info@fpinnovations.ca
web.fpinnovations.ca

LILLOOET TIMBER SUPPLY AREA BIOMASS AVAILABILITY ESTIMATION

CONTRACT NUMBER: 1070-20/OT23FHQ191

Audrey Standish

March 2023

The biomass yield per hectare predicted for the Lillooet Timber Supply Area (TSA) is 16 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 14%. Over the next 20 years at total of 2.86 million odt of available biomass are predicted to be generated by harvest in the Lillooet TSA, or approximately 142,272 odt/yr. Of this, approximately 7,177 odt in total, or 358 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 84% of the total predicted volume is expected to be available at $120/odt: a total of 1 million odt, or 50,818 odt/yr.

Project number: 301015539

ACKNOWLEDGEMENTS

This project was financially supported by the Ministry of Forests, Lands, and Natural Resource Operations, Innovation, Bioeconomy and Indigenous Opportunities Branch.

The author(s) would also like to thank Stefan Tack, William Bi and Qinglin Li.

APPROVER CONTACT INFORMATION
Ryan Clark
Manager, Forestry
ryan.clark@fpinnovations.ca

AUTHOR CONTACT INFORMATION
Audrey Standish
Researcher, Forestry
audrey.standish@fpinnovations.ca
(236) 989-9049

EXECUTIVE SUMMARY

Forest origin, harvest residue, biomass estimates were made by FPInnovations for the Lillooet Timber Supply Area (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 Lillooet TSA is 16 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 14%. Over the next 20 years at total of 2,865,450 odt of available biomass are predicted to be generated by harvest in the Lillooet TSA, or approximately 143,272 odt/yr. Of this, approximately 7,177 odt in total, or 358 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 84% of the total predicted volume is expected to be available at $120/odt: a total of 1 million odt, or 50,818 odt/yr. (Table 7 from the text, follows.)

Biomass Available (odt)			
at $60/odt	at $90/odt	At $120	total ($170/odt)
7,177	472,124	1,016,372	1,203,489
per year	per year	Per year	per year
359	23,606	50,818	60,174

Most of the available biomass is not considered economically available (<= $60/odt) (approximately 1%). This is most likely due to the fact that there is only 1 available delivery point within the TSA, causing a large portion of the TSA to have a high of travel distance between the block and the mill. The amount of economically available biomass increases in Period 2 and begins to decrease again in Periods 3 and 4. This may be because Period 2 happens to contain more blocks situated closer to Lillooet.

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1 INTRODUCTION

Forest origin, harvest residue, and biomass estimates were made by FPInnovations for the Lillooet Timber Supply Area (TSA), largely following the process previously established for previous BC TSAs using FPInterface (2010-2022). 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 Lillooet 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 Timber Supply Areas (TSAs). It is reviewed below.

The analysis focused on the Lillooet 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 Lillooet TSA.

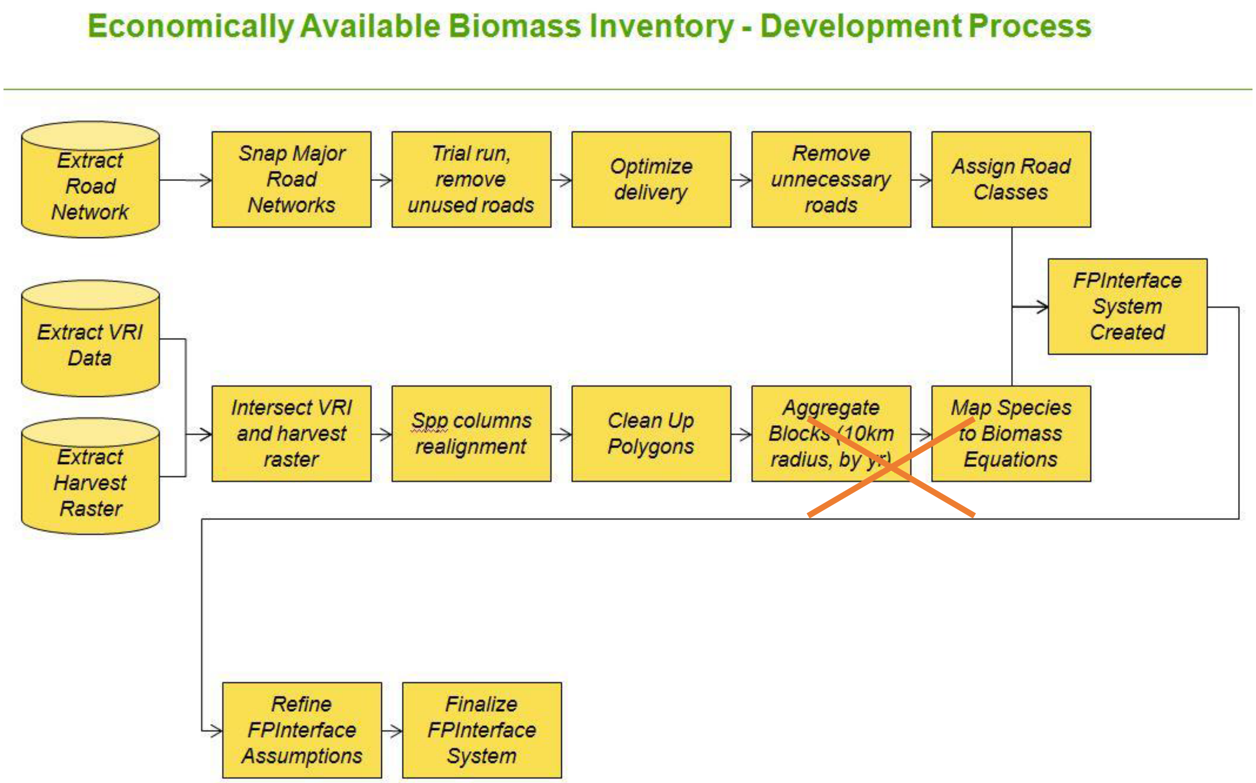


Figure 1. Inventory development process for economically available biomass.

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 $1.99
- 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 government rates. Because of these very notable and impactful changes, the baseline for collecting and moving biomass to transit points tended to be more expensive compared to previous studies.

3.2 Data Acquisition

Data layers were acquired from the Ministry for the Lillooet 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 four five-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 sub-optimal 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 single-tree 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 tree 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	AC, ACT, AT
Subalpine fir	BL	Subalpine fir	B, BL
Western red cedar	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

FPInterface can assign road classes 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 $1.99/litre was assigned which is an average of federal rates from the past year (2022) for diesel for Kamloops.[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 $36.59/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 $36.59/odt (Table 3).

Table 3. FPInterface parameters

Run Descriptor	Base Case - Default Grinding Efficiency
run name	BC-Lillooet
output name	Biomass Report- BC- Lillooet
block system	LillooetBlocks.shp
road system	LillooetRoads.shp
transfer yard(s)	Lillooet and Merritt Mill
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

[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
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	$1.99
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	Lillooet and Merritt Mill
topping diameter	10 cm
truck used for logs	Tridem Tractor B-train
truck used for chips	Semi trailer with 3-axles
harvesting fuel price / litre (x3)	$1.99
harvesting shifts / day (x3)	1
harvesting hours / shift (x3)	12
harvesting days / year (x3)	200
harvesting system	full tree with roadside processing
felling & processing	mechanized and bunched
skid type	skidder with grapple
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)	$1.99
biomass hours / shift (x2)	12
biomass shifts / day (x2)	1

Run Descriptor	Base Case - Default Grinding Efficiency
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-woods operations (not from mills) were directed to large industrial areas in or near the Lillooet TSA. In this model, only the Lillooet mill was used as a delivery location. 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.

