Woodshed Model Outputs

Although the TMP2000 application can model various spatial and non-spatial landbase netdown scenarios, variable retention was not accounted for in the THLB netdown theme (Davide Cuzner, pers. comm.).

The THLB for the NCLRMP Woodshed analysis was provided by MSRM to the industry group and Lynx tested the THLB by comparing the NCLRMP timber Supply Analysis THLB area and mature operable volumes against the NCLRMP Woodshed analysis THLB area and mature operable volumes.

The result of this comparison was that the NCLRMP Woodshed analysis THLB area and volume did not match the NCLRMP timber supply analysis THLB area and volume. This problem was reportedly corrected by the industry group in the last analysis, but the results were not available for review by Lynx at the time of port submission.

3.5 Woodshed Model Suitability To Account For Current Operating Constraints

The TMP 2000 Model can assess the impacts of any current operating constraints that can be modelled in the definition of the THLB database. The Woodshed Model can be run to assess the timber volume and value impacts of those assumptions. The current THLB, as provided by the MSRM, was assessed in the NCLRMP Woodshed analysis.

Individual woodshed reports can be generated which include tabular summaries of inputs into both the cost and value models, as well as a breakdown of the costs, and values, which determine the current woodshed value index (Timberline Forest Inventory Consultants Ltd, Final Report: Assessing Current Timber Harvesting Value in the Central Coast, August 2000).

3.6 Woodshed Model Ability to Incorporate Different Management Regimes (ie: Old Growth Management Areas, greenup)

The Woodshed Model is limited by the fact that it cannot assess timber yield constraints that have a temporal element (ie: effects of "greenup / adjacency" constraints over time). However, if the desired management regime constraints can be modelled in the definition of the THLB database, woodshed can be run to assess the timber volume and value impacts of those assumptions at a specific point in time.

If it was desirable to assess the impacts of management constraints on timber volumes and values over time with the Woodshed Model, it would be possible to complete several analyses within a rotation period for comparison purposes. This could be done by redefining the THLB at specified times within the rotation period (recalculating THLB area and volumes using the TMP 2000 application), then using those different THLB areas and volumes as a basis for re-estimating delivered wood cost and timber values. **The Woodshed Model (the ACCESS application) could then generate reports summarizing the timber volumes and values for each THLB at a corresponding specific point in time for comparison purposes.**

3.7 Timber Inventory Accuracy Impacts On Woodshed Model Outcomes

As stated earlier, the Woodshed Model is designed to assess the operating cost and sales value of timber, for strategic level planning purposes, at any given point in time within a woodshed.

The model's value is completely dependent on the quality of the data inputs. The three most important inputs include the quality and resolution of forest cover inventory information, log grade distribution data, and the key delivered wood cost drivers of projected logging systems and road development cost estimates. Clearly, if inventory information is unreliable or not representative, the results of the Woodshed analysis will not be reliable.

The specific North Coast inventory issue, identified by both government and industry, was the lack of reliability of cedar volume estimates. Lynx investigated this concern using a sub-contractor, Karen Jahraus of Jahraus and Associates who is an experienced statistician who helped compile the inventory audit data for the latest North Coast inventory project. We reviewed the inventory audit data to compare both yellow and red cedar volumes in the current inventory classification versus the field audit plot data to quantify any potential inventory inaccuracies.

The analysis was based on a limited sample of only 42 audit samples that were distributed across the entire TSA. Therefore the results must be viewed with caution as to their statistical accuracy.

The analysis results indicate that the mature volume (>60 years old) of **red cedar is overestimated by approximately 19%** and **yellow cedar volume is underestimated by approximately 31%** across the total productive forest landbase. **The yellow cedar underestimation and western red cedar overestimation may indicate potential species misclassification in the inventory. On a combined species basis, the data indicates that red and yellow cedars are underestimated by approximately 10% for the total productive forest landbase.**

This combined underestimation would have a negative impact on the projected woodshed values, as red and yellow cedars have a significantly higher sales value per m3 than all other species. Using the 10 year weighted average Vancouver Log Market prices and the TSA average species profile (as per the industry woodshed analysis summary), a volume increase of 10% split evenly between red and yellow cedar, combined with a decrease of 10% in Hemlock volume would result in an average stand value increase of approximately $7/m3.

Due to the difference in cedar market values when compared to all other species, this issue has the potential to significantly influence the current value index of woodsheds analysed within the North Coast TSA. To aid future strategic decision making, forest cover species accuracy should be reviewed as part of future inventory work.

4.0 Economic Gain Spatial Analysis – Timber / NCLRMP Woodshed Analysis Comparison

Overview

An initial meeting was held in Smithers on April 10, 2003 with Eamon O'Donoghue, Gary Reay, Jody Holmes and Robert Prescott-Allen to discuss the Lynx contract and explore linkages between the two analysis processes, review similarities and differences between the Coast Information Team's

Economic Gain Spatial Analysis and the North Coast LRMP Woodshed analysis as well as make recommendations on ways to improve linkages.

Doug Williams of Coretex Consultants Inc. was later contacted by Lynx to review process similarities and differences, review the geographic areas used for analysis by both analyses and investigate potential linkages between the processes. The summary of process similarities and differences below is based primarily on interviews with Doug Williams, and Davide Cuzner, but also with other contacts familiar with the two processes.

