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OKANAGAN TIMBER SUPPLY AREA BIOMASS AVAILABILITY ESTIMATION

CONTRACT NUMBER: 1070-20/OT23FHQ191

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The biomass yield per hectare predicted for the Okanagan Timber Supply Area (TSA) is 16.2 oven-dried tonnes per hectare (odt/ha) from harvest residues. The biomass ratio, which is the ratio of recovered biomass to recovered merchantable roundwood, is estimated at 10.9 %. Over the next 20 years, a total of over 11 million odt of available biomass is predicted to be generated by harvest in Okanagan TSA, or approximately 553,723 odt/yr. Of this, approximately 8,357 odt in total, or 417 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 57% of the total predicted volume is expected to be available at $90/odt, totalling to approximately 2.65 million odt, or 132,974 odt/yr.

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EXECUTIVE SUMMARY

Forest origin, harvest residue, and biomass estimates were made by FPInnovations for the Okanagan TSA, largely following the process previously established for several BC TSAs using FPInterface™ (2010-2023). The biomass inventory was based on 20-year harvest and road network plans for Crown land provided by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) and excludes Tree Farm Licenses, Community Forest Agreements, and First Nations tenures.

The biomass yield per hectare predicted for the Okanagan TSA is 16.2 oven-dried tonnes per hectare (odt/ha) from harvest residues. The biomass ratio, which is the ratio of recovered biomass to recovered merchantable roundwood, is estimated at 10.9%. Over the next 20 years at total of 11,074,655 odt of available biomass is predicted to be generated by harvest in the Okanagan TSA, or approximately 553,732 odt/yr. Of this, approximately 8,357 odt in total, or 417 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 57% of the total predicted volume is expected to be available at $90/odt, totalling to approximately 2.65 million odt, or 132,974 odt/yr. lastly about 96% of the total predicted volume is accounted for at a dollar amount of $120/odt. In terms of actual amounts this 96% translates to 4.47 million odt or 223,880 odt/yr. (Table 7 from the text, follows.)

Biomass Available (odt)			
at $60/odt	at $90/odt	at $120/odt	total ($180/odt)
8,357	2,659,492	4,477,609	4,651,107
per year	per year	per year	per year
417	132,974	223,880	232,567
% of total volume	% of total volume	% of total volume	% of total volume
<0.2%	57%	96%	100%

Most of the available biomass (99.8%) is not considered economically available (<= $60/odt). This is primarily due to long travel distances to get to mills and/or transfer yards. Additionally, the amount of economically available biomass decreases through time from 259,132 odt/year in the first 10 years to 206,002 odt/year in the last 10 years. This decrease is likely due to a much lower amount of biomass available in Period 2 (4.9 million odt) compared to Period 1 (6.1 million odt).

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1 INTRODUCTION

Forest origin, harvest residue, and biomass estimates were made by FPInnovations for the Okanagan TSA, largely following the process previously established for previous BC TSAs using FPInterface (2010-2023). The biomass inventory was based on 20-year harvest and road network plans for Crown land provided by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) and excludes Tree Farm Licenses (TFLs), Community Forest Agreements (CFAs), and First Nations tenures. Detailed introductory statements applying to this project and the greater project, may be found in the report, "Estimating Quesnel Biomass Supply Using FPInterface®." It is hoped that the information in this report will assist in understanding biomass availability for industrial proposals**.**

2 OBJECTIVE

The objective of the project was to calculate the cost of forest-origin biomass as a feedstock in the Okanagan TSA.

Specific deliverables include:

a. An analysis showing the delivered cost of biomass from point of origin; and
b. An analysis showing the amount of biomass delivered at different price points. A value of $60 for one oven-dried tonne (odt) is regarded as the market value for biomass, in accordance with the previous analyses.

3 METHODS

3.1 Overall Process

The basic methodology for determining biomass supply in western Canada was established during analysis of the Quesnel and Williams Lake TSAs. It is reviewed below.

The analysis focused on the Okanagan TSA and was based on polygon data (tree characteristics) and a road data set supplied by the Ministry. It did not include any nearby woodlots, CFA's, or any First Nations tenures. Including some of these areas could alter the available supply of biomass.

Additionally, small piece size stands that are not considered merchantable were not included in the analysis. The analysis focused on recovering harvest residues from merchantable stands. Purpose-harvesting unmerchantable stand for biomass could add to the biomass supply and further analysis could be undertaken to determine its profitability. Recent analysis has shown that harvesting these stands is not yet profitable.

The following process map (Figure 1) graphically displays the steps taken to build the final inventory of economically available biomass for the Quesnel TSA. A similar process was used for the Okanagan TSA.

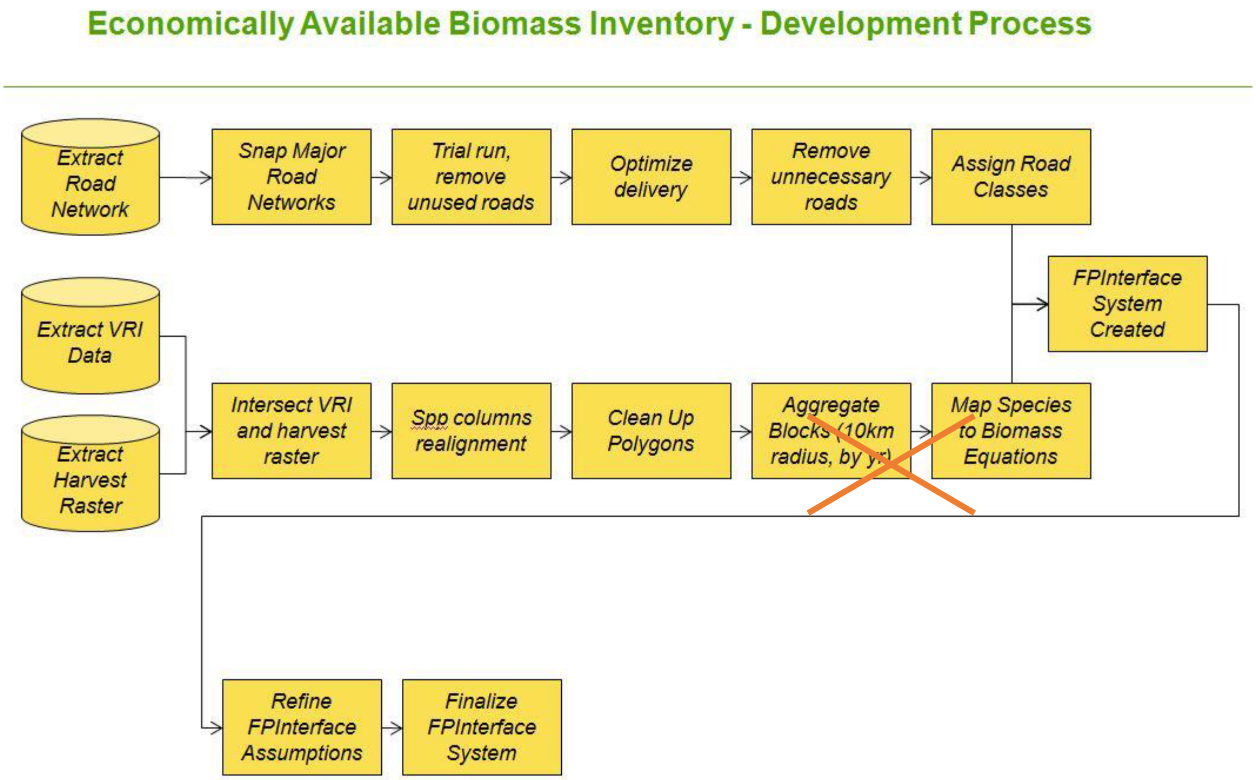


Figure 1. Inventory development process for economically available biomass.

A note on this study: Some of the baseline costs used as defaults in the FPInterface system were deemed outdated and no longer aligned with present-day inflation levels. Thus, the following changes were made:

- Fuel cost changed from a default of $1.25 to $1.98
- Truck driver wage changed from a default of $30 to $42
- Machine operator wage changed from a default of $30 to $38

These new inputs were determined based on interviews with local foresters and fuel cost was informed by Federal rates. Because of these very notable and impactful changes, the baseline for collecting and transporting biomass to transit points tended to be more expensive.

3.2 Data Acquisition

Data layers were acquired from the Ministry for the Okanagan TSA (excluding woodlots, CFA areas, and any First Nations tenure areas), including Vegetation Resource Inventory (VRI) polygons with attributes, and road linework with attributes. The polygon data was for 20 years of harvest in two 10-year periods.

The total 20-year harvest raster is a point in time snapshot. It indicates which polygons are expected to be harvested in the next 20 years. No attempt was made to model possible growth or mortality during the 20-year horizon. Any projections of growth or mortality are already accounted for in the harvestable proportion contained in the harvest raster data.

3.3 Data Transformation

FPInterface requires two major inputs – a polygon layer of harvestable blocks with attributes and a road layer. The polygon layer must also have a harvest raster built into it, indicating which polygons are to be cut in which time period. To calculate biomass amounts, FPInterface requires both tree size data (or height and diameter at breast height (dbh)) and either stand density (stems per ha) or volume per ha by species in each polygon. When the polygon layer is uploaded, it is necessary to tie species in the resultant to FPInterface species.

