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NORTH ISLAND TIMBER SUPPLY AREA BIOMASS AVAILABILITY ESTIMATION

CONTRACT NUMBER: 1070-20/OT23FHQ191

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The biomass yield per hectare predicted for the North Island Timber Supply Area (TSA) is 26.8 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 9.8%. Over the next 20 years a total of 5.69 million odt of available biomass are predicted to be generated by harvest in the North Island TSA, or approximately 284,987 odt/yr. Of this, approximately 20,896 odt in total, or 1,044 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 30% of the total predicted volume is expected to be available at $90/odt: a total of 726 thousand odt, or 36,341 odt/yr.

Project number: 301015539

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EXECUTIVE SUMMARY

Forest origin, harvest residue, and biomass estimates were made by FPInnovations for the North Island 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 North Island TSA is 26.8 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 9.8%. Over the next 20 years a total of 5,699,743 odt of available biomass are predicted to be generated by harvest in the North Island TSA, or approximately 284,987 odt/yr. Of this, approximately 20,896 odt in total, or 1,044 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 30% of the total predicted volume is expected to be available at $90/odt: a total of 726,822 odt, or 36,341 odt/yr. (Table 6 from the text, follows.)

Biomass Available (odt)			
at $60/odt	at $90/odt	At $120/odt	total ($180/odt)
20,896	726,822	2,202,429	2,393,892
per year	per year	per year	per year
1,044	36,341	110,121	119,694

Most of the available biomass is not considered economically available (<= $60/odt) (approximately 1%). This is most likely due to the fact that a large southeastern portion of the TSA has a high travel distance to the closest mill/transfer yard. The amount of economically available biomass decreases through time from approximately 16,325 odt in the first 10 years to 4,571 odt in the last 10 years. This decrease is likely due to a higher amount of available biomass in Period 1 (337,472 available odt/year) versus Period 2 (232,501 available odt/year).

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1 INTRODUCTION

Forest origin, harvest residue, biomass estimates were made by FPInnovations for the North Island Timber Supply Area, 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 North Island 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 North Island 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 North Island TSA.