The CIT planning process completed for the mid-coast area used a Woodshed study conducted on the central coast as a starting point for their dynamic, strategic analysis titled “CIT Economic Gain Spatial Analysis – timber project” (Mid-Coast EGSA - timber). The Mid-Coast EGSA - Timber made some modifications to the cost and revenue components to enable modelling of future harvests.

It is important to note that the CIT has requested some changes to the Mid-Coast EGSA – Timber process as the project has progressed. Some of these changes may apply in the North Coast EGSA – Timber, but this is yet to be determined. Therefore, it is difficult for Lynx to make definitive comparisons without the North Coast EGSA – Timber project being completed. In some cases, Lynx has only been able to refer to the Mid-Coast EGSA – Timber in comparison to the North Coast Woodshed analysis to illustrate similarities and differences between processes because the North Coast EGSA had not started at the date of this review.

The North Coast EGSA - timber is anticipated to draw data from the North Coast Woodshed analysis as it exists, with minimal modification to permit the forecasting of costs, revenues and volumes from future timber harvest (Doug Williams, pers. comm.).

Woodshed Landscape Units

The North Coast EGSA – Timber is planning to use similar Woodshed landscape units as the NCLRMP Woodshed analysis, but Lynx is not aware of any definitive analysis to determine whether the landscape units will be identical. In the Mid-Coast EGSA - Timber, the smallest geographic areas of analysis are a subset of the Landscape Units, but they can be aggregated up to the Landscape Unit level for comparative analysis purposes with the LRMP (Doug Williams, pers. comm.). Outputs required (and specified) by the CIT will be reported on the basis of specially developed “landscape” coverage which are generally composed of 3rd order watersheds, with some of the smaller watersheds aggregated. While similar landscape coverage has also been developed for the North Coast, the North Coast EGSA- Timber has not yet developed geographic analysis units for the CIT North Coast region. The CIT are considering adopting the NCLRMP Woodshed landscape units (Doug Williams, pers. comm.).

There may be differences in the Woodshed landscape units which will result in different timber volumes, values and operating costs generated by EGSA – Timber and the North Coast Woodshed analysis due solely to the difference in areas of the Woodshed landscape units.

In addition, the Mid-Coast EGSA – Timber analyzed timber growth over some defined rotational period, which added the complexity of projected forest growth and yield models and the projection of costs and revenues associated with future harvests. This difference in approach compared to the "snap shot in time" of the Woodshed standing stock analysis will make it impossible to make a true comparison of woodshed timber values unless the North Coast EGSA – Timber also completes a standing stock valuation at the start of their rotational period (year "0").

If an objective of the planning process is to compare results from the North Coast EGSA – Timber and NCLRMP Woodshed analysis valuation processes, then standardizing geographic areas of analysis, and completion of a comparative standing stock valuation within the North Coast EGSA – Timber would be required. If comparison of the two different analyses is not a key objective, then harmonizing the Woodshed landscape units and valuation volumes is not important.

Inventory Information

Similarities

- Both North Coast EGSA – Timber and the North Coast Woodshed analysis processes are using the latest available forest cover inventory (1996) and neither process altered or adjusted the inventory data in any way.

Differences

- None identified.

Operating Costs

Similarities

- The North Coast EGSA – Timber and the North Coast Woodshed analyses both will use the latest MOF Coast Appraisal Manual (CAM) as a base for operating costs.

- Both North Coast EGSA – Timber and the North Coast Woodshed analyses attempt to localize operating costs associated with road development and logging systems in each woodshed according to an operational projection of future roads and classification of terrain for harvest system.
- **If the North Coast EGSA - Timber uses the operating cost data as developed by the North Coast Woodshed analysis, there will be no differences.**

Differences

- The North Coast Woodshed analysis appears to have gone to a higher level of detail than the Mid-Coast Woodshed study in the projection of roads and harvest system by developing a detailed "access management plan" for each woodshed to build the woodshed model assumptions. The NC Woodshed analysis Access Management Plan used local engineering expertise to determine the length of existing and proposed mainline access, number and size of bridges, sort yard and log dump requirements, tabular and engineered cost estimates according to historic cutting permit data for each woodshed area as well as input from licensee engineering staff. All of the THLB mature timber was projected to be accessed to within a maximum distance of 200 meters of a road, and helicopter operable mature timber within 2.0 km (or woodshed height of land, whichever is closer) of potential drop sites.

- The EGSA – Timber may adjust the fixed and variable cost portion of the delivered wood costs for scenarios where the harvest level is reduced significantly (ie: ecosystem based management scenarios).

Volumes and Grade Distribution Data

Similarities

- Both the North Coast EGSA - Timber and the North Coast Woodshed analyses aggregate the polygon forest cover inventory attribute data up to the woodshed analysis unit to derive volume by species. Volumes are summed by species for each polygon, and all polygons within the woodshed are aggregated to create the woodshed total volume by species.

- Both processes ensure the volume for each species is then linked to log grade information to create a timber quality profile (coastal log grade distribution) for each species.

- Both processes use actual grade information from historic log scale data.

- Neither the Mid-Coast Woodshed study nor the North Coast Woodshed analyses stratified scale data by analysis unit (good/medium/poor).

- The North Coast EGSA – Timber plans to use whatever grade distribution information that has been developed for the North Coast Woodshed analysis as a starting point for their model.