In order to speed calculations, polygons with little or no merchantable volume were targeted for elimination. Polygons with no volume were removed from the resultant. Some of these polygons resulted from the process of intersecting the VRI and the harvest raster layers. Aggregation rules meant some blocks were grouped if they had an identical harvest period.

FPInterface calculates cost in part by finding a transport route from product origin in a polygon (block) to the mill or delivery site. It relies on a continuous path along the road network. If digital road segments are not joined together (snapped), the program is not able to find a path between block and mill or may find a suboptimal circuitous path.

Examination of the received data set showed that road snapping was required. A program was used to identify gaps in the road network and close them.

3.4 Biomass Equations

To perform the analysis, tree species indicated in the inventory are tied to singletree biomass equations in FPInterface. For the Quesnel analysis in 2010-11, these equations were based on "Canadian national tree above ground biomass equations" by Lambert, M.C., C.H. Ung, and F. Raulier, 1996-2008. Although this equation set includes trees from across Canada including western and northern Canada, there were very few samples from BC. More recently, Lambert et al. have released three equations for BC (accepted by the BC ministry) and these were incorporated into FPInterface for the Williams Lake and subsequent analyses, including this one.

3.5 FPInterface Parameters

3.5.1 Tree Species Associations

Species associations were made as follows in Table 1.

Table 1. Species associations

FPInterface species	System label	Named	Original data set
Trembling aspen	AT	Aspen	ACT, AT, ACB
Subalpine fir	BL	Subalpine fir	B, BL
Western redcedar	CW	WR Cedar	CW
White birch	EP	White Birch	E, EP
Douglas fir	FD	Doug Fir	FD, FDI
Western hemlock	HW	Western Hemlock	H, HW, HM
Western larch	LW	Western Larch	L, LW, LA
Whitebark pine	PA	White Bark Pine	PA
Lodgepole pine	PL	LP Pine	PL, PLI
Western white pine	PW	Western White Pine	PW
Ponderosa pine	PY	Ponderosa Pine	PY
Hybrid spruce	SX	Hybrid Spruce	S, SX, SB, SE, SW

3.5.2 Road Classes

When input into the FPInterface system, road classes are assigned based on the amount of volume hauled over each section of the road. The volume hauled is for merchantable volume as calculated by FPInterface. The volume and speeds associated with each road class were assigned according to Table 2. Empty and loaded trucks would travel at 95% and 85% of the posted speed respectively.

Table 2. Road Class Associations

FPInterface road class	Maximum volume (m_3)	Road speed (95% / 85%*)
Paved	50,000,000	90 km/h (86 / 77)
Class 1	10,000,000	70 km/h (67 / 60)
Class 2	2,000,000	50 km/h (48 / 43)
Class 3	1,000,000	40 km/h (38 / 34)
Class 4	500,000	20 km/h (19 / 17)
Class 5 (winter)	5,000	20 km/h (19 / 17)

* percent of posted speed

3.5.3 General Parameters

The price of fuel can have significant impacts on model results. Some equipment in the model can use diesel and some is eligible for marked fuel. A price of $1.98/litre was assigned which is slightly higher than current rates for diesel but approximates a medium-term average[1].

The program's default values for productivities and costs of forestry equipment rely on FPInnovations studies and information. If a user has specific values or costs, they wish to apply to any phase or machine, these can be used instead of the defaults. For this project, only the default values were used.

Average slope for the area was assigned to CPPA Class 3 (20-32%). Ground strength was rated CPPA Class 2 (good), and ground roughness was rated CPPA Class 2 (slightly even).

3.5.4 Comminution Cost

Working time for BC conditions was based on previous base case studies and consists of one 12-hour shift per day, 200 days per year. Grinder utilization was set at 60% and fuel used per productive machine hour for the grinder was the standard 135 L/PMH (litres per productive machine hour). These are the standard base case parameters used in past FPInnovations studies and enable comparisons to those studies. Here, they produced a grinding cost of $36.52/odt.

3.5.5 Parameters as Entered in FPInterface

A summary of some of the parameters as entered in FPInterface follows for the base case, which produces grinding costs of $36.52/odt (Table 3).

Table 3. FPInterface parameters

Run Descriptor	Base Case - Default Grinding Efficiency
run name	Okanagan
output name	Biomass report- Okanagan
block system	BlockOkanaganNetPeriods.shp
road system	RoadsOkanaganNET6.shp
transfer yard(s)	Valley Wood Lumby, North Enderby Timber Ltd, Interfor Adams Lake Division, Tolko Lavington Planer Division, Aspen Planers Ltd, Downie Timber, Gorman Bros Lumber Ltd, Tolko Armstrong Division, Weyerhauser, Vaagen Bros, Canoe Forest Products

[1] Government of Canada, N. R. C. (2006, June 1). *Daily average retail prices for diesel in 2023*. https://www2.nrcan.gc.ca/eneene/sources/pripri/prices_bycity_e.cfm?priceYear=2023&productID=5&locationID=66,8,39,17#priceGraph

Run Descriptor	Base Case - Default Grinding Efficiency
cost per transfer yard, respectively	0
year(s) analyzed	All
species attribute linking	BC
automatic assignment of road class by volume	Yes
road maintenance	Yes
haul speeds	Graduated
haul speeds at 95% / 85% of posted	Yes
transport shifts / day	1
transport hours / shift	12
transport days / year	200
transport fuel price / litre	$1.98
ground strength	2 - good
ground roughness	2 – slightly even
average slope %	20-32
slash used for biomass	Yes
full stem used for biomass	No
chip destination	Valley Wood Lumby, North Enderby Timber Ltd, Interfor Adams Lake Division, Tolko Lavington Planer Division, Aspen Planers Ltd, Downie Timber, Gorman Bros Lumber Ltd, Tolko Armstrong Division, Weyerhauser, Vaagen Bros, Canoe Forest Products
topping diameter	10 cm
truck used for logs	Tridem tractor B-train
truck used for chips	Semi trailer with 2 axles
harvesting fuel price / litre (x3)	$1.98
harvesting shifts / day (x3)	1
harvesting hours / shift (x3)	12
harvesting days / year (x3)	200

Run Descriptor	Base Case - Default Grinding Efficiency
harvesting system	full tree with roadside processing
felling & processing	mechanized and bunched
skid type	grapple skidding
type of roadside processing	cut-to-length
on site biomass treatment (roadside)	Comminution (chips)
recovery season	Winter
slash freshness	>3 months
slash pre-piled at roadside	Yes
grinder size type	horizontal 600 kW
biomass fuel price / litre (x2)	$1.98
biomass hours / shift (x2)	12
biomass shifts / day (x2)	1
Biomass days / year (x2)	200
grinder efficiency	60%
Grinder fuel use (L/PMH)	135
indirect costs - biomass ($ value)	$0.00
indirect costs - harvesting ($ value)	$0.00

3.6 Delivery Locations

All harvest residues from in-wood operations (not from mills) were directed to large industrial areas in or near the Okanagan TSA. In this model the following mills were used as destinations: Valley Wood Lumby, North Enderby Timber Ltd, Interfor Adams Lake Division, Tolko Lavington Planer Division, Aspen Planers Ltd, Downie Timber, Gorman Bros Lumber Ltd, Tolko Armstrong Division, Weyerhauser, Vaagen Bros, Canoe Forest Products. These locations were identified and chosen based off input given during interviews with local forestry experts. Initial comminution was set to take place at roadside, and costs are calculated for biomass delivered to the delivery locations.

3.7 Biomass Calculations

The biomass calculations in FPInterface produce a volume of total available biomass once merchantable roundwood has been removed. For this project, only biomass transported to roadside was considered recoverable and biomass likely to remain at the stump or dispersed on the cutblock was not. Once it is transported to roadside, some biomass becomes unavailable due to handling and technical losses. The remainder is considered recovered biomass. Figure 2 shows this breakdown with the numbers from the 20-year harvest of the base case with normal grinder utilization of 60% and fuel usage of 135 L/PMH.

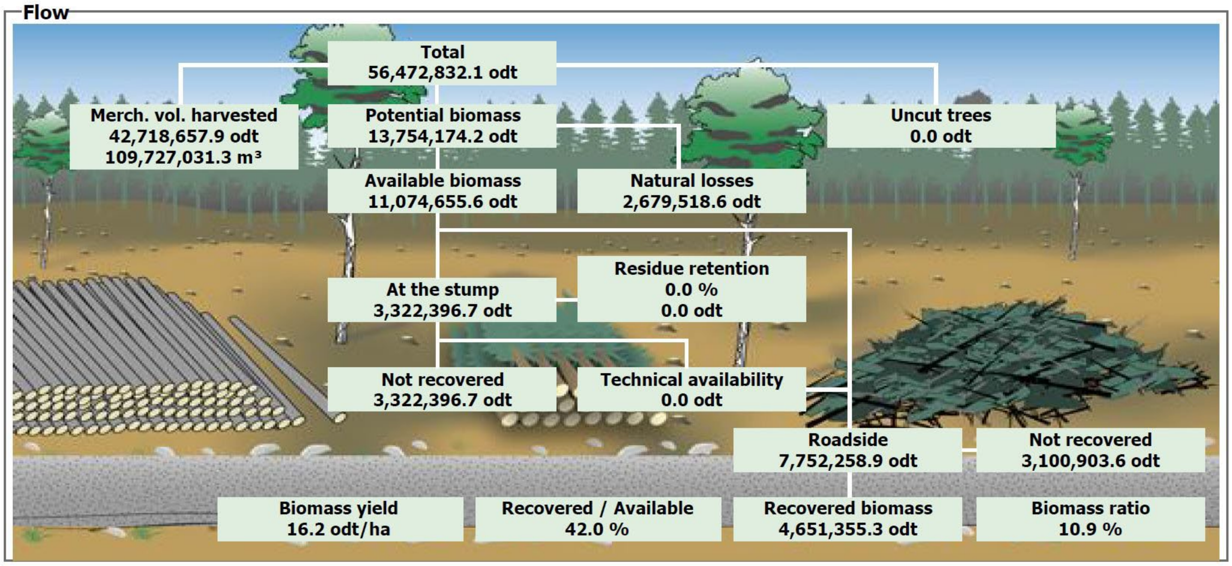


Figure 2. Recoverable biomass across entire Okanagan TSA.