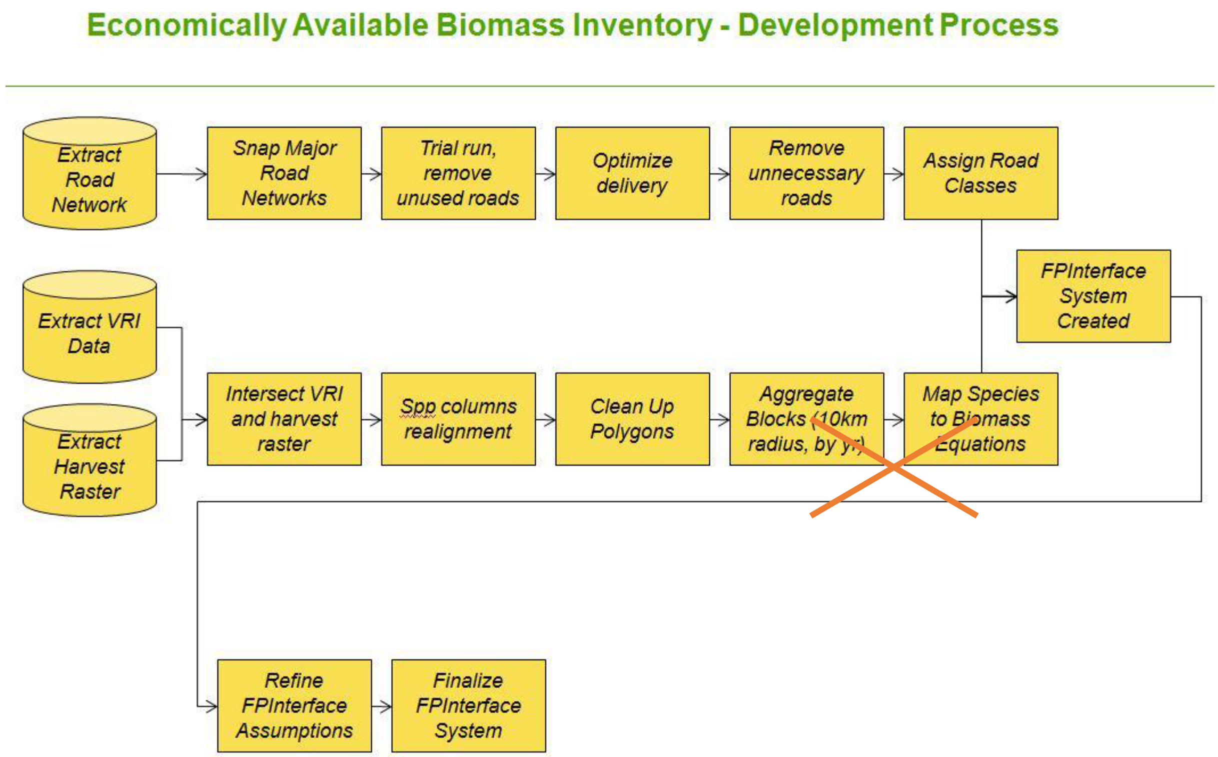


Figure 1. Inventory development process for economically available biomass.

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 $2.05.
- 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 federal data. Because of these very notable and impactful changes, the baseline for collecting and transiting biomass to transit points tended to be more expensive.

3.2 Data Acquisition

Data layers were acquired from the Ministry for the North Island TSA (excluding woodlots, CFA areas, and any First Nations tenure areas), including VRI (Vegetation Resource Inventory) 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 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.

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	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
Lodgepole pine	PL	LP Pine	PL, PLI
Western white pine	PW	Western White Pine	PW
Hybrid spruce	SX	Hybrid Spruce	S, SX, SB, SE, SW
Big leaf maple	MB	Bigleaf Maple	MB
Red alder	DR	Red Alder	DR

3.5.2 Road Classes

FPInterface assigns 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 $2.05/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 4 (poor), and ground roughness was rated CPPA Class 4 (rough). These assignments were based off interviews conducted with local foresters.

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 $36.94/odt.

3.5.5 Topping Diameter

Although BC regulations require a topping diameter of 10.0 cm for most merchantable species, this analysis used 12.5 cm to reflect more common industrial practise. Topping diameter can have a significant impact on the volume of a tree available for biomass use.

3.5.6 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 $36.94/odt (Table 3).

Table 3. FPInterface parameters

Run Descriptor	Base Case - Default Grinding Efficiency
run name	Main North Island
output name	Biomass report- Main North Island
block system	BlocksNorthIslandFinal.shp
road system	NorthIslandRoadsV6.shp

[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
transfer yard(s)	Holberg, Koprino, Mahatta River, Quatsino, Port McNeill, Lemare Group, Cleagh Creek, Shushartie, Beaver Cove
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	$1.25
ground strength	4 - poor
ground roughness	4 – rough
average slope %	20-32
slash used for biomass	Yes
full stem used for biomass	No
chip destination	Holberg, Koprino, Mahatta River, Quatsino, Port McNeill, Lemare Group, Cleagh Creek, Shushartie, Beaver Cove
topping diameter	12.5 cm
truck used for logs	Tridem Tractor B-train
truck used for chips	Semi Trailer with 3-axles
harvesting fuel price / litre (x3)	$2.05
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

Run Descriptor	Base Case - Default Grinding Efficiency
type of roadside processing	cut-to-length
on site biomass treatment (roadside)	comminution
recovery season	Winter
slash freshness	>3 months
slash pre-piled at roadside	Yes
grinder size type	horizontal 600 kW
biomass fuel price / litre (x2)	$2.05
biomass hours / shift (x2)	12
biomass shifts / day (x2)	1
Biomass days / year (x2)	200
grinder efficiency	60%
Grinder fuel use (L/PMH)	135
indirect costs - biomass ($ value)	$0.00
indirect costs - harvesting ($ value)	$0.00

3.6 Delivery Locations

All harvest residues from in-woods operations (not from mills) were directed to large industrial areas in or near the North Island TSA. In this model the following locations were used as biomass destinations: Holberg, Koprino, Mahatta River, Quatsino, Port McNeill, Lemare Group, Cleagh Creek, Shushartie, and Beaver Cove. 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.