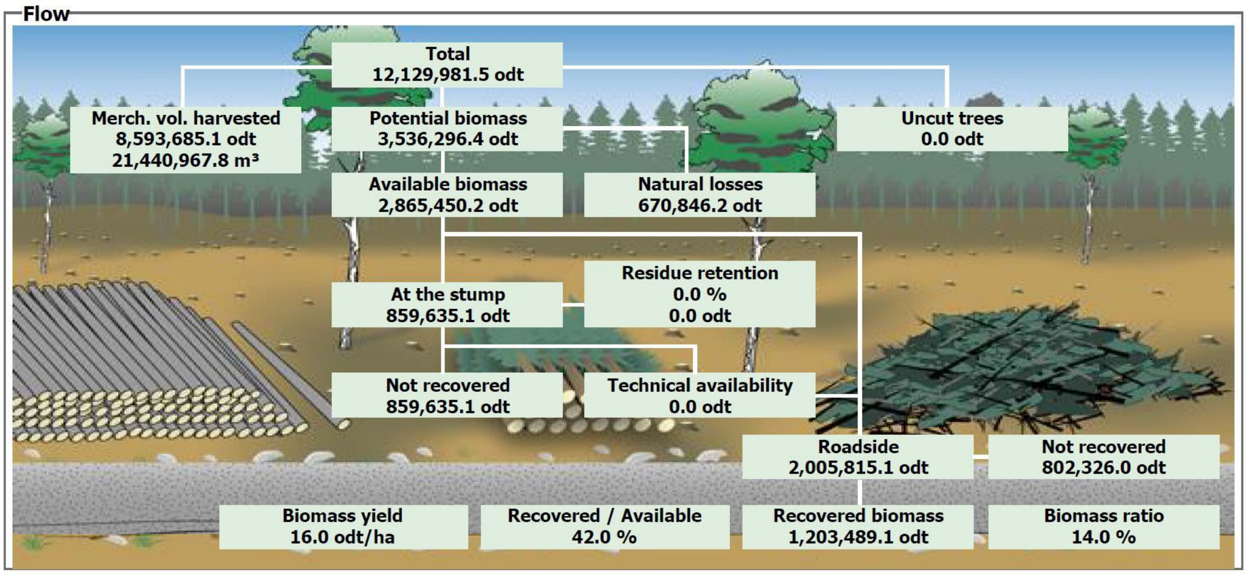


Figure 2. Recoverable biomass at delivery locations.

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 Lillooet TSA, based on inventory information and the road network supplied by the Ministry, indicates an average biomass yield of 16.0 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 yield for Lillooet TSA

Biomass Yield
16.0 odt/ha

4.1.1 Biomass Amounts

In total, there are predicted to be 1,203,489 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 with a slight increase in Period 4. This is likely because each 5 year period has decreasing amount of available biomass, and the final slight increase in Period 4 may be from a higher biomass yield (15.8 odt/ha) compared to Period 2 (15.7 odt/ha) and Period 3 (15.6 odt/ha). Key amounts of biomass availability are shown in Table 5.

Table 5. Key availability amounts

Biomass Available (odt)				
Total available biomass (odt)	Period 1 available biomass (odt)	Period 2 available biomass(odt)	Period 3 available biomass(odt)	Period 4 available biomass (odt)
2,865,450	919,233	755,471	610,385	580,359
% of total available biomass	% of total available biomass	% of total available biomass	% of total available biomass	% of total available biomass
100%	32%	26%	22%	20%
Total recovered biomass (odt)*	Period 1 recovered biomass (odt)	Period 2 recovered biomass (odt)	Period 3 recovered biomass (odt)	Period 4 recovered biomass (odt)
1,203,489	386,078	317,298	256,361	243,751

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

Additionally, the model indicates that there are about 1,530,481 odt of biomass that would be left on the cutblock and would not make it to roadside. This is approximately 43% of the total potential 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, 802,326 odt of biomass material 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 14% for the base case scenario. In this case 8,593,685 odt of roundwood are expected along with 1,203,489 odt of biomass. The BR is shown in Table 6.

Table 6. Biomass ratio

Biomass Ratio	
1,203,489	odt of biomass
8,593,685	odt of roundwood
14%	

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 7,177 odt or about 359 odt per year. Results in $10 increments for the 20 year period are further described in the following tables and graphs.

Table 7. Lillooet TSA biomass 'cost availability' at different prices for base case

Biomass Available (odt)			
at $60/odt	at $90/odt	At $120	total ($170/odt)
7,177	472,124	1,016,372	1,203,489
per year	per year	Per year	per year
359	23,606	50,818	60,174

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

Base Case		
Cost $/odt	Odt Available	Odt/year
$10	-	-
$20	-	-
$30	-	-
$40	-	-
$50	-	-
$60	7,177	359
$70	60,091	3,005
$80	248,398	12,420
$90	472,123	23,606
$100	666,967	33,348
$110	853,891	42,695
$120	1,016,372	50,819
$130	1,153,039	57,652
$140	1,190,216	59,510
$150	1,200,443	60,022
$160	1,203,391	60,169
$170	1,203,489	60,174

NOTE: The amounts 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.

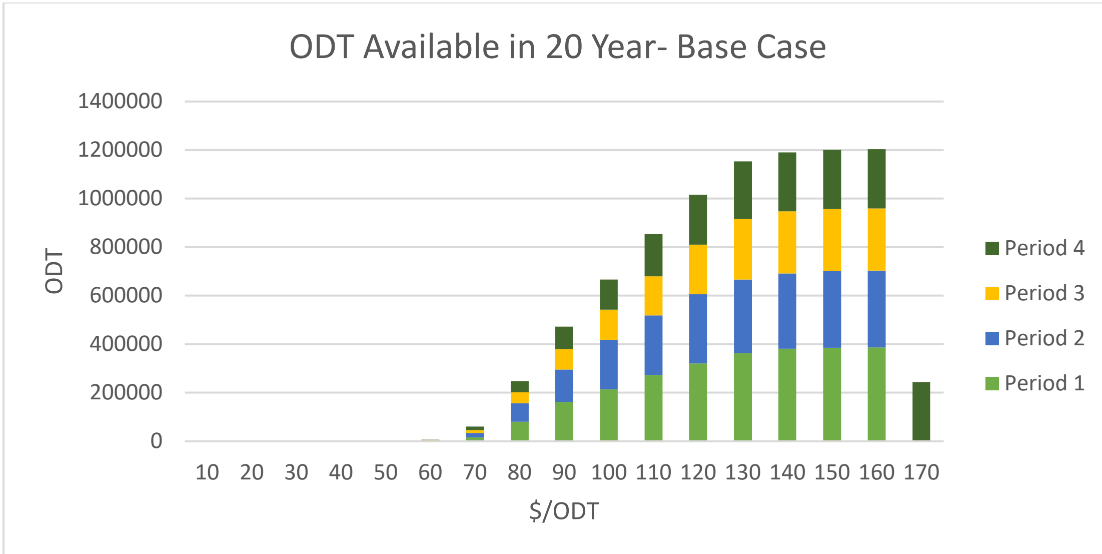


Figure 3. Lillooet TSA biomass 'cost-availability' in base case.

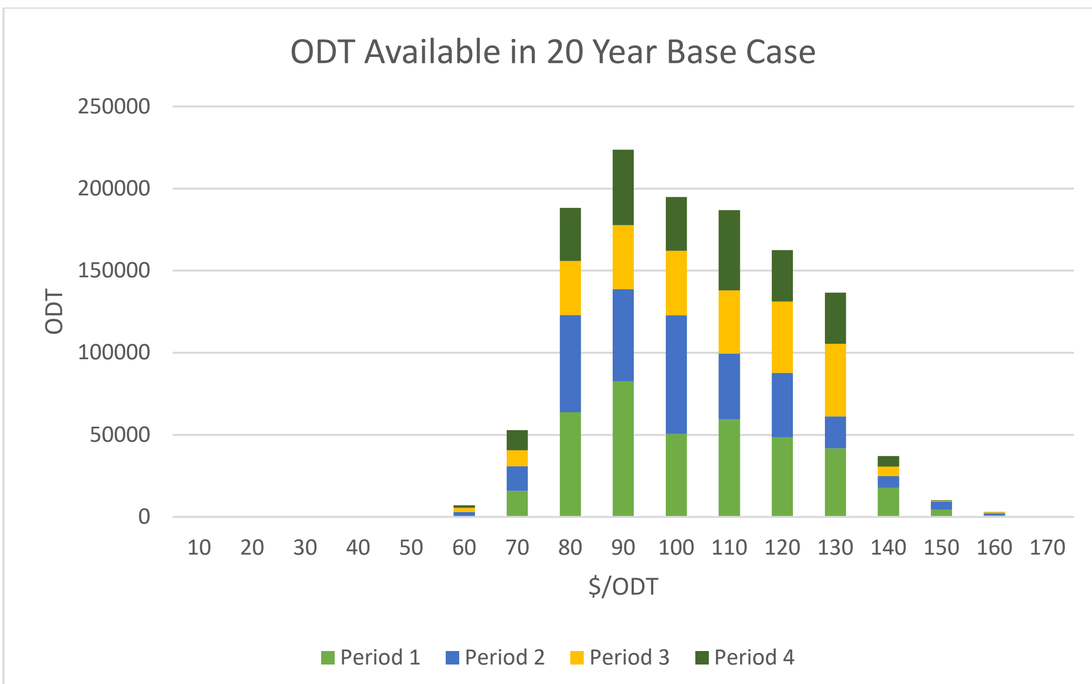


Figure 4. Lillooet TSA biomass 'cost-availability' in base case, displayed not cumulatively.

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)
102.93

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 raise 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 $102.93/odt, this is likely due to the low number of established mills in the area resulting in heightened travel times to transport residues.

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 5. 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.