4 RESULTS AND DISCUSSION

4.1 Summary of Key Results

All results from the different runs performed in FPInterface are summarized in Appendix. The FPInterface analysis of biomass supply in the Okanagan TSA, based on inventory information and the road network supplied by the Ministry, indicates an average biomass yield of 16.2 oven-dried tonnes (odt) per hectare for the base case. This is in the form of comminuted hog fuel and comes from harvest residues only – tops, branches, and other roadside logging waste. Mill residues are not predicted by the model. Biomass yield is shown in Table 4.

Table 4. Biomass yields for Okanagan TSA

Biomass Yield (Both Periods)	Biomass Yield Period 1	Biomass Yield Period 2
16.2 odt/ha	16.1 adt/ha	16.3 odt/ha

4.1.1 Biomass Amounts

In total, there are predicted to be 4,651,355 odt that can be recovered from roadside and delivered to the delivery locations over the course of 20 years. The amount of available biomass decreases over time. The first 10-year period has the highest amount of available biomass, which is most likely due to there being a much higher amount of available biomass. In Period 1, the amount of recoverable biomass works out to approximately 259,132 odt/yr, at any price point in the study area. Though the biomass yield in Period 2 is 0.2 odt/ha higher than Period 1, the amount of recoverable biomass in Period 2 drops to 206,002 odt/yr. Key amounts of biomass availability are shown in Table 5.

Table 5. Key availability amounts

Biomass Available (odt)		
Total available biomass	Period 1 available biomass	Period 2 available biomass
11,074,655	6,169,831	4,904,823
% of total available biomass	% of total available biomass	% of total available biomass
100%	56%	44%
Total recovered biomass*	Period 1 recovered biomass	Period 2 recovered biomass
4,651,355	2,591,329	2,060,026

*note that the ratio of recovered/available biomass for both periods was 42%

Additionally, the model indicates that there are about 3,322,396 odt of biomass that would be left on the cutblock and would not make it to roadside. This is approximately 30% of the available biomass and includes material that falls off trees naturally and material that breaks off timber and is left on the ground during normal harvesting operations. This vast amount of material retained in the forest is much higher than that deemed necessary to replenish the forest floor and prevent nutrient degradation to the soil. Additionally, 3,100,903 odt of biomass material (or 28% of available biomass) that makes it to roadside is not recovered due to technical handling efficiencies, that is, the material is too small or large for machine handling or is incorrectly positioned for economic accessibility.

4.1.2 Biomass Ratio

The biomass ratio (BR) is the ratio of recovered biomass to recovered merchantable roundwood. The BR is 10.9% for the base case scenario. In this case 42,718,657 odt of roundwood is expected along with 4,651,355 odt of biomass. The BR is shown in Table 6.

Table 6. Biomass ratio

Biomass Ratio	
4,651,355	odt of biomass
42,718,657	odt of roundwood
10.9%	

Knowing the biomass ratio for an area can be useful in making rough predictions of the amount of available harvest residue if the amount of merchantable timber harvest is known.

4.1.3 Cost Availability

FPInterface conveniently breaks down the available supply into delivered cost in $10 increments. At the presumed market rate of $60/odt, the amount available over 20 years is predicted at 8,357 odt or about 417 odt per year. The complete results in $10 increments for the entire 20-year period can be seen below in Table 7 and Figure 3.

Table 7. Okanagan biomass 'cost-availability' at different prices for base case

Biomass Available (odt)			
at $60/odt	at $90/odt	at $120/odt	total ($180/odt)
8,357	2,659,492	4,477,609	4,651,107
per year	per year	per year	per year
417	132,974	223,880	232,567
% of total volume	% of total volume	% of total volume	% of total volume
<0.2%	57%	96%	100%

Table 8. Okanagan biomass 'cost-availability' for base case

Cost $/odt	Odt available*	Odt/yr
10	0	0
20	0	0
30	0	0
40	0.00	0
50	0.00	0
60	8,357.20	417.86
70	312,580.10	15,629.00
80	1,313,625.00	65,681.25
90	2,659,492.70	132,974.63
100	3,784,224.30	189,211.21
110	4,247,835.50	212,391.77
120	4,477,609.40	223,880.47

Cost $/odt	Odt available*	Odt/yr
130	4,608,476.20	230,423.81
140	4,630,634.40	231,531.72
150	4,649,390.20	232,469.51
160	4,650,888.40	232,544.42
170	4,651,107.10	232,555.35
180	4,651,355.00	232,567.76

*The amounts of Odt available are cumulative. So the amount available at $60/odt, for example, includes all the biomass at $50/odt and the additional biomass available between $50 and $60 per odt.

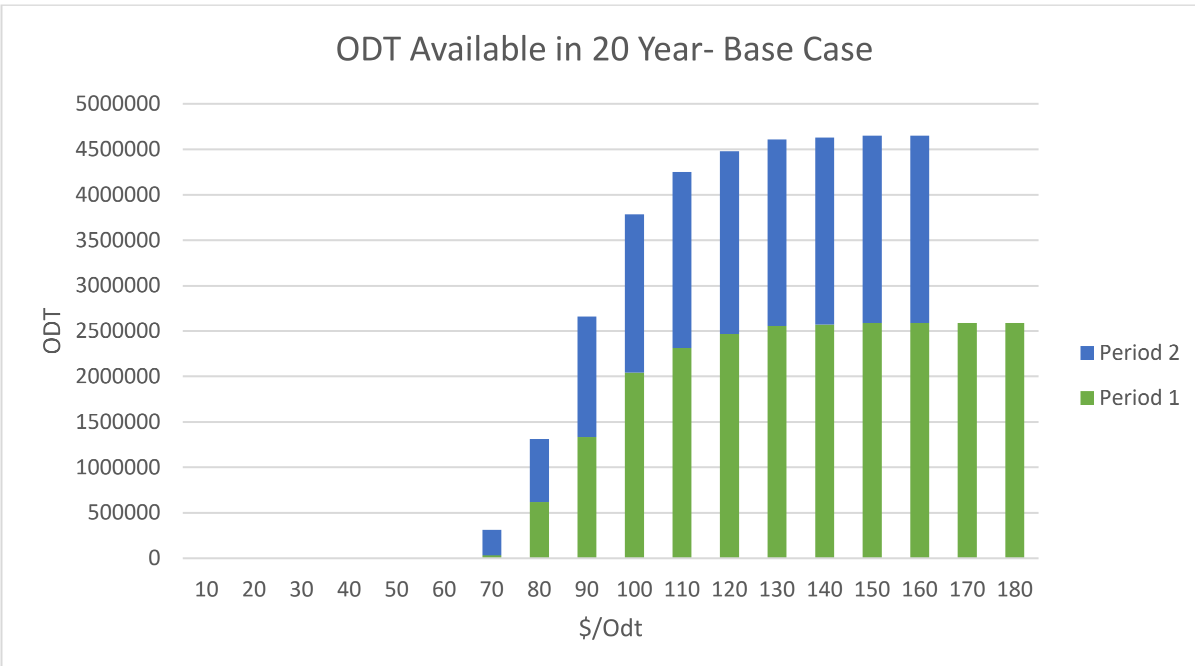


Figure 3. Okanagan TSA biomass 'cost-availability' in base case.