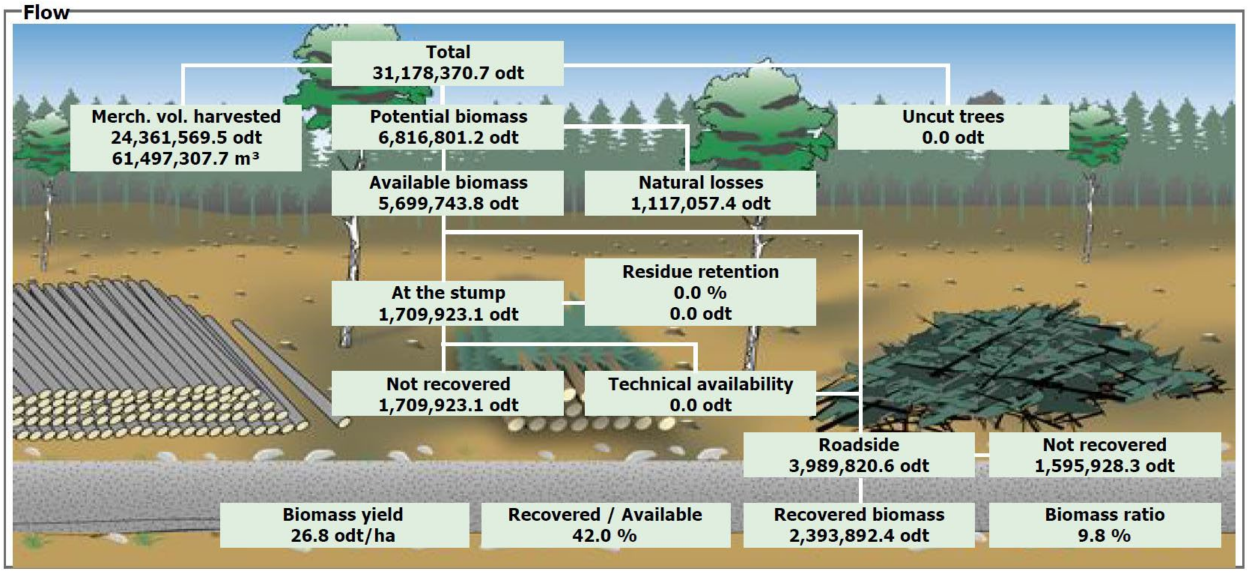


Figure 2. Recoverable biomass at delivery locations.

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 North Island TSA, based on inventory information and the road network supplied by the Ministry, indicates an average biomass yield of 26.8 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.

4.1.1 Biomass Amounts

In total, there are predicted to be 2,393,892 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, possibly due to a higher amount of available biomass being 337,472 odt/yr in Period 1 and 232,501 odt/yr in Period 2. The amount of biomass available each year works out to approximately 284,987 odt/yr, at any price point in the study area. (The economically available volume is estimated at 1,044 odt/year, as described below.) Key amounts of biomass availability are shown in Table 4.

Table 4. Key availability amounts

Biomass Available (odt)		
Total available biomass	Period 1 available biomass	Period 2 available biomass
5,699,743	3,374,729	2,325,014
% of total available biomass	% of total available biomass	% of total available biomass
100%	59%	41%
Total recovered biomass*	Period 1 recovered biomass	Period 2 recovered biomass
2,393,892	1,417,386	976,506

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

Additionally, the model indicates that there are about 1,709,923 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, 1,595,928 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 9.8% for the base case scenario. In this case 24,361,569 odt of roundwood are expected along with 2,393,892 odt of recovered biomass. The BR is shown in Table 5.

Table 5. Biomass ratio

Biomass Ratio	
2,393,892	odt of biomass
24,361,569	odt of roundwood
9.8%	

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 20,896 odt or about 1,044 odt per year. The complete results in $10 increments for the entire 20-year period can be seen below in the following tables and figures.