Differences

- The Mid-Coast Woodshed study grade distribution was based on data provided by the Ministry of Forests, Revenue Branch. The data covered a five year defined period, and was for all cutting permits harvested by major licensees and the small business operators during that defined period. The grade distribution information was geo-referenced for each cutting permit back to a map sheet, because the map sheet reference number was readily available in the MOF database. All CP samples for a given map sheet were averaged, and the average grade distribution information for each map sheet was then area-weighted for each woodshed based on the percentage of woodshed area that was covered by the specific map sheet. Where no historic grade information existed, an “overall average” was calculated based on all CP samples within the five year period, and applied to the woodsheds where no harvesting had occurred within the five year period. Similarly, where no grade information for a specific species was available on a given map sheet, because it had not been harvested within the five year period, the overall average of all CP samples was used for that species (Erik Wang, pers. comm.).

- Although the Mid-Coast Woodshed study’s methodology to develop log grade distribution is likely as statistically valid as any process, **Lynx recommends using a “volume-weighted” grade distribution rather than area-based. This could be derived from the scale samples by geo-referencing each specific CP back to a specific woodshed, as was done in the North Coast Woodshed analysis, and then weighting the average grades by volume.**

- The EGSA – timber model is capable of maximizing Net Present Value (NPV) with a projection to a 200 year horizon. This management objective will be one of four scenarios analyzed. Other objectives to be tested include maximizing timber production (parallel to the MOF TSR analyses).

- By harvesting the most profitable stands only, there would be a difference between the North Coast Woodshed analysis and the EGSA – Timber grade distribution for the woodshed harvest units. Over the analysis period, the EGSA – Timber would likely only use a subset of the woodsheds for harvest, and would likely have a higher percentage of 2nd growth logs, grades and values than the North Coast Woodshed analysis.

- Old growth log grades are used for the EGSA - Timber first rotation harvest (using Woodshed analysis grades provided) and 2nd growth log grades are modelled using the TIPSY model which can estimate log grades every five years along the growth curve using stand diameter and height data based on the timber type and site quality information of the polygon.

- North Coast Woodshed analysis uses log grade distribution information based on approximately 10 years worth of actual log scale information collected from all harvest activity during that period for each woodshed of the North Coast T.S.A.. The scale data for all volume for each species harvested during the ten year period was then geo-referenced back to the woodshed where the data originated to produce a summary grade distribution table (GDT) for each woodshed. **Although Lynx agrees that this data represents the most comprehensive information available for the period used in the analysis, we caution that grade distribution is likely the most critical data component to derive stand and woodshed value. Ultimately, if it is not representative for any reason, the timber value analysis will not be representative.**

- There is a risk that historic North Coast TSA harvest may have a disproportionate concentration in the better sites or “good and medium” analysis units, and that the grade distribution for the historic scale data is not representative of the profile of mature operable timber within all remaining analysis units (NCLRMP Environmental Risk Assessment: Base Case: Coarse Filter Biodiversity Pg 14, Allen Banner pers. comm.).

- Ideally, the risk of unrepresentative grade distribution data could be mitigated if the historic grade information from the scale data was stratified by good/medium/poor analysis units, and then only applied according to the appropriate analysis unit on the remaining operable timber (Allen Banner, pers. comm.). Because there is likely less difference in log grade distribution between the good and medium analysis units, these could potentially be lumped together as one analysis unit for summary and forecasting purposes (Allen Banner, pers. comm.). The poor analysis unit should have the historic grade distribution information summarized separately and be used to project grade distribution on the poor analysis units only (Allen Banner, pers. comm.).

- While Lynx agrees with the observation and recommendation by Allen Banner, geo-referencing the scale data back to its original analysis unit is likely not possible in many cases. Cutting permits, timber marks or even individual cut blocks from which timber is scaled may encompass a number of good/medium and poor analysis units. Where the harvest units bisect good/medium and poor analysis units the scale data could not be disaggregated accurately (because the analysis unit data is not recorded for each log within each timber mark at the time of scaling), resulting in a loss of data integrity.

- For the four woodsheds where no harvest had occurred during the last 10 years, the North Coast Woodshed analysis used adjacent landscape unit data as representative due to their ecological similarities (Dundas LU used McCauley GDT, Stevens LU used McCauley GDT, Kshwan LU used Kitsault GDT and Trutch LU used Moncton GDT) (Davide Cuzner, pers. comm.). There is some risk associated with borrowing grade information if it is not representative – but the criteria used for borrowing and allocating (ecologically similar units) appear to be reasonable.

- The North Coast Woodshed analysis does not use 2nd growth log grade distributions as their process only looked at the standing stock value of the mature (>60 yr old) timber in each woodshed as if the volume was all available to be harvested and sold today.

Sales Values

Similarities

- Both processes use Vancouver Log Market (VLM) sales values as published by the MOF for all species and grades.

Differences

- The EGSA – timber will report specified outputs for three price levels based on the amplitude of the most recent price cycle (1993-2002): 25%, 50% and 75% of the amplitude. For example, if the lowest price in the cycle was $75/m3, and the amplitude was $50/m3, then the price at 50% level would be ($75 + 0.5x$50=) $100/m3. The EGSA – Timber price levels are based on a percentage change from the "bottom of the market" and do not test the highest achieved market levels within recent historical record. This would underestimate the potential timber value at a snap shot in time at the highest amplitude of the market. On the other hand, the EGSA – Timber approach appears reasonable when considering their objective of projecting average market value of timber over a longer time span.