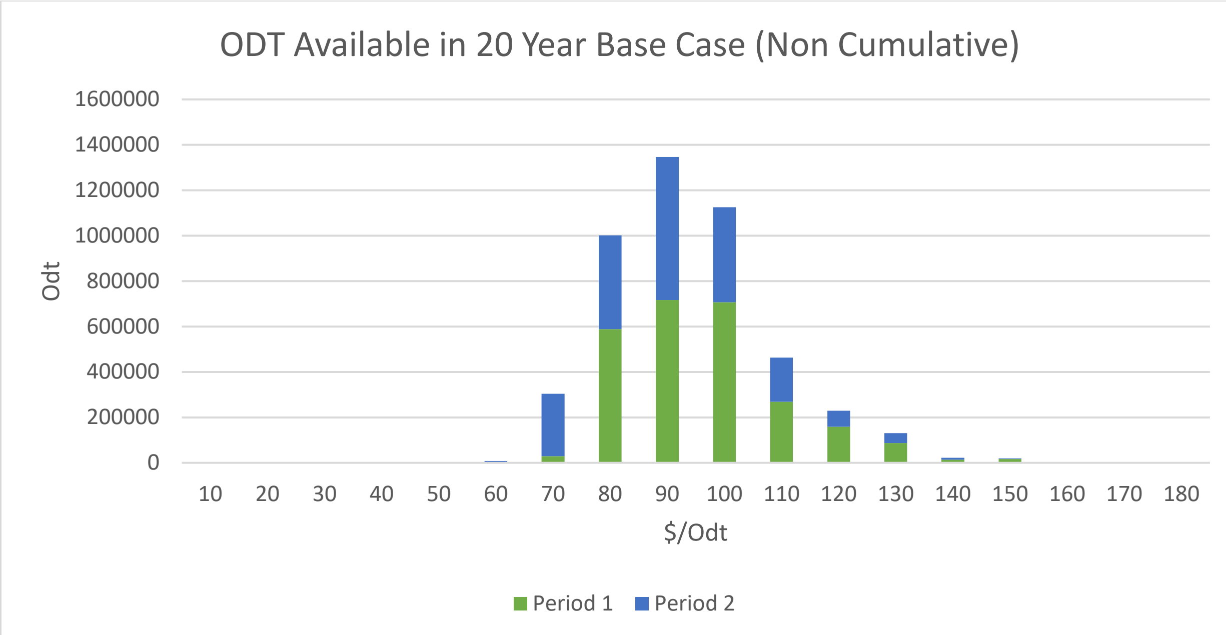


Figure 4. Okanagan TSA biomass 'cost-availability' in base case, displayed not cumulatively.

The average price for delivered biomass across the study area is shown in Table 9.

Table 9. Average cost of delivered biomass across entire study area

Average cost of delivered biomass ($/odt)
94.02

Adding delivery locations near high volume blocks can greatly reduce the overall average cost of delivered biomass. Differences to delivered costs can also be created by changes to equipment or practices that rise or lower operating costs. For example, if greater efficiency in grinding technology is realized, it can dramatically increase the amount of biomass that is economically available, especially, at the lower price points. In this scenario, the average cost of delivered biomass is relatively high at $94.02/odt, this is likely due to the lack of delivery points on the northern and southern portion of the TSA.

4.1.4 Mapping

The distribution of costs by cutblock is shown graphically in FPInterface with a colour scale ranging from green to red is shown in Figure 4. The blocks are coloured in colour increments with the greenest points being the ones with the lowest delivered biomass costs, and the reddest ones being the most expensive, with a yellow transition in the middle.

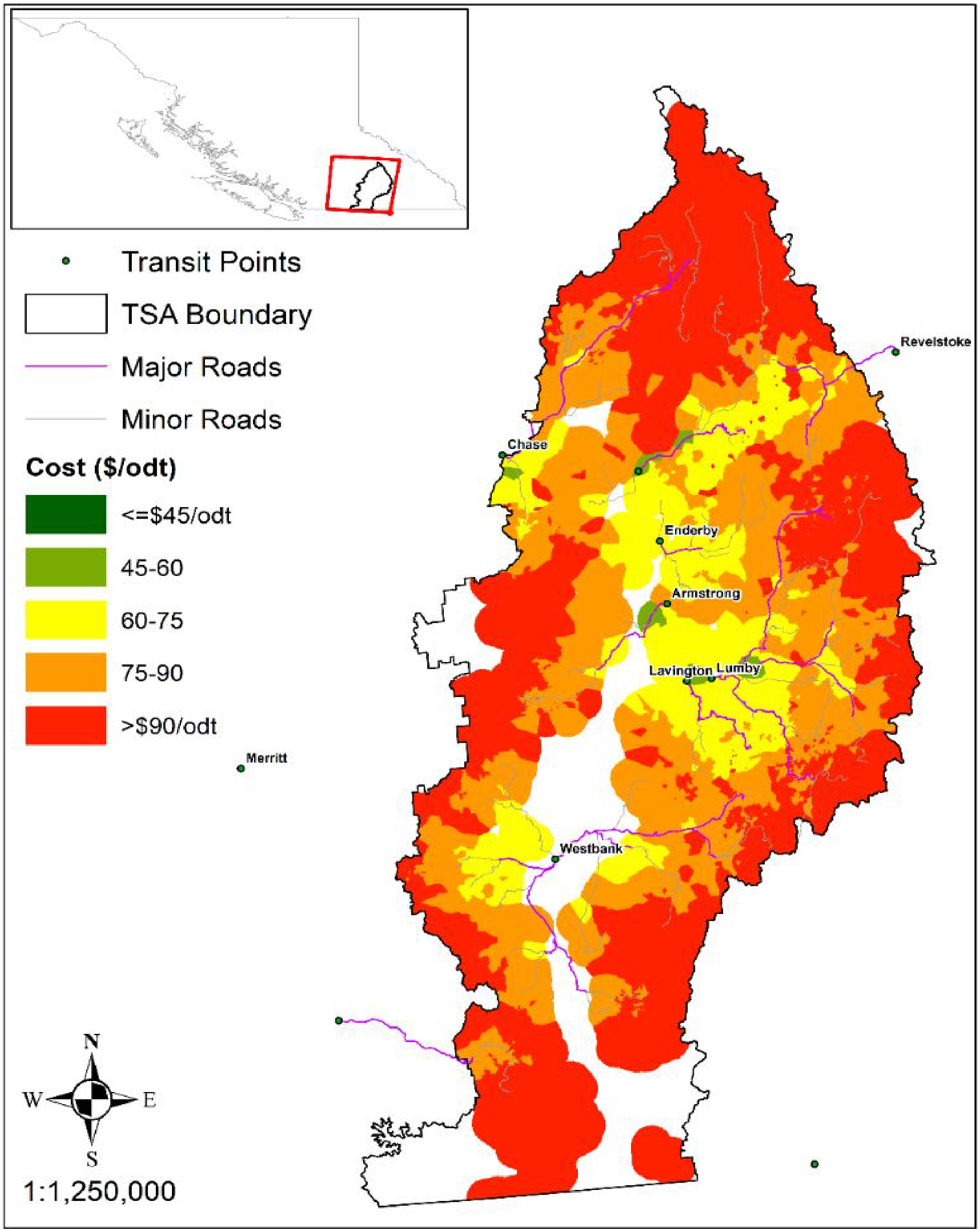


Figure 4. Spatial distribution of cutblocks by delivered biomass cost per odt.

As displayed in Figure 4, Most of the low delivered-cost biomass (green) is located closer to the centre of the TSA with the exception of some lower-cost areas around Chase and between Enderby and Revelstoke, while the high delivered-cost biomass (red) is concentrated primarily on the edges of the TSA boundary, and particularly towards the Northern and Southern points of the TSA. This is likely because there is a high number of delivery points close to the centre of the TSA.

4.1.5 Temporal Distribution of Harvest

The harvest data contains a temporal period assigned to each cutblock. There are two periods in the data representing 10-year periods. The first period covers the first 10 years of cutblocks, and the second period covers the last 10 years.

The harvest projection shows a decrease in supply of available biomass in the second period, as shown in Figure 5). The amount of recovered biomass decreases through time from approximately 518,265 odt/year in the first 10 years to 412,005 odt/year in the last 10 years. This decrease is likely due to a decrease in available biomass in Period 2 (4,904,823 odt) versus Period 1 (6,169,831).

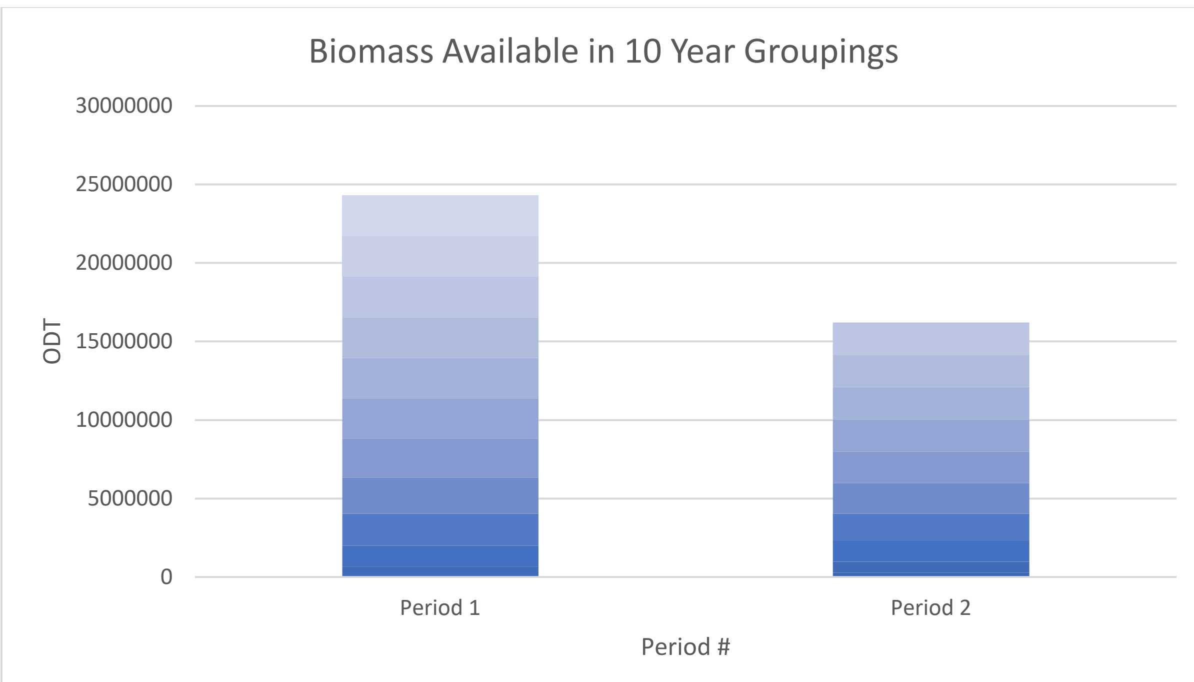


Figure 5. Biomass recoverable by period.