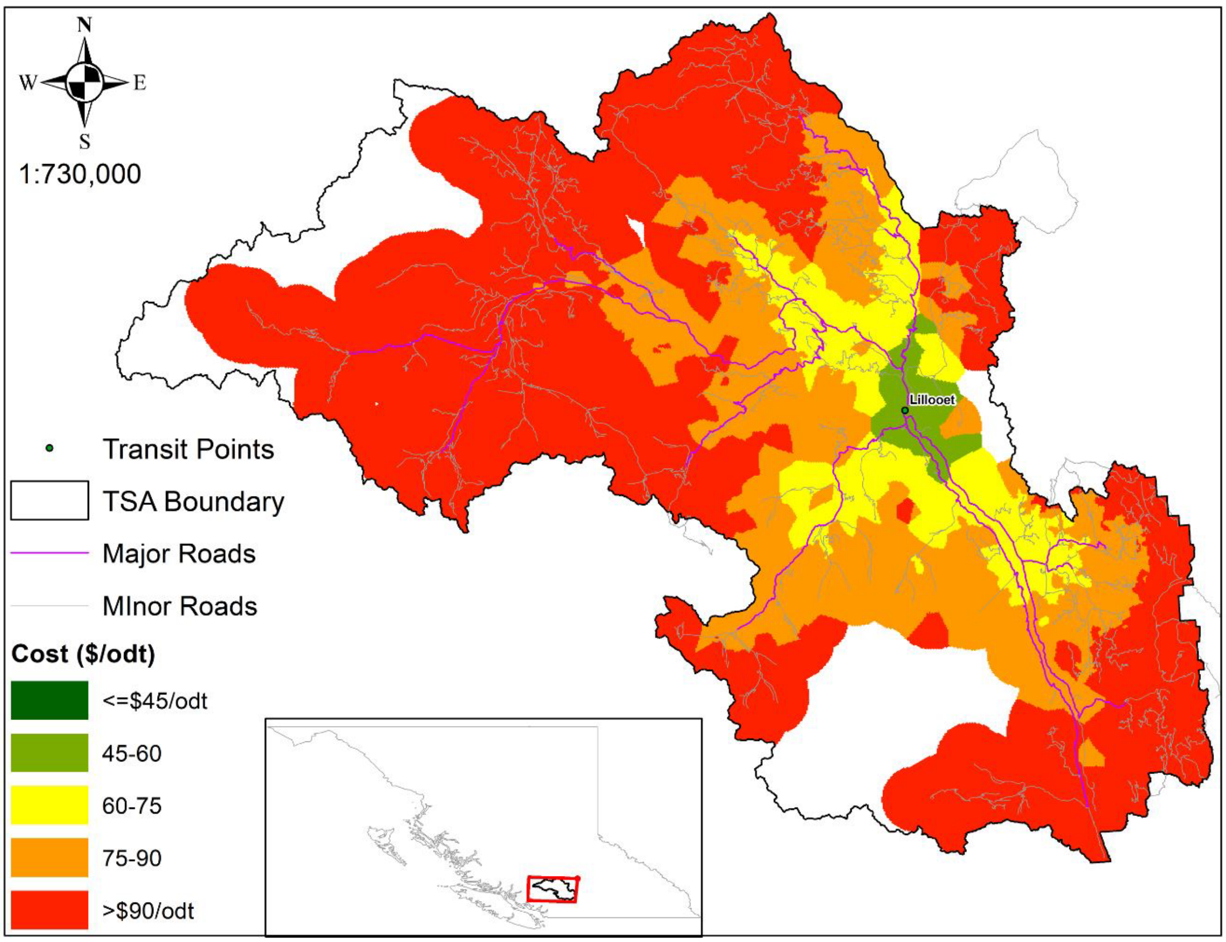


Figure 5. Spatial distribution of cutblocks by delivered biomass cost per odt.

Most of the low delivered-cost biomass (green) is located around the Lillooet area, while the high delivered-cost biomass (red) is limited to the outer reaches of the TSA, far from the central Lillooet delivery point.

4.1.5 Temporal Distribution of Harvest

The harvest data contains a temporal period assigned to each cutblock. There are four periods in the data, each of which represent 5-years (Figure 6).

The harvest projection shows an overall decrease in supply of available biomass in the second and third periods with a slight increase in the fourth period, as shown in Figure 7. The amount of economically available biomass is highest in periods 2 and 3 with approximately 2,508 odt and 2,467 odt, respectively. In periods 1 and 4 the economic biomass is much lower at 566 available economic odt and 1,634 available economic odt. Because these numbers are so small relative to the entire amount of available biomass, the difference in economic biomass may be that incrementally more blocks in periods 2 and 3 were situated closer to the Lillooet destination point than periods 1 and 4.

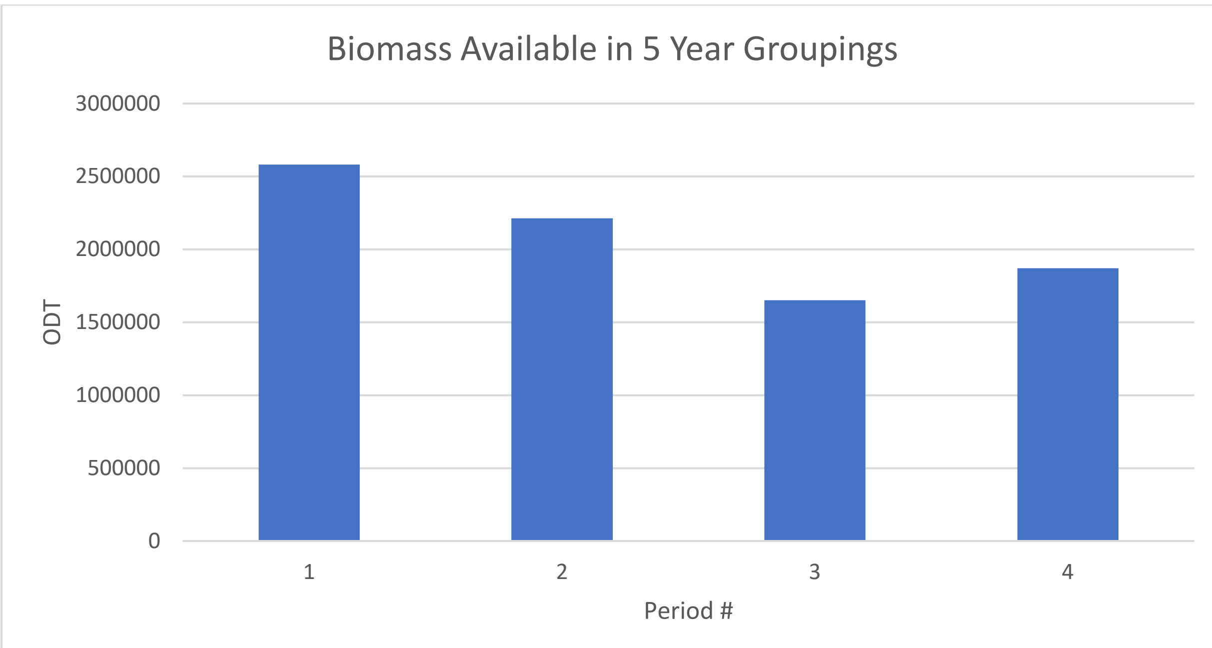


Figure 6. Biomass recoverable by period, where each period equates to 5 years.

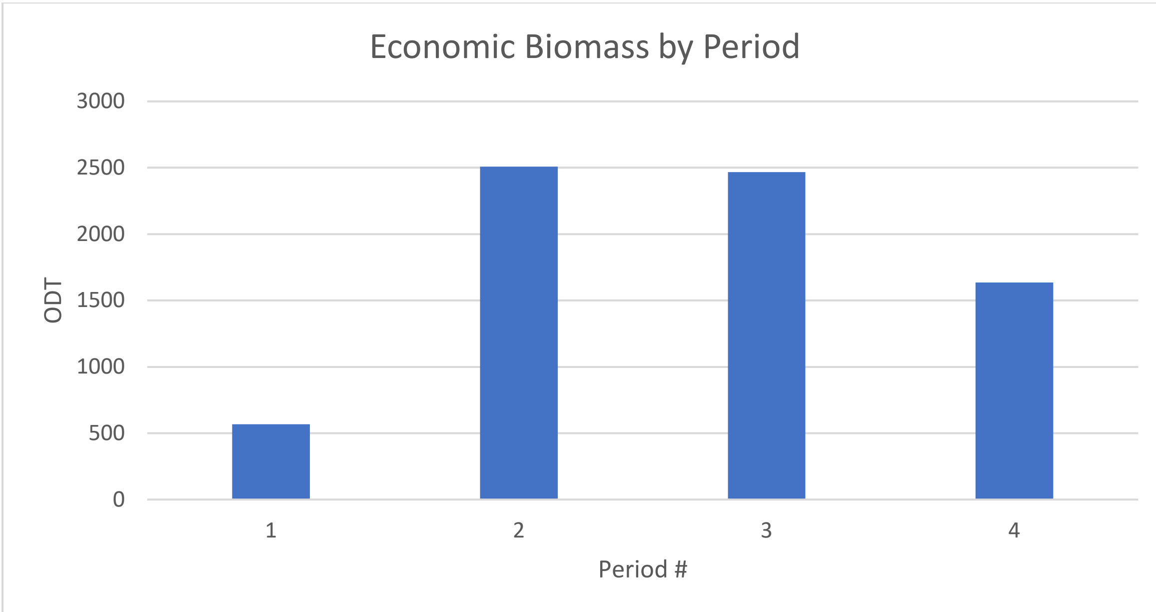


Figure 7. Economic biomass recoverable by 5-year grouping.