- The EGSA - Timber process does not value 2nd growth logs differently than old growth logs. **Lynx would suggest that 2nd growth timber be linked to a lower 2nd growth sales value to be consistent with the current market differences captured in MOF Vancouver Log Market reports.**

- The Mid-Coast EGSA - Timber assumed that log prices increased over time by 0.3% annually (Doug Williams, pers. comm.). During the period from 1993 to 2002, there was a large variation in annual sales values between species, with some species even exhibiting price declines between 1993 and 2002. Although the EGSA-timber assumption makes sense intuitively, it is not possible for Lynx to confirm if the price trend assumption is reasonable based on the most recent 10 year historic log price trends in the Vancouver Log Market. Perhaps longer term log sales trend data could confirm this. See Appendix II.

- For one management objective, the EGSA – Timber models the harvest of timber over a 250 year time frame to determine the Long Run Sustainable Yield (m3/yr AAC). The LRSY is then modelled over a 100 year timeframe, with an additional requirement for harvest scheduling to maximize the net present value (NPV) of timber during the 100 year analysis period.

- For the management objective of maximizing NPV, the ESGA - Timber uses a linear programming method to maximize the NPV by requesting the earliest possible harvest, regeneration and re-harvest of the most profitable woodsheds during the analysis period. This process derives a theoretical maximum NPV calculation for each woodshed. **Lynx believes that by using a linear programming method, the resulting estimate of timber value may be unrealistically high because of the optimal harvest scheduling. Also, it is possible that many stands (and possibly some woodsheds) may never be harvested if the model maximizes NPV, even if the stand has a positive net value. Therefore, it may be possible that a positive net value stand (ie: timber sales value is greater than timber operating cost) contribution could be “zero” to the timber revenue or value calculated by the model. If this were the case, the LRMP table needs to consider whether this is a reasonable valuation process to use in resource value trade-off decisions.**

- The Mid-Coast EGSA – Timber completed a similar analysis of timber values based on a high market (1995 average annual VLM data), mid market (arithmetic average of 1995 and 2000 VLM data), and low market (2000 average annual VLM data). **Lynx recommends refining the EGSA – timber valuation approach to assess the highest and lowest average annual market levels for each species as recorded in the Vancouver Log Market values from the last 10 year sales period.** This approach then independently recognizes the historic high and low market points of each species. The ten year log sales data confirms that log market values for all species do not move in unison to historic highs or low levels. Species values show significant independence from year to year, presumably changing based on the end-product markets supplied by that log species. The rationale is that if a species experienced that "high" market value sometime in the last ten years, it is likely to experience it again within some similar timeframe. See Table 1 for a summary of Vancouver Log Market log sales values for 1993 to 2002.

- North Coast Woodshed analysis uses a ten year arithmetic average of the VLM sales values by species and log grade. **If using a long term average as a benchmark, Lynx recommends weighting the values by volume produced in each year.** See Appendix III.

- The use of any average on its own would not give the LRMP table a sense of economic impact due to log market variations expected within business cycles. Therefore, **Lynx recommends completing a high market, weighted average market and low market analysis to assess woodshed economic operability in the various markets.** See Appendix III. The following tables were used to develop the North Coast Woodshed analysis inputs.

TABLE 2: Vancouver Log Market Data: 1993-2002

Average Market Prices By Log Grade ($/m3)

YEAR

2002

	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												73.26	72.80	73.05
BALSAM	149.89		123.35		91.02	73.21	69.69				44.58	39.16	38.57	74.43
CEDAR	362.94		314.73		212.68	156.08	146.61	195.72	169.13	121.16	84.09	52.88	19.19	155.24
COTTON												32.60	33.91	33.10
CYPRESS	712.10		469.34		264.03	164.77	117.42				81.35	33.54	21.74	180.70
HEMLOCK	240.15		170.61		92.56	71.90	57.43				42.46	39.58	38.36	64.80
PINE	286.34		88.91		69.60	50.09	69.94				28.70	20.98	19.81	58.12
SPRUCE	478.61	400.73	352.09	258.20	121.87	72.74	70.39				41.94	39.04	39.19	124.42

2001

	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												63.89	55.47	62.76
BALSAM	133.61		105.73		81.58	61.80	64.29				43.42	42.59	40.64	67.56
CEDAR	353.50		309.17		182.10	130.40	130.58	167.72	143.07	101.20	71.59	44.04	19.13	130.85
COTTON												37.87	34.95	35.97
CYPRESS	609.21		440.99		259.41	166.38	115.39				73.90	37.17	26.04	175.76
HEMLOCK	206.86		140.70		82.27	63.60	54.73				43.42	42.78	41.28	63.30
PINE	69.06		80.25		69.23	49.07	67.97				26.31	20.24	20.17	54.10
SPRUCE	476.07	385.59	328.47	252.19	135.06	79.61	72.72				41.72	41.96	42.20	120.32

2000

	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												60.25	50.81	58.26
BALSAM	155.61		132.93		95.42	75.30	67.36				47.01	45.73	44.50	75.80
CEDAR	378.07		333.16		193.58	142.70	126.49	165.00	142.23	97.32	65.27	37.01	17.54	129.08
COTTON												41.26	38.97	40.24
CYPRESS	619.12		460.90		289.01	187.16	114.13				72.59	34.72	24.13	171.24
HEMLOCK	246.95		164.16		95.12	74.13	56.15				46.38	45.47	45.27	67.44
PINE	121.76		85.29		72.44	51.94	63.45				22.94	20.95	20.63	47.24
SPRUCE	447.01	387.01	317.73	244.36	144.33	94.96	74.28				48.00	45.66	44.70	122.80