Table 6. North Island TSA biomass 'cost-availability' at different prices for base case

Biomass Available (odt)			
at $60/odt	at $90/odt	At $120/odt	total ($180/odt)
20,896	726,822	2,202,429	2,393,892
per year	per year	per year	per year
1,044	36,341	110,121	119,694

Table 7. North Island TSA biomass 'cost-availability' at different prices for base case

Base Case		
Cost $/odt	Odt Available	Odt/yr
10	0	0
20	0	0
30	0	0
40	2,459.50	122.97
50	2,459.50	122.97
60	20,896.90	1,044.84
70	206,378.60	10,318.93
80	472,153.70	23,607.68
90	726,822.80	36,341.14
100	986,686.90	49,334.34
110	1,819,386.80	90,969.34
120	2,202,429.00	110,121.45
130	2,304,488.10	115,224.40
140	2,338,102.90	116,905.14
150	2,369,554.60	118,477.73
160	2,388,147.50	119,407.37
170	2,393,892.40	119,694.62
180	2,393,892	119,694.60

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.

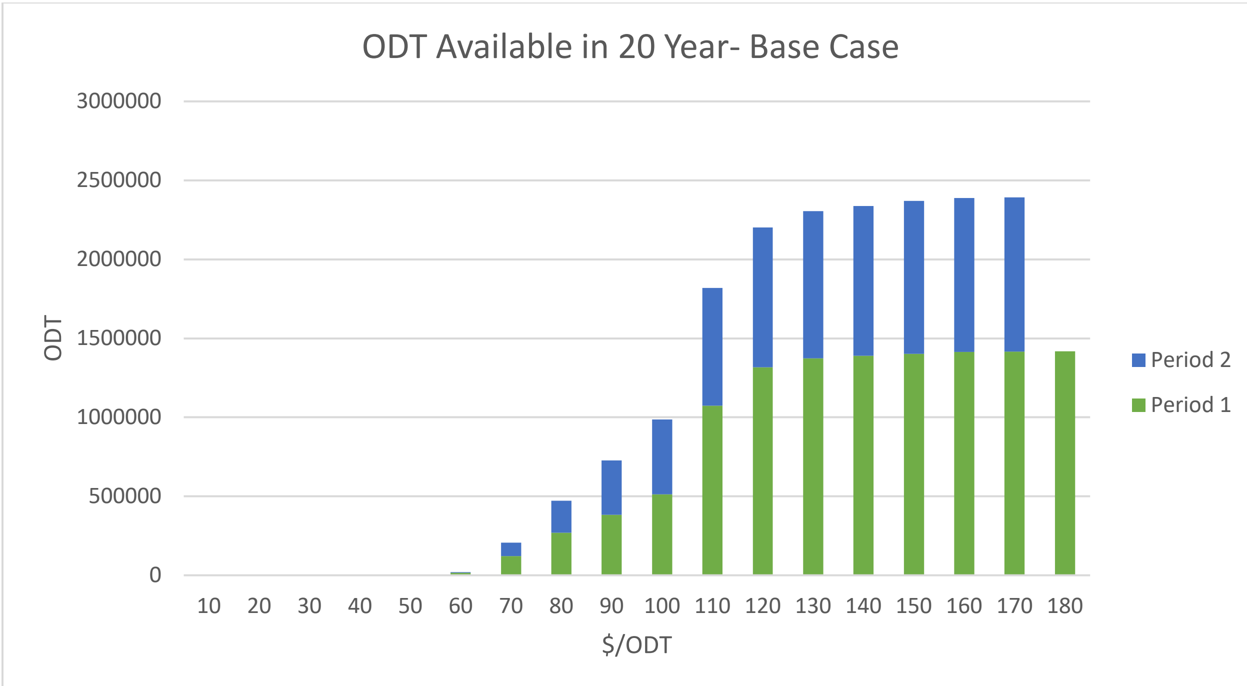


Figure 3. North Island biomass ‘cost-availability’ in base case.