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

Table 10. Cost availability by period

Cost $/ODT	Period 1	Period 2	Period 3	Period 4
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	566.6	2,508.50	2,467.80	1,634.40
70	16,360.50	17,606.50	12,263.90	13,860.20
80	80,054.60	76,888.40	45,133.00	46,322.90
90	162,793.30	132,910.80	84,017.40	92,402.10
100	213,239.90	205,277.30	123,238.70	125,212.00
110	272,706.30	245,304.50	161,632.30	174,248.10
120	321,101.40	284,559.60	205,147.50	205,563.60
130	362,886.60	303,996.40	249,456.10	236,700.70
140	380,755.50	310,866.00	255,378.80	243,215.90
150	385,100.20	316,007.70	255,773.00	243,562.60
160	386,078.00	317,298.10	256,361.90	243,653.00
170	0.00	0.00	0.00	243,751.10

5 CONCLUSION

The biomass yield per hectare predicted for the Lillooet TSA is 16 oven-dried tonnes per hectare (odt/ha) from harvest residues. Over the next 20 years a total of 2.86 million odt of available biomass are predicted to be generated by harvest in the Lillooet TSA, or approximately, 143,272 odt/yr. Of this, approximately 7,177 odt in total, or 358 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 84% of the total predicted volume is expected to be available at $120/odt: a total of 1 million odt, or 50,818 odt/yr. The biomass ratio, which is the ratio of recovered biomass to recovered merchantable roundwood, is estimated at 14%.

Most biomass is not considered economically available (<= $60/odt) as there is only 1 delivery point. Though there is a slight increase in Periods 2 and 3, The amount of economically available biomass remains relatively consistent throughout all periods. The Lillooet TSA overarchingly has a high average cost of delivered biomass due to the minimal number of delivery points, making travel distance very far, particularly on the outer edges of the TSA.

APPENDIX: FPINTERFACE SUMMARY REPORTS

FPInterface™

Summary report
Biomass
[BC-Lillooet: **Period 1**]

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

Statistics - Selected Items

Area	23,048.7 ha
Number of cut blocks	832
Recovered biomass	386,078.0 odt
Biomass yield	16.8 odt/ha
Biomass odt / Merchantable m^3	0.0733 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	30 : 1
Available energy	1,468,002 MWh
Fuel consumption	14.5 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.59 $/odt
Transfer yard	0.00 $/odt
Transportation	49.56 $/odt
Loading/unloading	10.63 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.37 $/odt
Indirect costs	0.00 $/odt
Total	98.15 $/odt

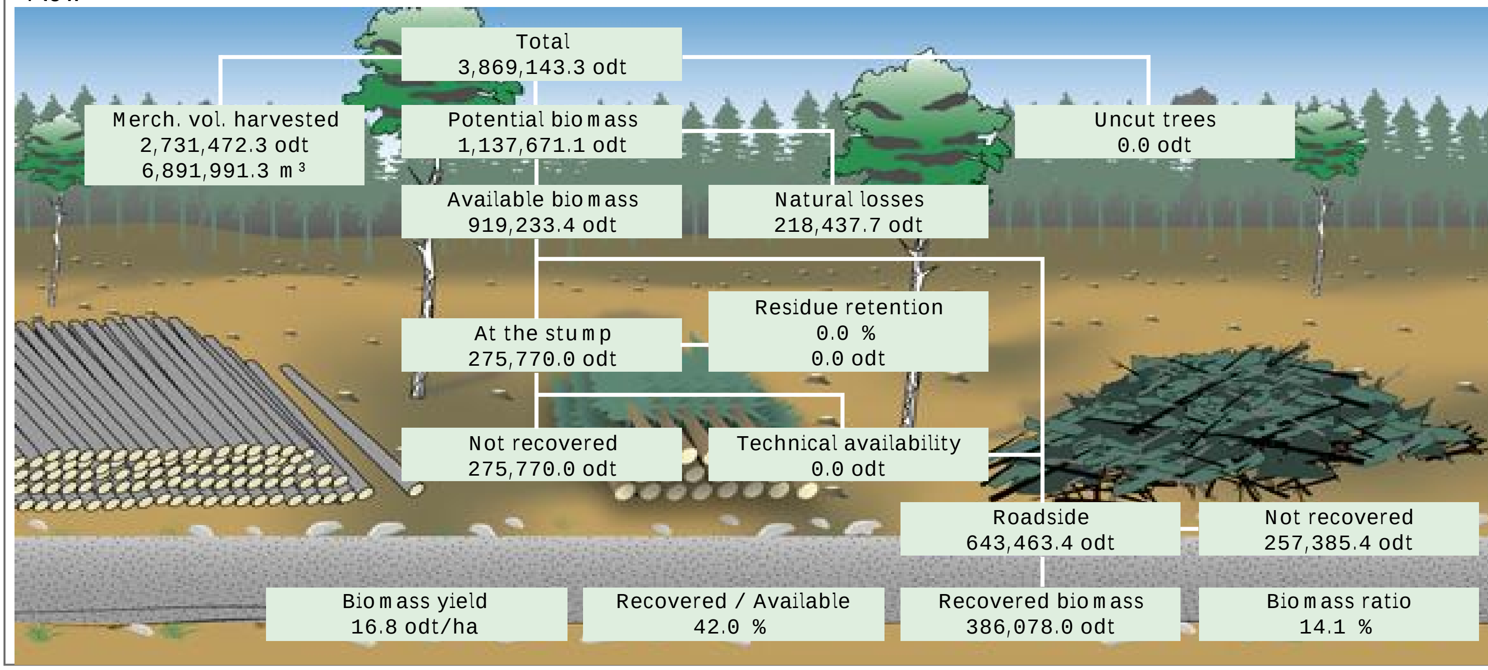
Revenue

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

Net

Profit	-98.15 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Hybrid spruce (residues)	118,562.3	0.0991	5.14
LP Pine (residues)	61,942.7	0.0553	2.69
Doug Fir (residues)	145,647.0	0.0881	6.32
Subalpine fir (residues)	48,732.0	0.0447	2.11
White Bark Pine (residues)	5,707.2	0.0590	0.25
Ponderosa Pine (residues)	2,258.3	0.0619	0.10
Western Hemlock (residues)	1,829.2	0.0399	0.08
Aspen (residues)	275.1	0.0522	0.01
Western white pine (residues)	755.8	0.0463	0.03
WR Cedar (residues)	207.0	0.0415	0.01
White Birch (residues)	161.5	0.1259	0.01
	386,078.0	0.0733	16.75