1999

	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												57.52	54.53	56.76
BALSAM	147.13		113.89		89.77	72.50	66.28				47.12	45.67	44.57	73.77
CEDAR	352.89		308.11		188.23	131.11	113.26	150.41	131.16	87.48	48.34	28.22	12.74	115.26
COTTON												35.47	35.21	35.37
CYPRESS	523.62		352.22		221.03	134.29	82.87				48.54	20.00	17.12	135.37
HEMLOCK	230.70		155.63		89.85	72.40	57.82				46.89	45.62	45.24	67.11
PINE	77.95		94.94		77.59	51.63	64.38				26.14	24.20	22.40	49.23
SPRUCE	393.52	339.31	309.14	194.12	110.00	75.32	68.20				45.04	45.54	45.51	99.02

1998	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												51.49	41.12	49.10
BALSAM	126.19		101.46		83.70	70.45	64.85				47.36	45.84	45.24	70.33
CEDAR	336.92		290.81		201.51	156.81	156.91	152.93	134.37	93.48	66.59	45.03	24.57	129.98
COTTON												32.84	34.22	33.36
CYPRESS	503.63		327.44		207.27	121.92	69.79				47.46	24.52	21.76	119.51
HEMLOCK	185.25		127.52		83.02	71.59	58.00				47.32	45.53	45.64	68.05
PINE	77.49		65.73		69.44	50.66	63.15				29.29	30.90	33.14	47.76
SPRUCE	369.15	272.25	278.33	181.02	113.66	81.03	68.22				51.58	46.96	44.69	121.01

1997	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												51.52	40.94	49.1
BALSAM	198.31		165.75		131.04	90.84	73.23				46.02	39.96	39.69	77.71
CEDAR	328.55		286.30		188.10	149.99	128.71	171.30	152.74	107.71	69.23	54.97	29.06	134.82
COTTON												42.82	43.15	43.00
CYPRESS	612.03		456.52		304.03	184.90	97.52				54.09	24.86	16.29	155.84
HEMLOCK	249.25		187.89		130.96	99.09	67.61				45.52	39.61	39.32	75.1
PINE	79.93		107.59		87.53	70.50	66.80				34.77	31.02	29.06	55.03
SPRUCE	844.61	660.73	614.56	459.26	244.62	186.44	82.46				67.52	38.29	38.22	195.22

1996	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												44.02	39.05	43.23
BALSAM	271.66		199.56		127.66	93.69	72.95				48.03	41.74	39.87	84.63
CEDAR	302.77		262.10		158.66	120.69	96.59	138.62	118.90	80.55	48.81	37.34	23.15	103.1
COTTON												36.23	34.51	35.54
CYPRESS	600.17		436.69		268.10	165.90	76.85				48.85	29.32	17.45	143.56
HEMLOCK	288.79		218.07		128.07	100.18	66.95				46.62	40.06	39.99	80.41
PINE	100.91		113.91		95.20	62.79	54.64				31.54	30.65	26.59	47.69
SPRUCE	1001.90	851.85	803.07	586.95	279.45	220.20	81.31				86.90	49.43	44.58	267.28

1995	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												40.45	37.39	39.69
BALSAM	344.49		252.53		153.92	120.39	96.32				89.33	88.97	88.35	114.58
CEDAR	247.35		219.85		138.52	103.97	81.95	120.80	101.02	71.68	43.46	35.69	25.37	90.05
COTTON												45.91	41.39	44.27
CYPRESS	629.34		474.11		284.77	185.80	85.34				61.64	44.36	27.28	163.39
HEMLOCK	355.70		272.00		154.33	126.79	98.38				91.17	88.71	88.89	112.27
PINE	103.34		83.72		100.70	84.23	78.10				74.11	76.48	74.55	78.37
SPRUCE	876.57	810.22	738.84	557.90	294.59	224.38	97.52				102.31	92.29	90.20	261.51

1994	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												43.06	34.30	41.31
BALSAM	310.95		228.23		145.36	109.38	75.46				60.45	57.45	57.50	95.05
CEDAR	209.84		187.85		123.86	99.37	79.00	104.68	89.88	68.81	45.21	36.28	27.67	89.13
COTTON												41.07	28.87	38.98
CYPRESS	678.19		533.10		349.72	237.57	106.14				80.28	64.11	43.23	215.08
HEMLOCK	316.11		250.02		144.97	114.73	72.35				60.27	56.77	56.81	87.82
PINE	232.28		157.99		94.36	67.30	52.20				46.91	48.47	49.03	57.65
SPRUCE	590.41	480.58	434.73	340.79	227.21	177.30	72.51				74.45	55.70	52.82	188.68

1993	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER											29.65	37.61	33.50	36.82
BALSAM	296.06		195.22		124.58	94.16	60.23				43.56	39.14	38.60	76.98
CEDAR	242.15		202.61		121.47	100.34	77.31	129.22	108.61	83.60	53.11	43.28	30.24	101.62
COTTON												27.33	20.99	27.72
CYPRESS	724.90		594.16		383.56	256.63	88.09	441.56	14.93	63.44	76.16	56.82	33.67	215.69
HEMLOCK	287.92		222.42		122.26	100.73	57.76				42.85	39.19	38.67	70.27
PINE	105.94		107.05		84.88	62.74	47.14				41.17	40.05	40.85	54.14
SPRUCE	567.12	516.08	492.82	375.35	213.63	167.75	60.81				58.34	39.66	36.72	160.53