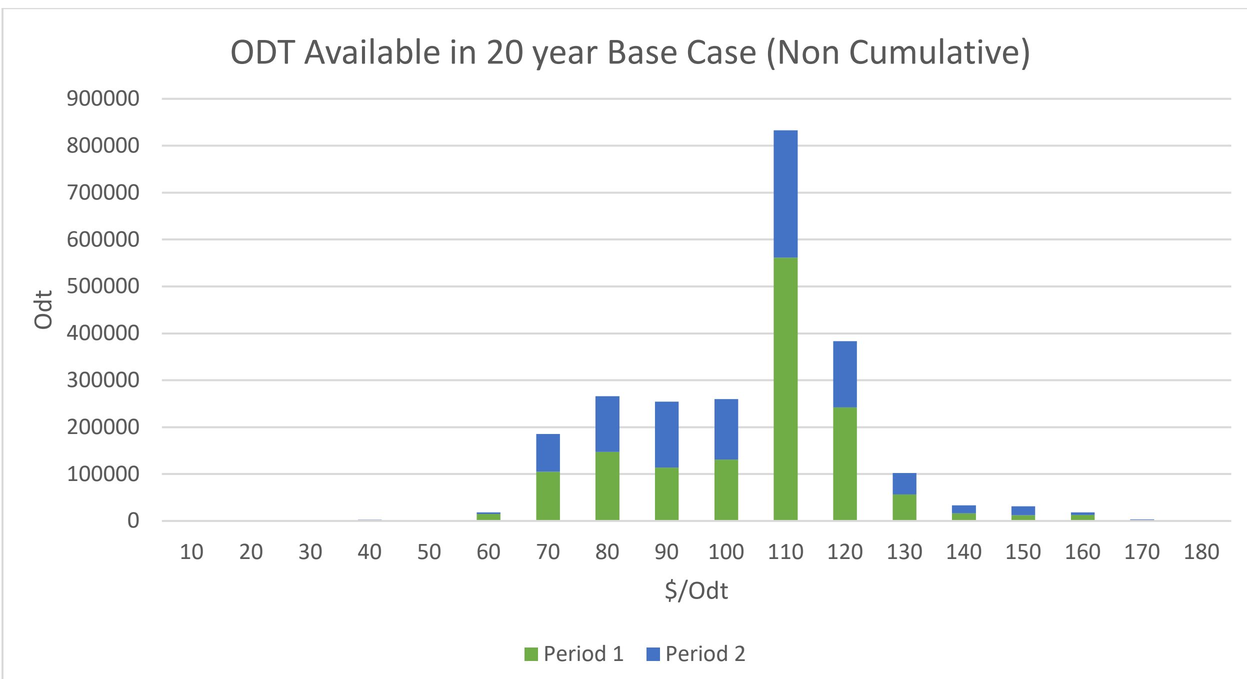


Figure 4. North Island biomass ‘cost-availability’ in base case, displayed not cumulatively.

The average price for delivered biomass across the study area is shown in Table 8.

Table 8. Average cost of delivered biomass across entire study area

Average cost of delivered biomass ($/odt)
103.83

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 low at $103.83/odt due to a high volume of blocks being located far from delivery points, particularly in the south eastern region 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 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.