Recovery summary

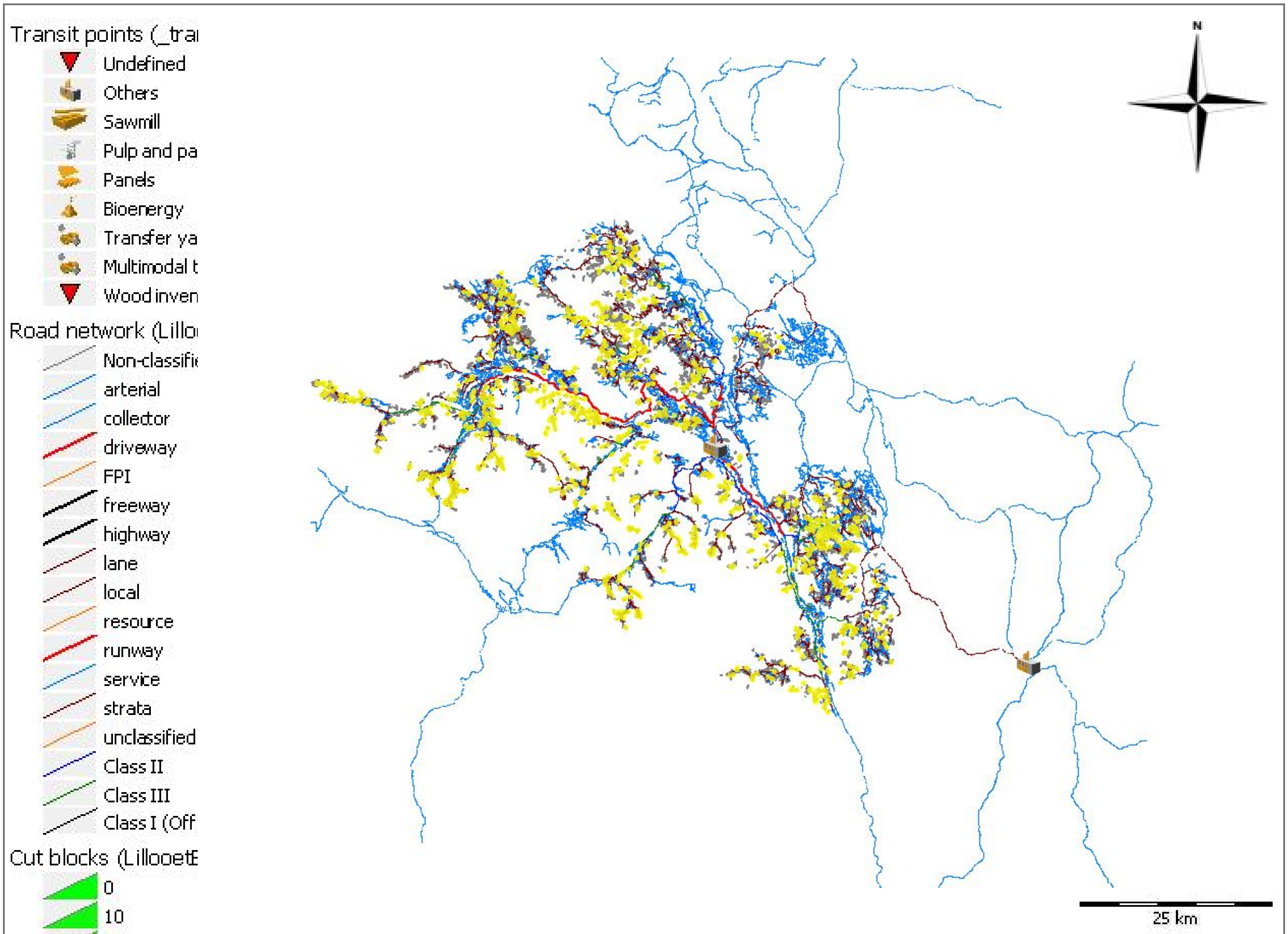
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	386,078.0	23,048.7	832
• Recovery season			
Summer	0.0	0.0	0
Winter	386,078.0	23,048.7	832
• Residue freshness			
Fresh	0.0	0.0	0
Brown	386,078.0	23,048.7	832
Brittle	0.0	0.0	0

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	566.6	566.6
70 $/odt	0.0	16,360.5	16,360.5
80 $/odt	0.0	80,054.6	80,054.6
90 $/odt	0.0	162,793.3	162,793.3
100 $/odt	0.0	213,239.9	213,239.9
110 $/odt	0.0	272,706.3	272,706.3
120 $/odt	0.0	321,101.4	321,101.4
130 $/odt	0.0	362,886.6	362,886.6
140 $/odt	0.0	380,755.5	380,755.5
150 $/odt	0.0	385,100.2	385,100.2
160 $/odt	0.0	386,078.0	386,078.0
Maximum cost	0.00 $/odt	156.21 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Lillooet				
	Aspen (residues)	Chips	275	96
	Doug Fir (residues)	Chips	145,647	71
	Hybrid spruce (residues)	Chips	118,562	88
	LP Pine (residues)	Chips	61,943	84
	Ponderosa Pine (residues)	Chips	2,258	70
	Subalpine fir (residues)	Chips	48,732	108
	Western Hemlock (residues)	Chips	1,829	68
	Western white pine (residues)	Chips	756	92
	White Bark Pine (residues)	Chips	5,707	108
	White Birch (residues)	Chips	162	104
	WR Cedar (residues)	Chips	207	95
			386,078	84
			386,078	84



832 selected block(s) / 3307

Area covered: 23,049 ha / 75,108 ha

FPInterface™

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

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

Statistics - Selected Items

Area	20,159.2 ha
Number of cut blocks	931
Recovered biomass	317,298.1 odt
Biomass yield	15.7 odt/ha
Biomass odt / Merchantable m^3	0.0763 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	32 : 1
Available energy	1,216,822 MWh
Fuel consumption	13.8 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.59 $/odt
Transfer yard	0.00 $/odt
Transportation	47.31 $/odt
Loading/unloading	10.31 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.11 $/odt
Indirect costs	0.00 $/odt
Total	95.32 $/odt

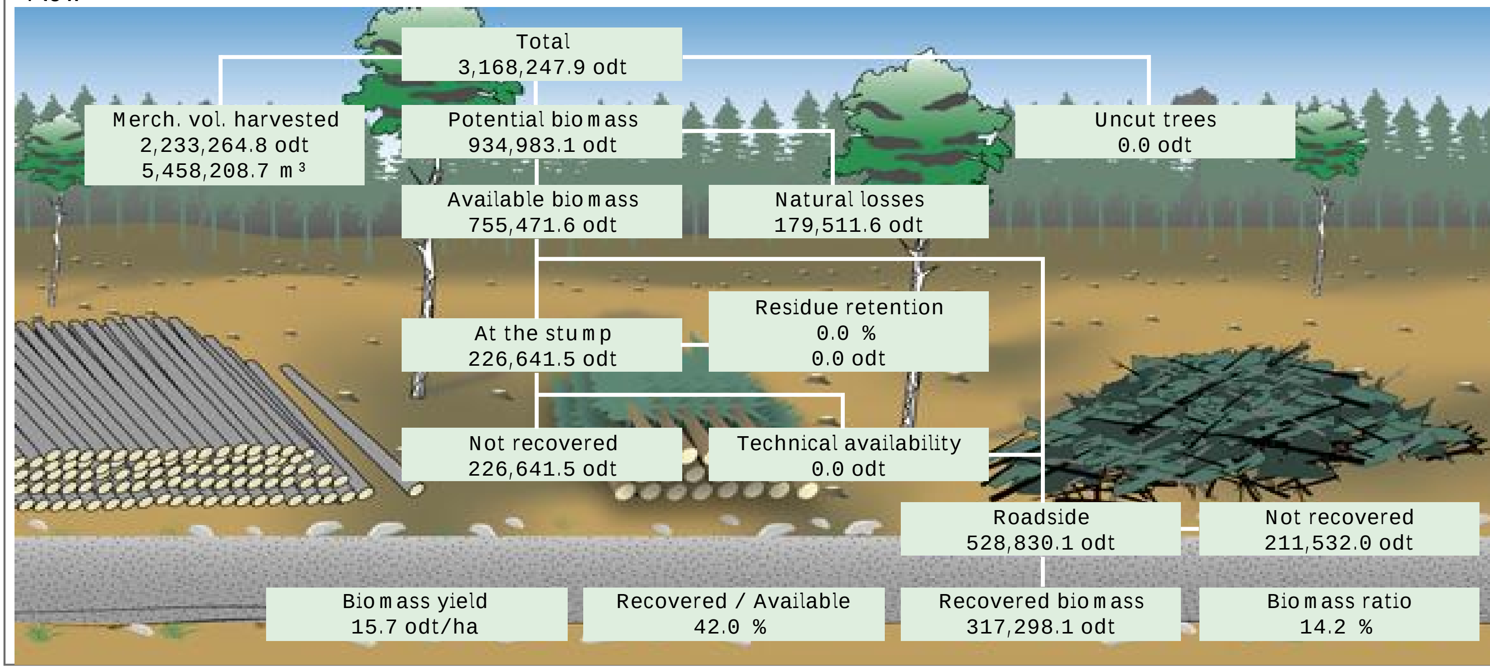
Revenue

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

Net

Profit	-95.32 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
LP Pine (residues)	53,869.4	0.0575	2.67
White Bark Pine (residues)	8,673.8	0.0594	0.43
Subalpine fir (residues)	26,221.6	0.0497	1.30
Doug Fir (residues)	165,658.0	0.0878	8.22
Hybrid spruce (residues)	57,966.7	0.0991	2.88
Aspen (residues)	361.4	0.0545	0.02
Ponderosa Pine (residues)	1,472.6	0.0633	0.07
WR Cedar (residues)	609.6	0.0850	0.03
White Birch (residues)	516.2	0.1394	0.03
Western Hemlock (residues)	1,400.2	0.0567	0.07
Western white pine (residues)	548.4	0.0540	0.03
	317,298.1	0.0763	15.74