Looking at the economic harvest available (the amount at $60/odt) in Figure 6, the amount is comparable to the total biomass available at any price point.

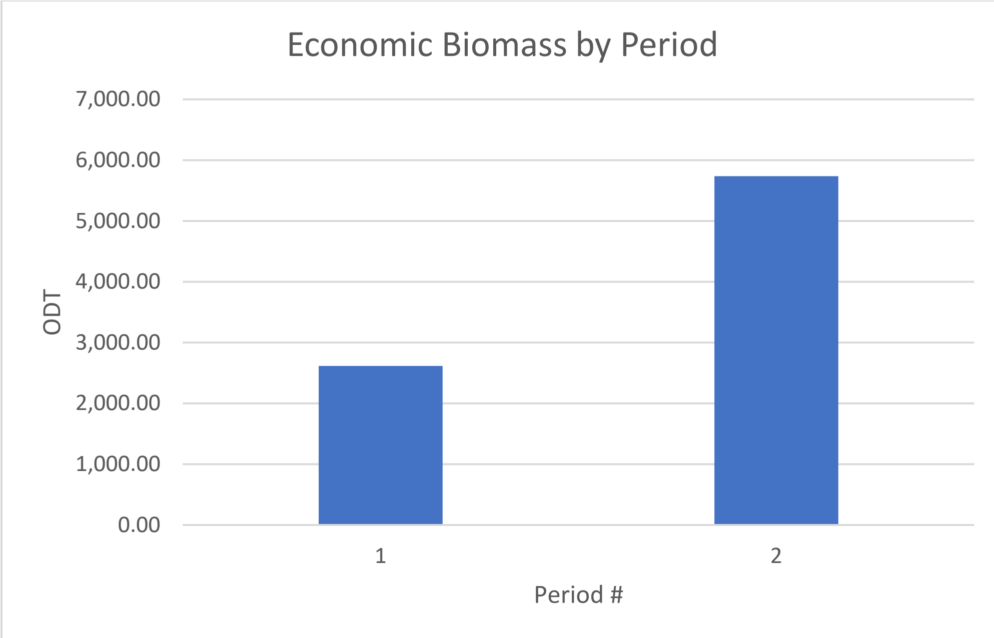


Figure 6. Economic biomass recoverable by 10-year grouping.

The data for cost availability by period at all price points in $10 increments is shown in Table 10. You can see the difference in economically available biomass between periods is comparable with the total biomass available at any price point.

Table 10. Cost availability by period

Cost	Period 1		Period 2	
$/Odt	Total Odt	Odt/yr	Total Odt	Odt/yr
10	0	0	0	0
20	0	0	0	0
30	0	0	0	0
40	0	0	0	0
50	0	0	0	0
60	2,618.30	261.83	5,738.90	573.89
70	28,552.60	2855.26	275,670.30	27567.03
80	588,362.70	58836.27	412,682.20	41268.22
90	716,587.40	71658.74	629,280.20	62928.02
100	706,831.10	70683.11	417,900.60	41790.06
110	268,698.80	26869.88	194,912.40	19491.24
120	159,521.80	15952.18	70,252.00	7025.2
130	86,758.00	8675.8	44,108.90	4410.89
140	14,372.50	1437.25	7,785.70	778.57
150	17,192.90	1719.29	1,563.00	156.3
160	1,366.30	136.63	131.80	13.18
170	218.70	21.87	0.00	0
180	248.30	24.83	0.00	0

5 CONCLUSION

The biomass yield per hectare predicted for the Okanagan TSA is 16.2 oven-dried tonnes per hectare (odt/ha) from harvest residues. Over the next 20 years, a total of 11,074,655 odt of available biomass are predicted to be generated by harvest in the Okanagan TSA, or approximately, 553,732 odt/yr. it should be noted, however, that very little of this, approximately 8,357 odt in total, or 417 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 57% of the total predicted volume is expected to be available at $90/odt, totalling to approximately 2.65 million odt, or 132,974 odt/yr. lastly about 96% of the total predicted volume is accounted for at a dollar amount of $120/odt. In terms of actual amounts this 96% translates to 4.47 million odt or 223,880 odt/yr. Lastly, the biomass ratio, which is the ratio of recovered biomass to recovered merchantable roundwood, is estimated at 10.9%.

Most of the biomass within the Okanagan TSA is not considered economically available (<= $60/odt). This may be due to a combination of factors including: far distances from mill locations and increased cost of labor and fuel which was factored into overarching cost modelling for this analysis.

APPENDIX: FPINTERFACE SUMMARY REPORTS

Territoire:	Unknown territory
Secteur:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	161,305.0 ha
Number of cut blocks	1417
Recovered biomass	2,591,329.4 odt
Biomass yield	16.1 odt/ha
Biomass odt / Merchantable m^3	0.0509 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	33 : 1
Available energy	9,821,714 MWh
Fuel consumption	13.2 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.52 $/odt
Transfer yard	0.00 $/odt
Transportation	42.17 $/odt
Loading/unloading	10.91 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.04 $/odt
Indirect costs	0.00 $/odt
Total	90.64 $/odt

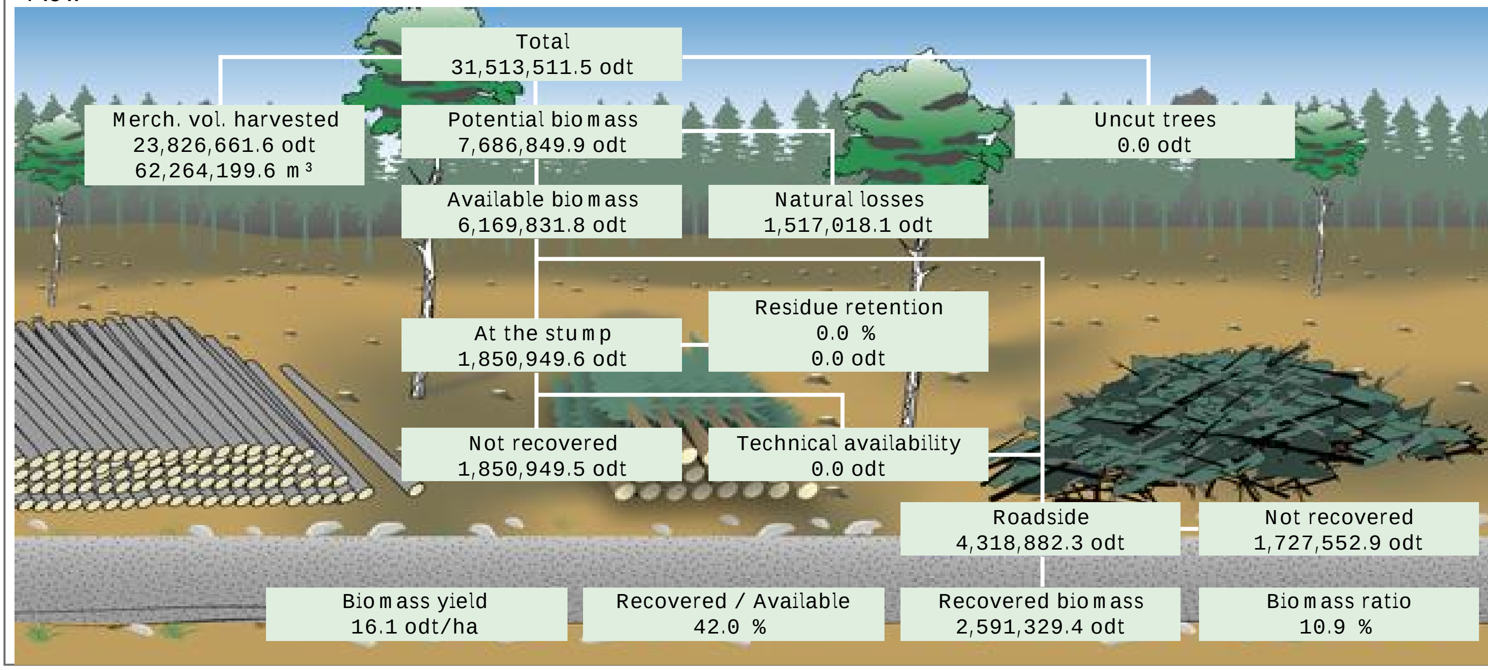
Revenue

Sale value	0.00 $/odt
Silvicultural discount	0.00 $/odt

Net

Profit	-90.64 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
LP Pine (residues)	163,424.8	0.0343	1.01
Hybrid spruce (residues)	774,200.3	0.0513	4.80
Doug Fir (residues)	633,203.2	0.0763	3.93
Subalpine fir (residues)	465,978.1	0.0418	2.89
White Bark Pine (residues)	25.4	0.0477	0.00
Aspen (residues)	12,514.7	0.0500	0.08
White Birch (residues)	22,795.9	0.1041	0.14
Ponderosa Pine (residues)	3,957.5	0.0626	0.02
western larch (residues)	81,482.8	0.0662	0.51
Western Hemlock (residues)	188,711.2	0.0433	1.17
WR Cedar (residues)	237,712.4	0.0448	1.47
Western white pine (residues)	7,323.2	0.0534	0.05
	2,591,329.4	0.0509	16.06