Red = highest average sales price/m3 for the species within the 10 year period

Blue = lowest average sales price/m3 for the species within the 10 year period

5.0 Recommendations

Lynx recommends the following for consideration of the North Coast Land and Resource Management Plan table:

a) If comparison of the timber value calculations of the EGSA – Timber and North Coast Woodshed analysis processes are important, then harmonizing woodshed analysis areas and completing a standing stock valuation with the EGSA -Timber analysis at “year 0” should be done.

b) Review the EGSA –Timber NPV analysis appropriateness with respect to its potential valuation limitations on unharvested stands (ie: Are positive net value stands being valued at zero because they are not harvested in the model’s quest to maximize NPV?).

c) Second growth timber harvested in the EGSA – Timber analysis ought to have second growth log sales values attributed to the volume to avoid overstating timber value.

d) For the Woodshed analysis, review options to post-stratify historic scale grade data by analysis unit (good/medium and poor) to better focus projected grades and values on the remaining timber in the woodsheds. The best methodology may be to classify all harvested timber marks by the leading area of analysis unit harvested (ie: if >50% of the timber mark area was poor, then assign the timber mark scale sample a poor analysis unit designation).

e) As engineered bridges are relatively expensive in comparison to comparable lengths of engineered subgrade, remove engineered bridge costs from the average cost per kilometre for engineered roads. Use an average cost/ lineal bridge meter for all projected bridges. This will help remove upward bias to engineered road cost estimates.

f) Refine the high market, low market and average market sensitivity analysis for log sales values used in the Woodshed analysis. Use the absolute lowest, absolute highest and 10 year average log sales values by species (as supported by the last 10 years of Vancouver Log Market data) to test market sensitivity of each species. The 10 year average ought to be weighted by volume produced in each specific year, rather than the arithmetic average used in the North Coast woodshed analysis.

g) The Woodshed Model could perhaps be better used to test and define new Timber Harvesting Land Base areas and volumes by initially removing all operability constraints except for the most obvious, critical exclusions (ie: parks, riparian reserves, etc), applying average operating costs to the remaining land base, then varying log sales price to define the potential economic THLB under different sales value scenarios.

h) Consider refining the forest cover inventory information used in the Woodshed analysis to better estimate the real species breakdown in the inventory type groups and individual forest cover polygons. The combined red and yellow cedar content, which is currently believed to be underestimated in the current inventory, is a significant driver of stand value when considering potential net value of timber stands for resource valuation.

6.0 Conclusions

The Woodshed analysis methodology and data inputs are appropriate at the strategic level for valuation of the North Coast TSA standing stock timber volumes. The Woodshed Model is a relatively low cost strategic planning tool that can help decision makers rank woodsheds according to their relative gross or net timber values and to help assess potential changes to the THLB given different log market conditions.

The Woodshed Model does not consider changes in inventory, markets, labour and capital costs, and harvesting technology (Timberline Forest Inventory Consultants Ltd, Final Report: Assessing Current Timber Harvesting Value in the Central Coast, August 2000). The model is only designed to provide an assessment of timber values for a snapshot in time.

It is important to remember that the model's value is completely dependent on the quality of the data inputs. In particular, the reliability of the model results is most dependent upon three significant sets of data: the quality and resolution of forest cover inventory information, log grade distribution data, and the key delivered wood cost drivers of projected logging systems and road development cost estimates.

While the reliability of the Woodshed Model results is affected by the quality of the data inputs, the utility of the Woodshed analysis tool is not (Timberline Forest Inventory Consultants Ltd, Final Report: Assessing Current Timber Harvesting Value in the Central Coast, August 2000).

Linkages do exist between the EGSA - Timber and North Coast Woodshed analysis processes with respect to timber valuation. While there are a number of key similarities such as landbase, timber inventory data, timber value and operating cost data, there are fundamental differences related to the analysis period and valuation methodologies. Without a thorough explanation of the Coast Information Team and North Coast LRMP timber analyses to the table members, there will likely be significant confusion created over the roles and objectives of each process for land use planning.

7.0 Closure

Conclusions and recommendations presented herein are based on the data sources identified and personal interviews with the contacts mentioned in the report. The conclusions are based on information obtained during the project term as well as the experience and opinions of the author. A detailed review of all timber inventory data used, actual industry operating costs or sales revenues was **NOT** completed to arrive at the conclusions contained in this report. **As such, conclusions of this report should be considered as an opinion only**.

This report was prepared for use by the Ministry of Sustainable Resource Management, which includes distribution as required for purposes for which this assessment was commissioned. The assessment has been carried out in accordance with generally accepted practice for the forest industry. Judgment has been applied in developing the recommendations and conclusions in this report. No other warranty is made, either expressed or implied to our clients, third parties, or any regulatory agencies that may be impacted by the recommendations or conclusions.