Recovery summary

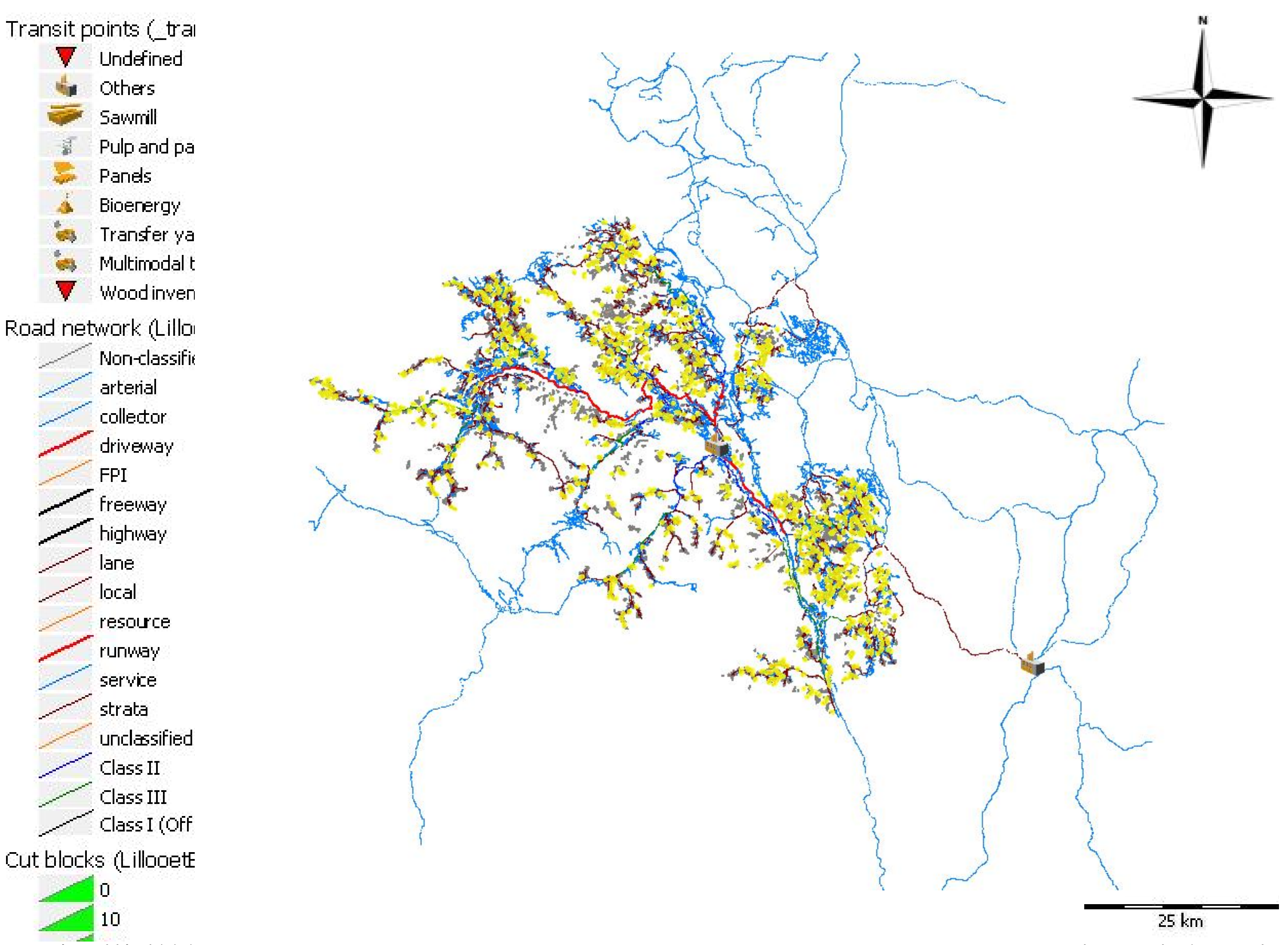
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	317,298.1	20,159.2	931
• Recovery season			
Summer	0.0	0.0	0
Winter	317,298.1	20,159.2	931
• Residue freshness			
Fresh	0.0	0.0	0
Brown	317,298.1	20,159.2	931
Brittle	0.0	0.0	0

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	2,508.5	2,508.5
70 $/odt	0.0	17,606.5	17,606.5
80 $/odt	0.0	76,888.4	76,888.4
90 $/odt	0.0	132,910.8	132,910.8
100 $/odt	0.0	205,277.3	205,277.3
110 $/odt	0.0	245,304.5	245,304.5
120 $/odt	0.0	284,559.6	284,559.6
130 $/odt	0.0	303,996.4	303,996.4
140 $/odt	0.0	310,866.0	310,866.0
150 $/odt	0.0	316,007.7	316,007.7
160 $/odt	0.0	317,298.1	317,298.1
Maximum cost	0.00 $/odt	152.89 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Lillooet				
	Aspen (residues)	Chips	361	87
	Doug Fir (residues)	Chips	165,658	65
	Hybrid spruce (residues)	Chips	57,967	80
	LP Pine (residues)	Chips	53,869	85
	Ponderosa Pine (residues)	Chips	1,473	78
	Subalpine fir (residues)	Chips	26,222	101
	Western Hemlock (residues)	Chips	1,400	64
	Western white pine (residues)	Chips	548	108
	White Bark Pine (residues)	Chips	8,674	88
	White Birch (residues)	Chips	516	53
	WR Cedar (residues)	Chips	610	46
			317,298	75
			317,298	75



931 selected block(s) / 3307
Area covered: 20,159 ha / 75,108 ha

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

Statistics - Selected Items

Area	16,453.3 ha
Number of cut blocks	784
Recovered biomass	256,361.9 odt
Biomass yield	15.6 odt/ha
Biomass odt / Merchantable m³	0.0734 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	30 : 1
Available energy	974,038 MWh
Fuel consumption	14.6 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.59 $/odt
Transfer yard	0.00 $/odt
Transportation	51.63 $/odt
Loading/unloading	10.68 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.27 $/odt
Indirect costs	0.00 $/odt
Total	100.17 $/odt

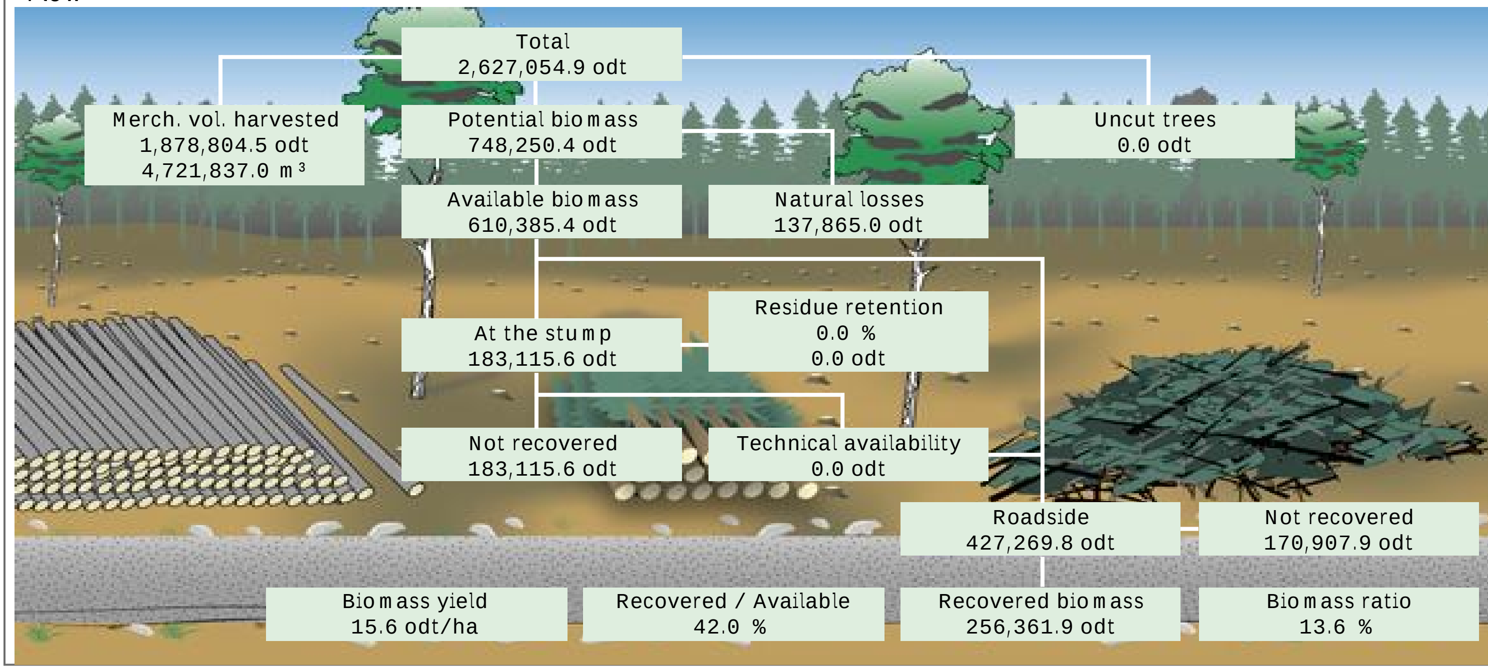
Revenue

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

Net

Profit	-100.17 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
LP Pine (residues)	72,045.8	0.0620	4.38
Doug Fir (residues)	74,047.0	0.0825	4.50
Subalpine fir (residues)	26,864.9	0.0512	1.63
Hybrid spruce (residues)	74,723.6	0.0991	4.54
White Bark Pine (residues)	6,085.7	0.0582	0.37
Ponderosa Pine (residues)	891.0	0.0445	0.05
Western white pine (residues)	489.9	0.0555	0.03
Aspen (residues)	156.2	0.0487	0.01
Western Hemlock (residues)	719.4	0.0623	0.04
WR Cedar (residues)	338.4	0.0501	0.02
	256,361.9	0.0734	15.58