Recovery summary

	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	2,591,329.4	161,305.0	1,417
• Recovery season			
Summer	0.0	0.0	0
Winter	2,591,329.4	161,305.0	1,417
• Residue freshness			
Fresh	0.0	0.0	0
Brown	2,591,329.4	161,305.0	1,417
Brittle	0.0	0.0	0

Supply summary

Recovered biomass to	Merchantable volume (odt)	Residues (odt)	Total biomass (odt)
10 $/odt	0.0	0.0	0.0
20 $/odt	0.0	0.0	0.0
30 $/odt	0.0	0.0	0.0
40 $/odt	0.0	0.0	0.0
50 $/odt	0.0	0.0	0.0
60 $/odt	0.0	2,618.3	2,618.3
70 $/odt	0.0	31,170.9	31,170.9
80 $/odt	0.0	619,533.6	619,533.6
90 $/odt	0.0	1,336,121.0	1,336,121.0
100 $/odt	0.0	2,042,952.1	2,042,952.1
110 $/odt	0.0	2,311,650.9	2,311,650.9
120 $/odt	0.0	2,471,172.7	2,471,172.7
130 $/odt	0.0	2,557,930.7	2,557,930.7
140 $/odt	0.0	2,572,303.2	2,572,303.2
150 $/odt	0.0	2,589,496.1	2,589,496.1
160 $/odt	0.0	2,590,862.4	2,590,862.4
170 $/odt	0.0	2,591,081.1	2,591,081.1
180 $/odt	0.0	2,591,329.4	2,591,329.4
Maximum cost	0.00 $/odt	170.03 $/odt	

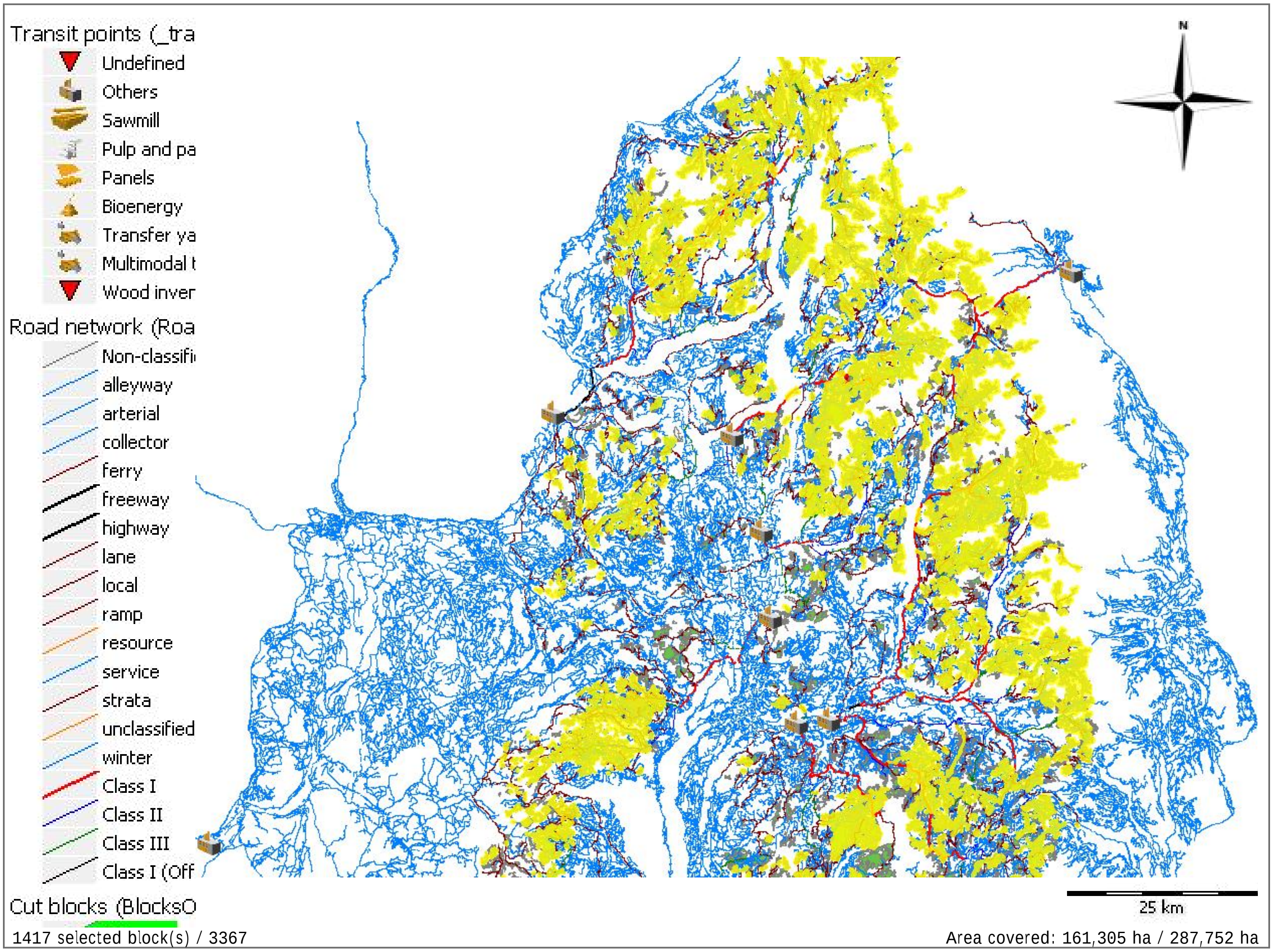
Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Valley Wood Lumby				
	Aspen (residues)	Chips	2,243	61
	Doug Fir (residues)	Chips	140,483	64
	Hybrid spruce (residues)	Chips	206,930	67
	LP Pine (residues)	Chips	18,862	64
	Ponderosa Pine (residues)	Chips	106	46
	Subalpine fir (residues)	Chips	133,746	67
	Western Hemlock (residues)	Chips	52,324	72
	western larch (residues)	Chips	23,335	57
	Western white pine (residues)	Chips	1,268	68
	White Birch (residues)	Chips	3,999	60
	WR Cedar (residues)	Chips	62,654	67
			645,950	66
North Enderby Timber Ltd				
	Aspen (residues)	Chips	274	42
	Doug Fir (residues)	Chips	56,414	39
	Hybrid spruce (residues)	Chips	27,120	38
	LP Pine (residues)	Chips	1,409	35
	Subalpine fir (residues)	Chips	24,919	36
	Western Hemlock (residues)	Chips	15,113	43
	western larch (residues)	Chips	7,529	33
	Western white pine (residues)	Chips	42	44
	White Birch (residues)	Chips	2,391	40
	WR Cedar (residues)	Chips	23,565	40
			158,776	39
Interfor, Adams Lake Division				
	Aspen (residues)	Chips	3,449	83
	Doug Fir (residues)	Chips	114,401	72
	Hybrid spruce (residues)	Chips	103,748	78
	LP Pine (residues)	Chips	3,776	65

Destination	Product	Format	odt	Transport average distance (Km)
Interfor, Adams Lake Division				
	Ponderosa Pine (residues)	Chips	67	25
	Subalpine fir (residues)	Chips	68,343	85
	Western Hemlock (residues)	Chips	47,576	99
	Western white pine (residues)	Chips	3,717	99
	White Birch (residues)	Chips	10,861	68
	WR Cedar (residues)	Chips	62,070	91
			418,007	82
Tolko, Lavington Planer Division				
	Aspen (residues)	Chips	516	41
	Doug Fir (residues)	Chips	21,553	36
	Hybrid spruce (residues)	Chips	80,766	41
	LP Pine (residues)	Chips	9,885	40
	Ponderosa Pine (residues)	Chips	143	38
	Subalpine fir (residues)	Chips	42,332	41
	Western Hemlock (residues)	Chips	16	41
	western larch (residues)	Chips	11,597	34
	White Birch (residues)	Chips	257	33
	WR Cedar (residues)	Chips	3,275	35
			170,339	40
Downie Timber				
	Aspen (residues)	Chips	1,915	60
	Doug Fir (residues)	Chips	41,256	55
	Hybrid spruce (residues)	Chips	41,118	59
	LP Pine (residues)	Chips	162	61
	Subalpine fir (residues)	Chips	30,722	57
	Western Hemlock (residues)	Chips	41,067	65
	western larch (residues)	Chips	1,471	59
	Western white pine (residues)	Chips	1,004	69
	White Birch (residues)	Chips	1,837	61
	WR Cedar (residues)	Chips	41,590	66