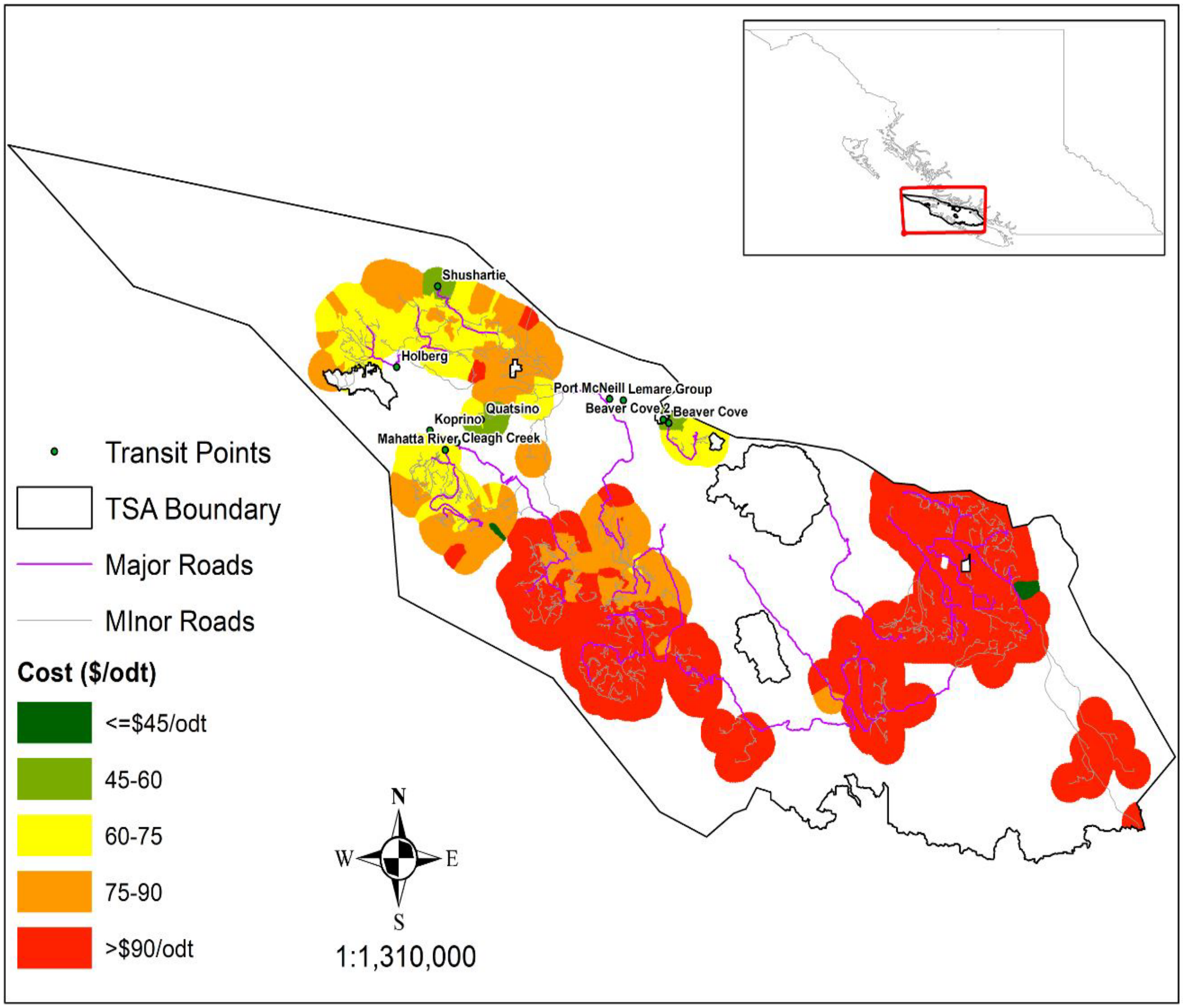


Figure 5. Spatial distribution of cutblocks by delivered biomass cost per odt.

Most of the low delivered-cost biomass (green) is located around the northwestern portion of the TSA, while the high delivered-cost biomass (red) is limited to the southeastern reaches of the TSA, far from any delivery points.

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 6. The amount of economically available also biomass decreases through time from approximately 16,325 odt in the first 10 years to 4,571 odt in the last 10 years. This decrease is likely due to a higher amount of available biomass in Period 1 (3,374,729 available odt/year) versus Period 2 (2,325,014 available odt/year).