Appendix I

Source Documents / Materials Reviewed

Revenue Branch Coast Appraisal Manual, Effective April, 2003

Coretex Consultants Inc., Economic Gain Spatial Analysis – Timber Sector, March 03, 2003

Coretex Consultants Inc., Opportunity Costs of Rules Defining the Timber Harvesting Landbase and Harvesting Order, July, 1993

Ministry of Sustainable Resource Management, Terrestrial Information Branch, North Coast TSA Inventory Audit, 1997

International Forest Products Ltd, Woodshed Analysis Methodology & Approach for the North Coast LRMP, March 11, 2003

Ministry of Forests, Timber Market Potential Analysis- TMP 2000,

Ministry of Forests, Coast Log Scaling and Grading Manual

Ministry of Forests, NCLRMP Environmental Risk Assessment: Base Case: Coarse Filter Biodiversity, March 2003

Ministry of Forests, 1993 to 2002 Coast Log Average Market Values, Revenue Branch Report, July 2003

List of Interviewees

Bella Coola

Hans Granander, R.P.F.

Nanaimo

Ministry of Forests, Vancouver Region, Stewart Messenger, Log Scaling Manager

Prince Rupert

Viking Ecological Consultants, Davide Cuzner, R.P.F.,

Smithers

Ministry of Sustainable Resources, Hubert Berger, R.P.F.,

Ministry of Sustainable Resources, Laura Bolster, R.P.F.,

Ministry of Sustainable Resources, Eamon O'Donoghue, R.P.F.,

Ministry of Forests, Allen Banner, Research Ecologist

Ministry of Forests, Mark Blaney, Regional Scaling Manager

Terrace

International Forest Products Ltd., Drew McKay, R.P.F., Area Engineer,

International Forest Products Ltd., Shawn Munson, R.P.F., Assistant Engineer,

International Forest Products Ltd., Peter Scharf, R.P.F., Woodlands Manager

Vancouver

Jahraus and Associates, Karen Jahraus

Interpac Ltd, Rod Fowler, Area Manager

Triumph Timber Ltd., Shawn Kenmuir, R.P.F., Forest Manager

Timberline Inventory Consultants, Eric Wang, R.P.F.

Timberline Inventory Consultants, Stu Grundison, R.P.F.

Victoria

Ministry of Energy and Mines, Dan Evans, Economist

Ministry of Sustainable Resource Management, Keith Tudor, R.P.F., Coordinator, Vegetation Inventory

Coretex Consultants Inc., Doug Williams, Ph.D.,

Ministry of Forests, Valuation Branch, Mike Falkiner, Manager, Timber Pricing

Appendix II

Vancouver Log Market Price Trend Summary By Species and Log Grade

Period: 1993 to 2002

Log Price Trend Analysis: Average annual price change from 1993 to 2002 as a % of 1993 prices*

	Coast Log Grades													
	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER												0.09	0.12	0.10
BALSAM	-0.05		-0.04		-0.03	-0.02	0.02				0.00	0.00	0.00	0.00
CEDAR	0.05		0.06		0.08	0.06	0.09	0.05	0.06	0.04	0.06	0.02	-0.04	0.05
COTTON												0.02	0.06	0.02
CYPRESS	0.00		-0.02		-0.03	-0.04	0.03				0.01	-0.04	-0.04	-0.02
HEMLOCK	-0.02		-0.02		-0.02	-0.03	0.00				0.00	0.00	0.00	-0.01
PINE	0.17		-0.02		-0.02	-0.02	0.05				-0.03	-0.05	-0.05	0.01
SPRUCE	-0.02	-0.02	-0.03	-0.03	-0.04	-0.06	0.02				-0.03	0.00	0.01	-0.02

* prices do not include adjustments for inflation

Appendix III

Woodshed Analysis Inputs: Vancouver Log Market Average Market Values

Vancouver Log Market: 1993-2002
Average Market Value By Species and Log Grade ($/m3)

Species	D	E	F	G	H	I	J	K	L	M	U	X	Y	Total
ALDER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.97	52.31	45.99	51.01
BALSAM	213.39	0.00	161.87	0.00	112.41	86.17	71.07	0.00	0.00	0.00	51.69	48.63	47.75	81.08
CEDAR	311.50	0.00	271.47	0.00	170.87	129.15	113.74	149.64	129.11	91.30	59.57	41.47	22.87	117.91
COTTON	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.34	34.62	36.76
CYPRESS	621.23	0.00	454.55	0.00	283.09	180.53	95.35	44.16	1.49	6.34	64.49	36.94	24.87	167.61
HEMLOCK	260.77	0.00	190.90	0.00	112.34	89.51	64.72	0.00	0.00	0.00	51.29	48.33	47.95	75.66
PINE	125.50	0.00	98.54	0.00	82.10	60.10	62.78	0.00	0.00	0.00	36.19	34.39	33.62	54.93
SPRUCE	604.50	510.44	466.98	345.01	188.44	137.97	74.84	0.00	0.00	0.00	61.78	49.45	47.88	166.08

Lynx Recommended Log Sales Values For Sensitivity Analysis

Lowest, Highest and Volume Weighted Average Sales Price By Species For 1993-2002

Species	All Grades		
	High	Low	10 yr Wtd. Ave.
ALDER	73.05	36.82	51.66
BALSAM	114.58	67.56	83.58
CEDAR	155.24	89.13	115.07
COTTON	44.27	27.72	37.72
CYPRESS	215.69	119.51	171.53
HEMLOCK	112.27	63.30	77.74
PINE	78.37	47.24	55.05
SPRUCE	267.28	99.02	167.72

Appendix IV

Forest Cover Inventory Audit Data: Jahraus & Associates Review Results

The Inventory Audit data for the North Coast TSA was used to compare cedar volumes reported in the current inventory with actual cedar volumes compiled from the audit ground samples. The audit samples were restricted to the productive forest landbase, and stands older than 60 years. A total of 42 samples were available for analysis[i]. The samples were also post-stratified by operability: 14 samples were in the operable forest landbase and 31 samples were in the inoperable forest landbase[ii].