Destination	Product	Format	odt	Transport average distance (Km)
Downie Timber				
			202,144	61
Gorman Bros. Lumber Ltd.				
	Aspen (residues)	Chips	2,500	52
	Doug Fir (residues)	Chips	98,397	59
	Hybrid spruce (residues)	Chips	152,328	65
	LP Pine (residues)	Chips	92,612	64
	Ponderosa Pine (residues)	Chips	2,931	56
	Subalpine fir (residues)	Chips	53,550	66
	Western Hemlock (residues)	Chips	6	55
	western larch (residues)	Chips	29,538	79
	White Birch (residues)	Chips	797	78
	WR Cedar (residues)	Chips	1,117	67
			433,776	64
Tolko Industries Ltd, Armstrong Div.				
	Aspen (residues)	Chips	459	53
	Doug Fir (residues)	Chips	51,411	54
	Hybrid spruce (residues)	Chips	59,643	66
	LP Pine (residues)	Chips	21,042	64
	Ponderosa Pine (residues)	Chips	443	57
	Subalpine fir (residues)	Chips	26,899	63
	western larch (residues)	Chips	343	46
	White Birch (residues)	Chips	281	55
	WR Cedar (residues)	Chips	4,060	51
			164,580	61
Weyerhaeuser				
	Aspen (residues)	Chips	394	87
	Doug Fir (residues)	Chips	35,014	83
	Hybrid spruce (residues)	Chips	15,738	81
	LP Pine (residues)	Chips	11,828	76
	Ponderosa Pine (residues)	Chips	171	82

Destination	Product	Format	odt	Transport average distance (Km)
Weyerhaeuser				
	Subalpine fir (residues)	Chips	3,391	80
	western larch (residues)	Chips	367	98
	White Bark Pine (residues)	Chips	25	67
	White Birch (residues)	Chips	92	82
	WR Cedar (residues)	Chips	7	51
			67,027	81
Vaagan Bros				
	Aspen (residues)	Chips	9	54
	Doug Fir (residues)	Chips	1,910	57
	LP Pine (residues)	Chips	321	58
	Ponderosa Pine (residues)	Chips	64	55
	Subalpine fir (residues)	Chips	13	54
	western larch (residues)	Chips	2,025	57
			4,343	57
Canoe Forest Products				
	Aspen (residues)	Chips	757	61
	Doug Fir (residues)	Chips	72,365	46
	Hybrid spruce (residues)	Chips	86,808	47
	LP Pine (residues)	Chips	3,527	51
	Ponderosa Pine (residues)	Chips	32	34
	Subalpine fir (residues)	Chips	82,062	47
	Western Hemlock (residues)	Chips	32,609	53
	western larch (residues)	Chips	5,277	43
	Western white pine (residues)	Chips	1,293	57
	White Birch (residues)	Chips	2,282	48
	WR Cedar (residues)	Chips	39,375	52
			326,388	48
			2,591,329	62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Cut blocks (BlocksO
N
25 km
1417 selected block(s) / 3367
Area covered: 161,305 ha / 287,752 ha

FPInterface™

Summary report
Biomass
[**BC-Okanagan: Period 2**]

Territoire:	Unknown territory
Secteur:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	126,446.8 ha
Number of cut blocks	1950
Recovered biomass	2,060,026.0 odt
Biomass yield	16.3 odt/ha
Biomass odt / Merchantable m^3	0.0533 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	36 : 1
Available energy	7,842,147 MWh
Fuel consumption	12.3 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.52 $/odt
Transfer yard	0.00 $/odt
Transportation	38.40 $/odt
Loading/unloading	10.50 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	0.79 $/odt
Indirect costs	0.00 $/odt
Total	86.20 $/odt

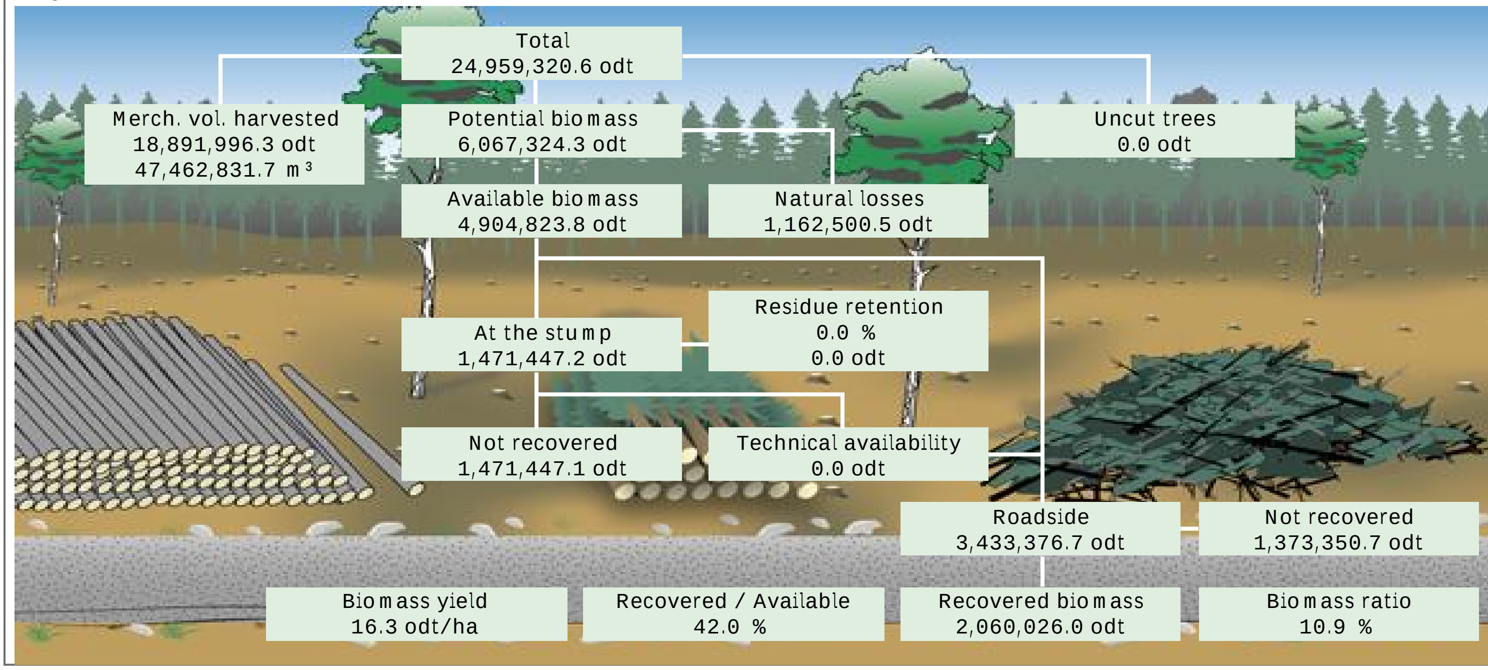
Revenue

Sale value	0.00 $/odt
Silvicultural discount	0.00 $/odt

Net

Profit	-86.20 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Subalpine fir (residues)	241,948.0	0.0423	1.91
LP Pine (residues)	273,693.6	0.0350	2.16
Hybrid spruce (residues)	466,000.5	0.0514	3.69
Doug Fir (residues)	724,816.6	0.0763	5.73
White Bark Pine (residues)	113.0	0.0499	0.00
Aspen (residues)	13,415.0	0.0507	0.11
White Birch (residues)	30,363.9	0.1047	0.24
western larch (residues)	113,964.1	0.0621	0.90
Ponderosa Pine (residues)	6,512.7	0.0621	0.05
Western Hemlock (residues)	71,510.7	0.0460	0.57
WR Cedar (residues)	113,983.6	0.0471	0.90
Western white pine (residues)	3,704.3	0.0578	0.03
	2,060,026.0	0.0533	16.29

Recovery summary

	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	2,060,026.0	126,446.8	1,950
• Recovery season			
Summer	0.0	0.0	0
Winter	2,060,026.0	126,446.8	1,950
• Residue freshness			
Fresh	0.0	0.0	0
Brown	2,060,026.0	126,446.8	1,950
Brittle	0.0	0.0	0

Supply summary

Recovered biomass to	Merchantable volume (odt)	Residues (odt)	Total biomass (odt)
10 $/odt	0.0	0.0	0.0
20 $/odt	0.0	0.0	0.0
30 $/odt	0.0	0.0	0.0
40 $/odt	0.0	0.0	0.0
50 $/odt	0.0	0.0	0.0
60 $/odt	0.0	5,738.9	5,738.9
70 $/odt	0.0	281,409.2	281,409.2
80 $/odt	0.0	694,091.4	694,091.4
90 $/odt	0.0	1,323,371.6	1,323,371.6
100 $/odt	0.0	1,741,272.2	1,741,272.2
110 $/odt	0.0	1,936,184.6	1,936,184.6
120 $/odt	0.0	2,006,436.6	2,006,436.6
130 $/odt	0.0	2,050,545.5	2,050,545.5
140 $/odt	0.0	2,058,331.2	2,058,331.2
150 $/odt	0.0	2,059,894.2	2,059,894.2
160 $/odt	0.0	2,060,026.0	2,060,026.0
Maximum cost	0.00 $/odt	154.70 $/odt	