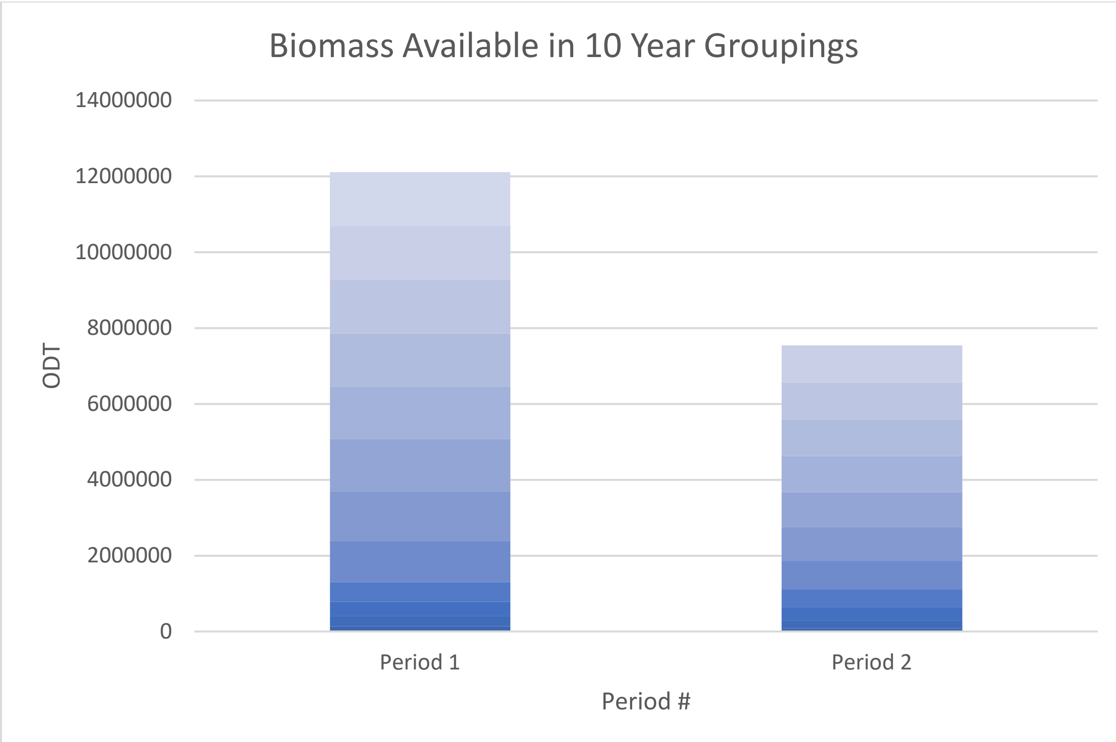


Figure 6. Biomass recoverable by period.

Looking at the economic harvest available (the amount of biomass priced at or below $60/odt) in Figure 7, there is a similar discrepancy between overall available biomass and available economic biomass.