All volumes reported here represent net merchantable volume per hectare defined as stem volume inside bark of all live trees excluding a 10cm diameter inside-bark top, a 30cm high stump, and excluding decay, waste 2, and breakage (as estimated from Ministry loss factors). Dead potential and veteran trees were not included in these estimates to correspond with inventory volume estimates provided by VDYP. All volumes were calculated for a utilization standard defined at 17.5+cm dbh.

To obtain the cedar volume, the cedar species percent was applied to the polygon volume/hectare[iii]. Western red cedar (Cw) was distinguished from yellow cedar (Yc) in the analysis.

Paired t-tests were used to determine if the difference between the average cedar volume in the new inventory and the audit ground samples was statistically significant. The results are shown in the Table 1. Where the p-value was less than 0.05, the difference was significant at the 5% significance level (indicated with a double asterisk in the table). Similarly, where the p-value was less than 0.10, the difference was significant at the 10% significance level (indicated with a single asterisk in the table).

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[i] Refer to the North Coast TSA Inventory Audit report available on the MSRM website for further details: http://srmwww.gov.bc.ca/tib/audits/north%20coast/northcoasttsa.htm. The audit sampling was originally designed based on the old inventory (conducted in the 1970's). To evaluate the new inventory (completed between 1994 and 1996), the new inventory stratification was overlain on the original audit plots (which were comprised of a 9 point cluster). New inventory attribute values for the original audit samples were computed by averaging the polygon values for the new inventory polygons in which the original audit plots were located. That is, each audit sample point was assigned the appropriate new inventory attributes and these attributes were then averaged to obtain values that were represented by the audit sample.

[ii] Operable and inoperable samples do not sum to the total since samples may be comprised of a mixture of operable and inoperable polygons under the new inventory stratification. Samples overlain on the new inventory, may contribute to both.

[iii] Inventory species composition is based on the photo-interpreters estimate of relative gross volume (or number of stems per hectare in younger stands). Applying the cedar percentage to the polygon volume generated from VDYP may not provide exact cedar volumes in all cases since VDYP includes factors that adjust polygon volume for species mixtures. However, discussions with Cam Bartram at MSRM indicated that this approach would provide reasonable estimates of species volume.

Inventory audit results for cedar volumes in the North Coast TSA. Volume estimates are at 17.5+cm dbh utilization (net decay waste and breakage).

	Audit mean vol/ha (95% conf. interval)	Inventory mean vol/ha (95% conf. interval)	Difference (audit – inventory) (p-value for paired t-test)	Ratio of means
Total productive forest, 60+ yrs (n=42)				
All species	355 (298 – 411)	365 (313 – 417)	-10 (0.662)	0.97
Cedar (Cw and Yc)	**119** (89 – 149)	**107** (82 – 131)	**12** (0.343)	1.11
Western red cedar	**54** (33 – 76)	**73** (52 – 95)	**-19** (0.019)**	0.74
Yellow cedar	**64** (43 – 86)	**34** (23 – 44)	**31** (0.005)**	1.88
Operable productive forest, 60+ yrs (n=14)				
All species	473 (389 – 557)	484 (389 – 579)	-11 (0.804)	0.98
Cedar (Cw and Yc)	114 (50 – 178)	101 (44 – 159)	13 (0.661)	1.13
Western red cedar	31 (1 – 61)	68 (29 – 108)	-37 (0.051)*	0.46
Yellow cedar	83 (29 – 137)	33 (9 – 57)	50 (0.051)*	2.52
Inoperable productive forest, 60+ yrs (n=31)				
All species	309 (246 – 372)	319 (264 – 373)	-10 (0.719)	0.97
Cedar (Cw and Yc)	118 (85 – 150)	107 (80 – 133)	11 (0.362)	1.10
Western red cedar	65 (37 – 92)	74 (47 – 100)	-9 (0.271)	0.88
Yellow cedar	53 (33 – 73)	33 (23 – 43)	20 (0.051)*	1.61

The audit results showed that the new inventory slightly overestimated volume but that this volume overestimation was not statistically significant. **When trends for cedar volume were examined it appeared that in the total productive forest (operable and inoperable) greater than 60 years, western red cedar volumes are significantly *over*estimated in the new inventory and yellow cedar volumes are significantly *under*estimated.** In the operable productive forest, with a very limited sample size (n=14) the same trends were apparent and were statistically significant at the 10% significance level. In the inoperable productive forest, yellow cedar volume was significantly underestimated[iv] in the inventory but the volume difference between the audit and the inventory for western red cedar was not statistically significant.

The yellow cedar underestimation and western red cedar overestimation may indicate potential species misclassification in the inventory. Note that the audit indicated that the inventory underestimated total cedar volume (Cw and Yc) by about 10%. However this volume underestimation was not significant based on the audit sample.

[iv] At the 10% significance level.