Recovery summary

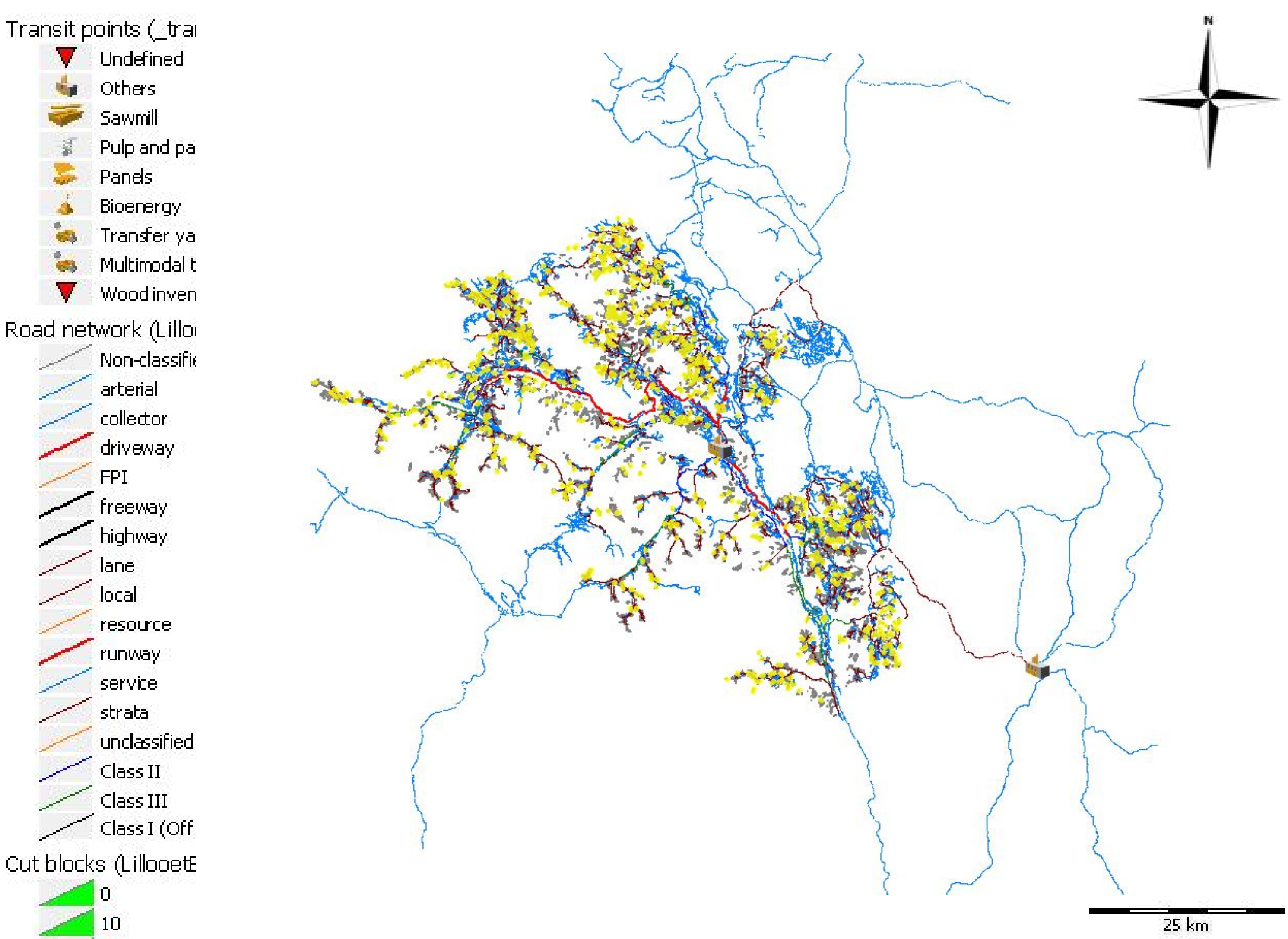
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	256,361.9	16,453.3	784
• Recovery season			
Summer	0.0	0.0	0
Winter	256,361.9	16,453.3	784
• Residue freshness			
Fresh	0.0	0.0	0
Brown	256,361.9	16,453.3	784
Brittle	0.0	0.0	0

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	2,467.8	2,467.8
70 $/odt	0.0	12,263.9	12,263.9
80 $/odt	0.0	45,133.0	45,133.0
90 $/odt	0.0	84,017.4	84,017.4
100 $/odt	0.0	123,238.7	123,238.7
110 $/odt	0.0	161,632.3	161,632.3
120 $/odt	0.0	205,147.5	205,147.5
130 $/odt	0.0	249,456.1	249,456.1
140 $/odt	0.0	255,378.8	255,378.8
150 $/odt	0.0	255,773.0	255,773.0
160 $/odt	0.0	256,361.9	256,361.9
Maximum cost	0.00 $/odt	153.38 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Lillooet				
	Aspen (residues)	Chips	156	70
	Doug Fir (residues)	Chips	74,047	74
	Hybrid spruce (residues)	Chips	74,724	80
	LP Pine (residues)	Chips	72,046	90
	Ponderosa Pine (residues)	Chips	891	74
	Subalpine fir (residues)	Chips	26,865	94
	Western Hemlock (residues)	Chips	719	77
	Western white pine (residues)	Chips	490	126
	White Bark Pine (residues)	Chips	6,086	90
	WR Cedar (residues)	Chips	338	100
			256,362	83
			256,362	83



784 selected block(s) / 3307

Area covered: 16,453 ha / 75,108 ha

FPInterface™

Summary report
Biomass
[**BC-Lillooet: Period 4**]

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

Statistics - Selected Items

Area	15,446.6 ha
Number of cut blocks	760
Recovered biomass	243,751.1 odt
Biomass yield	15.8 odt/ha
Biomass odt / Merchantable m³	0.0735 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	31 : 1
Available energy	927,696 MWh
Fuel consumption	14.3 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.59 $/odt
Transfer yard	0.00 $/odt
Transportation	49.44 $/odt
Loading/unloading	10.57 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.23 $/odt
Indirect costs	0.00 $/odt
Total	97.83 $/odt