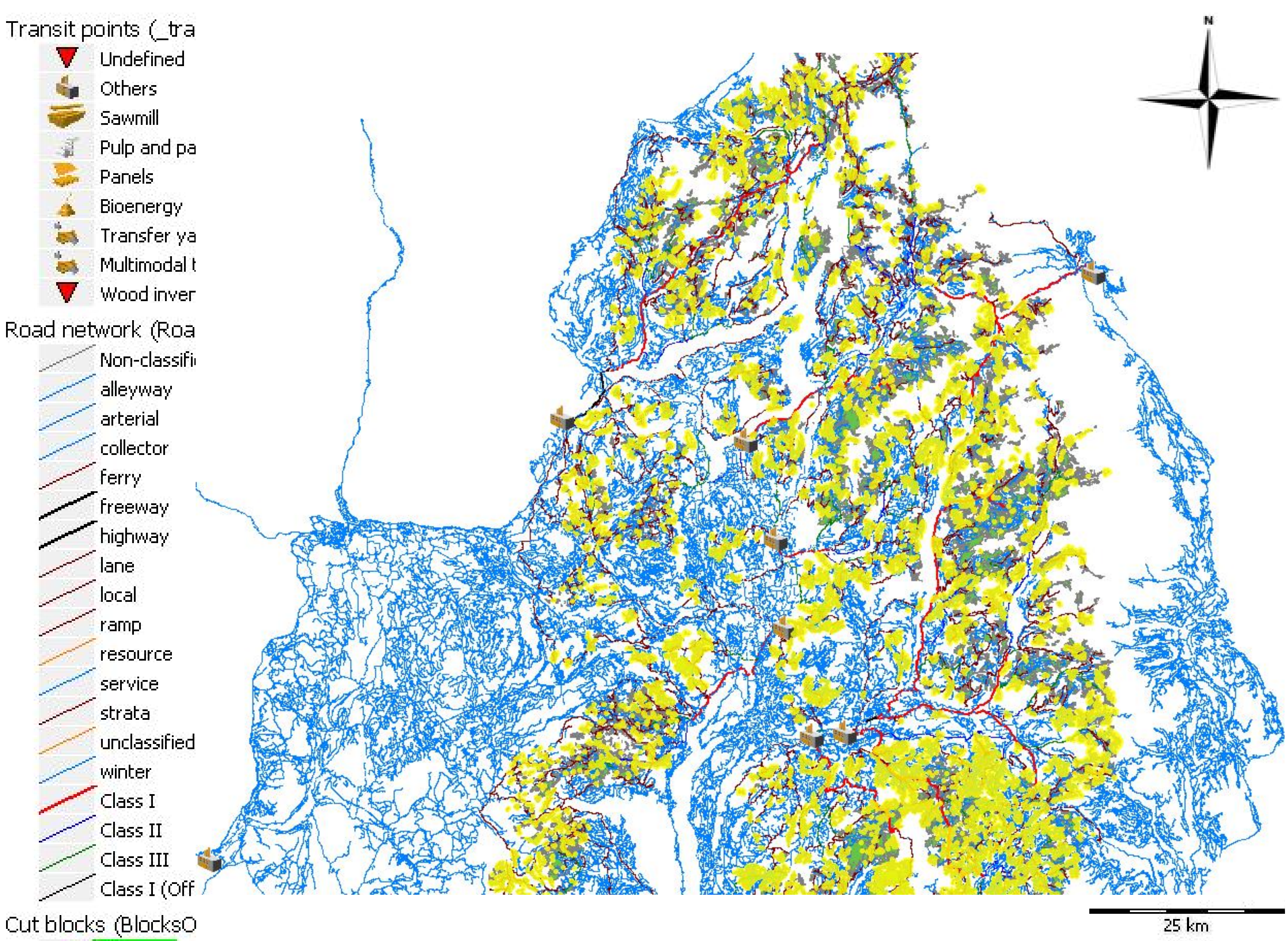
Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Valley Wood Lumby				
	Aspen (residues)	Chips	2,392	61
	Doug Fir (residues)	Chips	121,531	52
	Hybrid spruce (residues)	Chips	153,995	57
	LP Pine (residues)	Chips	25,961	57
	Ponderosa Pine (residues)	Chips	162	26
	Subalpine fir (residues)	Chips	93,015	59
	Western Hemlock (residues)	Chips	13,639	66
	western larch (residues)	Chips	26,710	43
	Western white pine (residues)	Chips	1,176	68
	White Birch (residues)	Chips	5,148	58
	WR Cedar (residues)	Chips	28,175	59
			471,906	56
North Enderby Timber Ltd				
	Aspen (residues)	Chips	597	39
	Doug Fir (residues)	Chips	114,927	29
	Hybrid spruce (residues)	Chips	17,508	36
	LP Pine (residues)	Chips	7,518	28
	Ponderosa Pine (residues)	Chips	489	19
	Subalpine fir (residues)	Chips	11,454	37
	Western Hemlock (residues)	Chips	15,544	36
	western larch (residues)	Chips	23,237	27
	Western white pine (residues)	Chips	79	50
	White Birch (residues)	Chips	6,812	26
	WR Cedar (residues)	Chips	24,681	30
			222,847	30
Interfor, Adams Lake Division				
	Aspen (residues)	Chips	2,325	79
	Doug Fir (residues)	Chips	82,084	58
	Hybrid spruce (residues)	Chips	36,764	74

Destination	Product	Format	odt	Transport average distance (Km)
Interfor, Adams Lake Division				
	LP Pine (residues)	Chips	4,543	44
	Ponderosa Pine (residues)	Chips	251	19
	Subalpine fir (residues)	Chips	26,119	83
	Western Hemlock (residues)	Chips	16,944	98
	Western white pine (residues)	Chips	1,760	99
	White Birch (residues)	Chips	7,995	57
	WR Cedar (residues)	Chips	27,500	80
			206,286	70
Tolko, Lavington Planer Division				
	Aspen (residues)	Chips	193	21
	Doug Fir (residues)	Chips	35,621	24
	Hybrid spruce (residues)	Chips	23,322	29
	LP Pine (residues)	Chips	20,516	31
	Ponderosa Pine (residues)	Chips	117	22
	Subalpine fir (residues)	Chips	3,164	34
	western larch (residues)	Chips	16,922	17
	White Birch (residues)	Chips	961	15
	WR Cedar (residues)	Chips	1,194	18
			102,010	25
Downie Timber				
	Aspen (residues)	Chips	674	42
	Doug Fir (residues)	Chips	25,154	51
	Hybrid spruce (residues)	Chips	10,022	54
	LP Pine (residues)	Chips	76	53
	Subalpine fir (residues)	Chips	9,364	54
	Western Hemlock (residues)	Chips	15,789	52
	western larch (residues)	Chips	778	56
	Western white pine (residues)	Chips	556	53
	White Birch (residues)	Chips	2,019	44
	WR Cedar (residues)	Chips	12,407	50

Destination	Product	Format	odt	Transport average distance (Km)
Downie Timber				
			76,838	52
Gorman Bros. Lumber Ltd.				
	Aspen (residues)	Chips	4,717	49
	Doug Fir (residues)	Chips	206,940	51
	Hybrid spruce (residues)	Chips	166,685	60
	LP Pine (residues)	Chips	177,812	62
	Ponderosa Pine (residues)	Chips	4,974	49
	Subalpine fir (residues)	Chips	62,428	59
	Western Hemlock (residues)	Chips	29	45
	western larch (residues)	Chips	36,331	64
	White Birch (residues)	Chips	559	57
	WR Cedar (residues)	Chips	3,492	53
			663,967	58
Tolko Industries Ltd, Armstrong Div.				
	Aspen (residues)	Chips	1,855	37
	Doug Fir (residues)	Chips	54,478	44
	Hybrid spruce (residues)	Chips	16,979	63
	LP Pine (residues)	Chips	12,787	52
	Ponderosa Pine (residues)	Chips	122	61
	Subalpine fir (residues)	Chips	11,327	41
	western larch (residues)	Chips	3,700	30
	White Birch (residues)	Chips	3,246	35
	WR Cedar (residues)	Chips	1,678	43
			106,171	47
Weyerhaeuser				
	Aspen (residues)	Chips	179	74
	Doug Fir (residues)	Chips	33,414	70
	Hybrid spruce (residues)	Chips	19,071	68
	LP Pine (residues)	Chips	22,134	67
	Ponderosa Pine (residues)	Chips	83	77

Destination	Product	Format	odt	Transport average distance (Km)
Weyerhaeuser				
	Subalpine fir (residues)	Chips	4,150	68
	western larch (residues)	Chips	104	96
	White Bark Pine (residues)	Chips	113	62
	White Birch (residues)	Chips	163	74
	WR Cedar (residues)	Chips	52	60
			79,463	69
Vaagan Bros				
	Aspen (residues)	Chips	23	49
	Doug Fir (residues)	Chips	1,757	51
	LP Pine (residues)	Chips	222	51
	Ponderosa Pine (residues)	Chips	276	54
	Subalpine fir (residues)	Chips	35	49
	western larch (residues)	Chips	2,162	51
			4,474	51
Canoe Forest Products				
	Aspen (residues)	Chips	459	37
	Doug Fir (residues)	Chips	48,912	40
	Hybrid spruce (residues)	Chips	21,655	43
	LP Pine (residues)	Chips	2,124	41
	Ponderosa Pine (residues)	Chips	39	24
	Subalpine fir (residues)	Chips	20,893	45
	Western Hemlock (residues)	Chips	9,565	45
	western larch (residues)	Chips	4,020	37
	Western white pine (residues)	Chips	134	56
	White Birch (residues)	Chips	3,460	51
	WR Cedar (residues)	Chips	14,804	44
			126,064	42
			2,060,026	53



1950 selected block(s) / 3367

Area covered: 126,447 ha / 287,752 ha

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