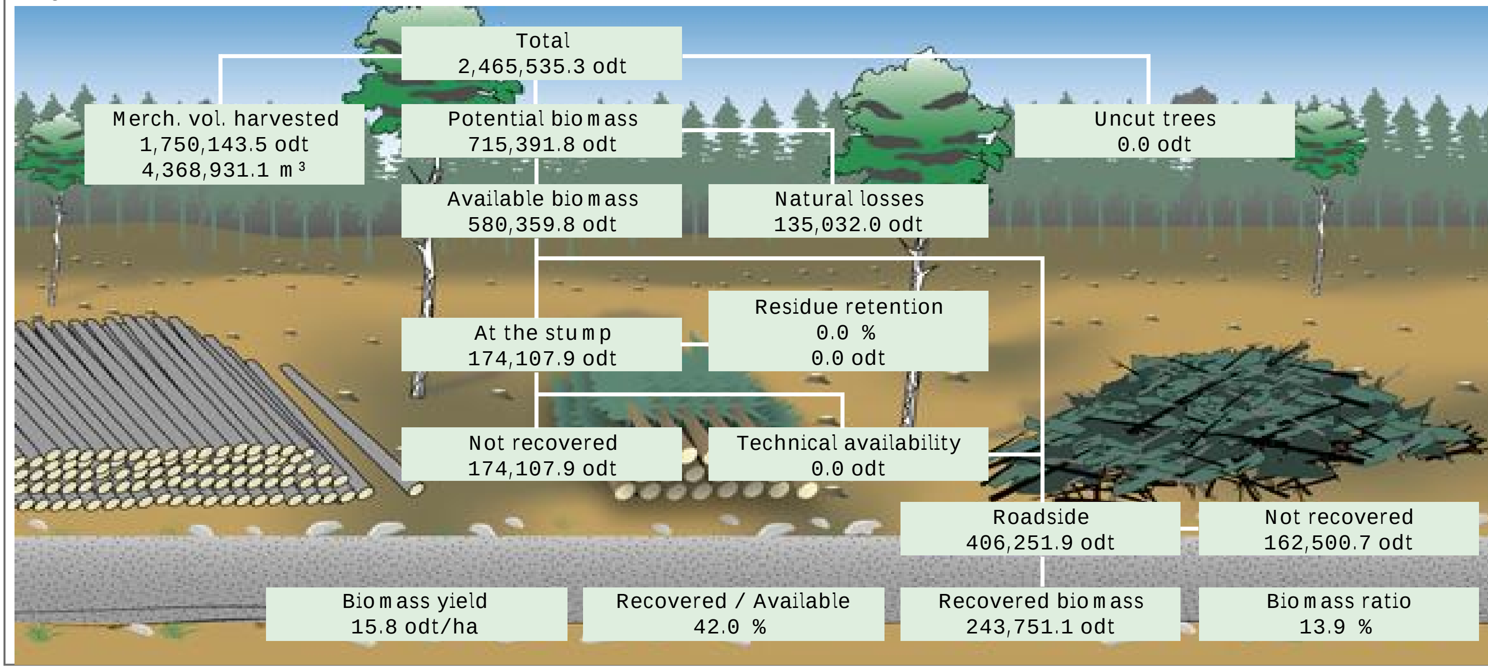
Revenue

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

Net

Profit	-97.83 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
LP Pine (residues)	50,669.5	0.0531	3.28
White Bark Pine (residues)	3,329.7	0.0580	0.22
Doug Fir (residues)	87,941.8	0.0875	5.69
Subalpine fir (residues)	23,874.3	0.0486	1.55
Hybrid spruce (residues)	74,531.0	0.0991	4.83
Ponderosa Pine (residues)	2,662.3	0.0563	0.17
White Birch (residues)	130.6	0.1096	0.01
Western Hemlock (residues)	284.2	0.0647	0.02
Aspen (residues)	166.8	0.0589	0.01
Western white pine (residues)	119.2	0.0815	0.01
WR Cedar (residues)	41.9	0.0469	0.00
	243,751.1	0.0735	15.78

Recovery summary

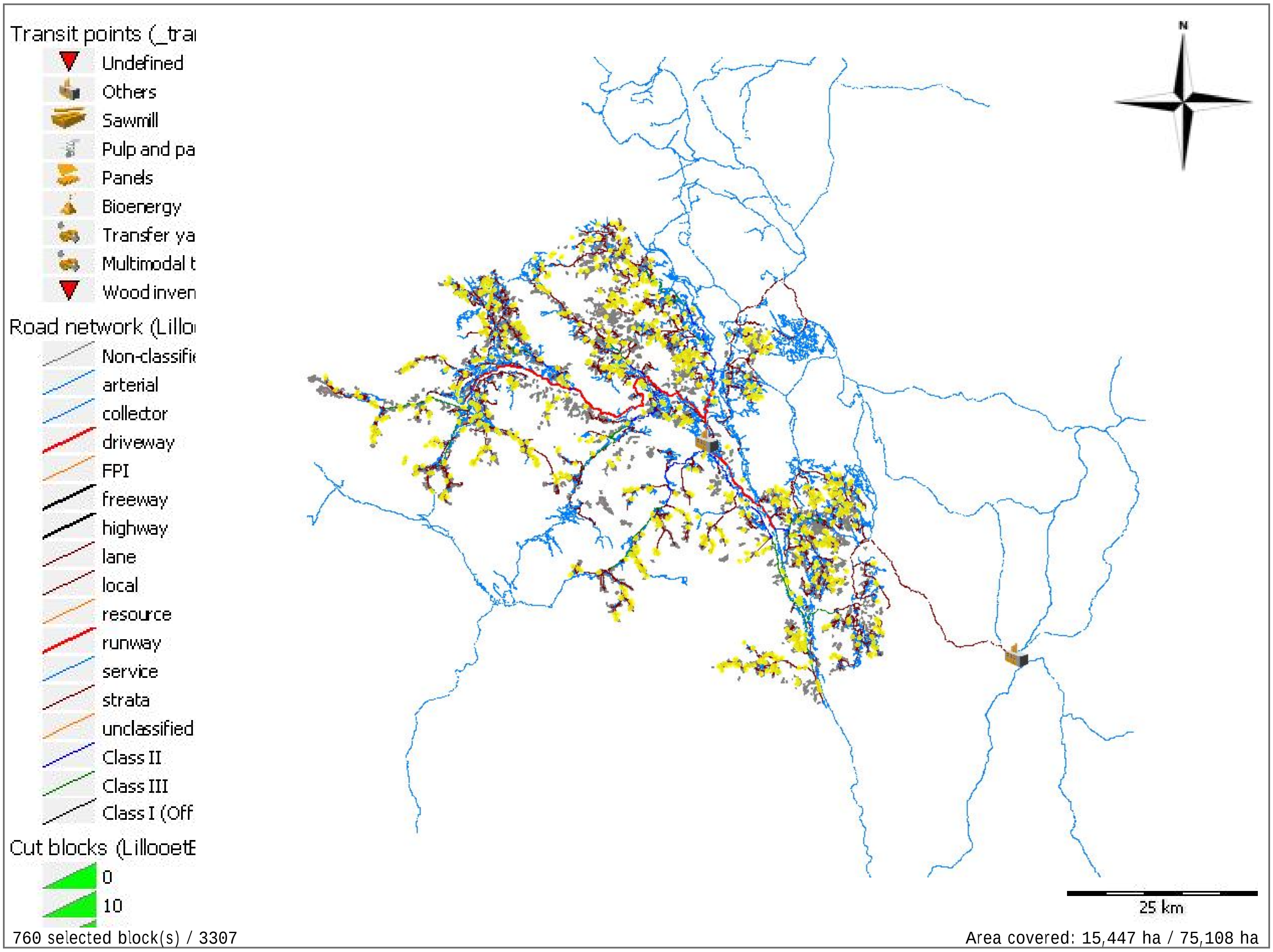
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	243,751.1	15,446.6	760
• Recovery season			
Summer	0.0	0.0	0
Winter	243,751.1	15,446.6	760
• Residue freshness			
Fresh	0.0	0.0	0
Brown	243,751.1	15,446.6	760
Brittle	0.0	0.0	0

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	1,634.4	1,634.4
70 $/odt	0.0	13,860.2	13,860.2
80 $/odt	0.0	46,322.9	46,322.9
90 $/odt	0.0	92,402.1	92,402.1
100 $/odt	0.0	125,212.0	125,212.0
110 $/odt	0.0	174,248.1	174,248.1
120 $/odt	0.0	205,563.6	205,563.6
130 $/odt	0.0	236,700.7	236,700.7
140 $/odt	0.0	243,215.9	243,215.9
150 $/odt	0.0	243,562.6	243,562.6
160 $/odt	0.0	243,653.0	243,653.0
170 $/odt	0.0	243,751.1	243,751.1
Maximum cost	0.00 $/odt	163.53 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Lillooet				
	Aspen (residues)	Chips	167	56
	Doug Fir (residues)	Chips	87,942	72
	Hybrid spruce (residues)	Chips	74,531	82
	LP Pine (residues)	Chips	50,669	82
	Ponderosa Pine (residues)	Chips	2,662	56
	Subalpine fir (residues)	Chips	23,874	103
	Western Hemlock (residues)	Chips	284	73
	Western white pine (residues)	Chips	119	91
	White Bark Pine (residues)	Chips	3,330	71
	White Birch (residues)	Chips	131	66
	WR Cedar (residues)	Chips	42	97
			243,751	80
			243,751	80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Class II
Class III
Class I (Off
Cut blocks (LillooetE
0
10
N
25 km
760 selected block(s) / 3307
Area covered: 15,447 ha / 75,108 ha

FPInnovations

info@fpinnovations.ca
web.fpinnovations.ca

Follow us

OUR OFFICES

Pointe-Claire
570 Saint-Jean Blvd.
Pointe-Claire, QC
Canada H9R 3J9
(514) 630-4100

Vancouver
2665 East Mall
Vancouver, BC
Canada V6T 1Z4
(604) 224-3221

Québec
1055 rue du P.E.P.S.
Québec, QC
Canada G1V 4C7
(418) 659-2647