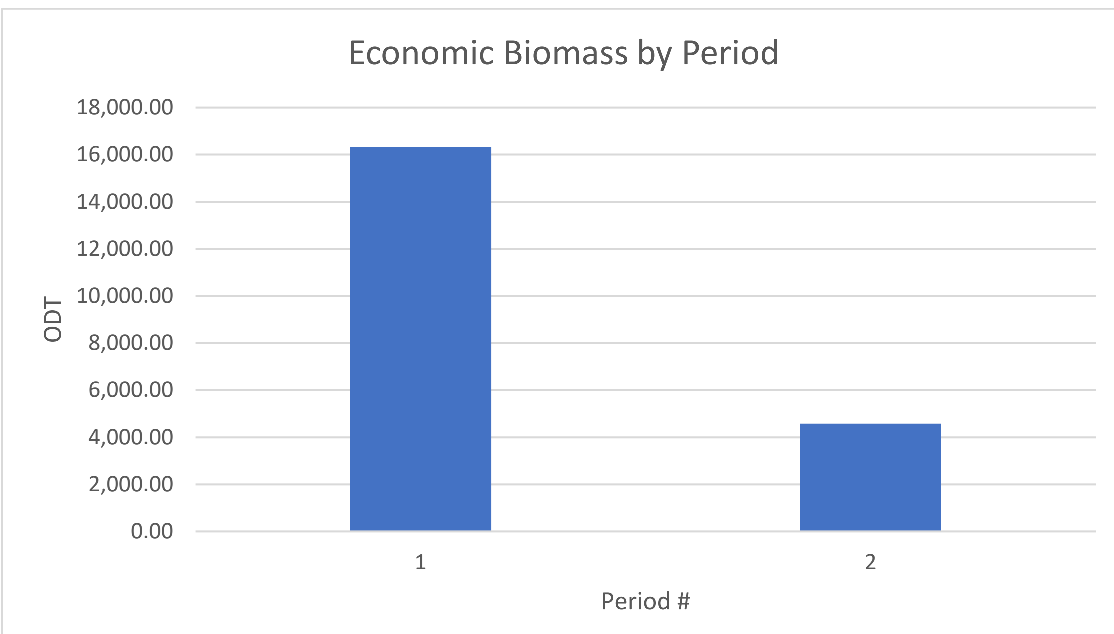


Figure 7. Economic biomass recoverable by 10-year grouping.

The data for cost availability by period at all price points in $10 increments is shown in Table 9. You can see the differences in economically available biomass between periods is comparable with the total biomass available at any price point.

Table 9. Cost availability by period

	Period 1		Period 2	
cost $/odt	Odt available	odt/yr	Odt available	odt/yr
10	0	0	0	0
20	0	0	0	0
30	0	0	0	0
40	1,710.00	171	749.5	74.95
50	1,710.00	171	749.5	74.95
60	16,325.00	1,632.5	4,571.90	457.19
70	121,307.70	12,130.77	85,070.80	8,507.08
80	268,606.40	26,860.64	203,547.30	20,354.73
90	382,319.30	38,231.93	344,503.50	34,450.35
100	513,109.00	51,310.9	473,577.90	47,357.79
110	1,074,176.00	107,417.6	745,210.80	74,521.08
120	1,316,343.30	131,634.33	886,085.70	88,608.57
130	1,372,724.80	137,272.48	931,763.20	93,176.32
140	1,389,177.10	138,917.71	948,925.80	94,892.58
150	1,401,451.40	140,145.14	968,103.20	96,810.32
160	1,414,386.40	141,438.64	973,761.10	97,376.11
170	1,415,141.10	141,514.11	976,506.20	97,650.62
180	1,417,386.20	141,738.62		

5 CONCLUSION

The biomass yield per hectare predicted for the North Island TSA is 26.8 oven-dried tonnes per hectare (odt/ha) from harvest residues. Over the next 10 years a total of 5,699,743 odt of available biomass are predicted to be generated by harvest in the North Island TSA, or approximately, 284,987 odt/yr. Of this, approximately 20,896 odt in total, or 1,044 odt/yr, is expected to be available at the economic price of $60 per oven-dried tonne. Approximately 76% of the available amount is expected to be available at $100/odt: a total of 986,686 odt, or 49,334 odt/yr. The biomass ratio, which is the ratio of recovered biomass to recovered merchantable roundwood, is estimated at 9.8%.

Most biomass not considered economically available (<= $60/odt), but rather has an average cost of $103.83/odt. This is largely due to a substantial amount of the TSA having operations far from delivery points, however there is more opportunity for biomass utilizations in the northwestern portion of the TSA where biomass collection is cheaper.

A note on the following Appendix: Because FPInterface does not easily integrate the cost of barging, the smaller islands surrounding this TSA were not included in the overall findings. However smaller TSA analyses were preformed for each Island. These additional analyses are attached in this report.

APPENDIX: FPINTERFACE SUMMARY REPORTS

FPInterface™

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

Statistics - Selected Items

Area	52,697.5 ha
Number of cut blocks	579
Recovered biomass	1,417,386.2 odt
Biomass yield	26.9 odt/ha
Biomass odt / Merchantable m^3	0.0439 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	29 : 1
Available energy	5,608,445 MWh
Fuel consumption	15.7 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.94 $/odt
Transfer yard	0.00 $/odt
Transportation	51.17 $/odt
Loading/unloading	10.56 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	0.90 $/odt
Indirect costs	0.00 $/odt
Total	99.57 $/odt

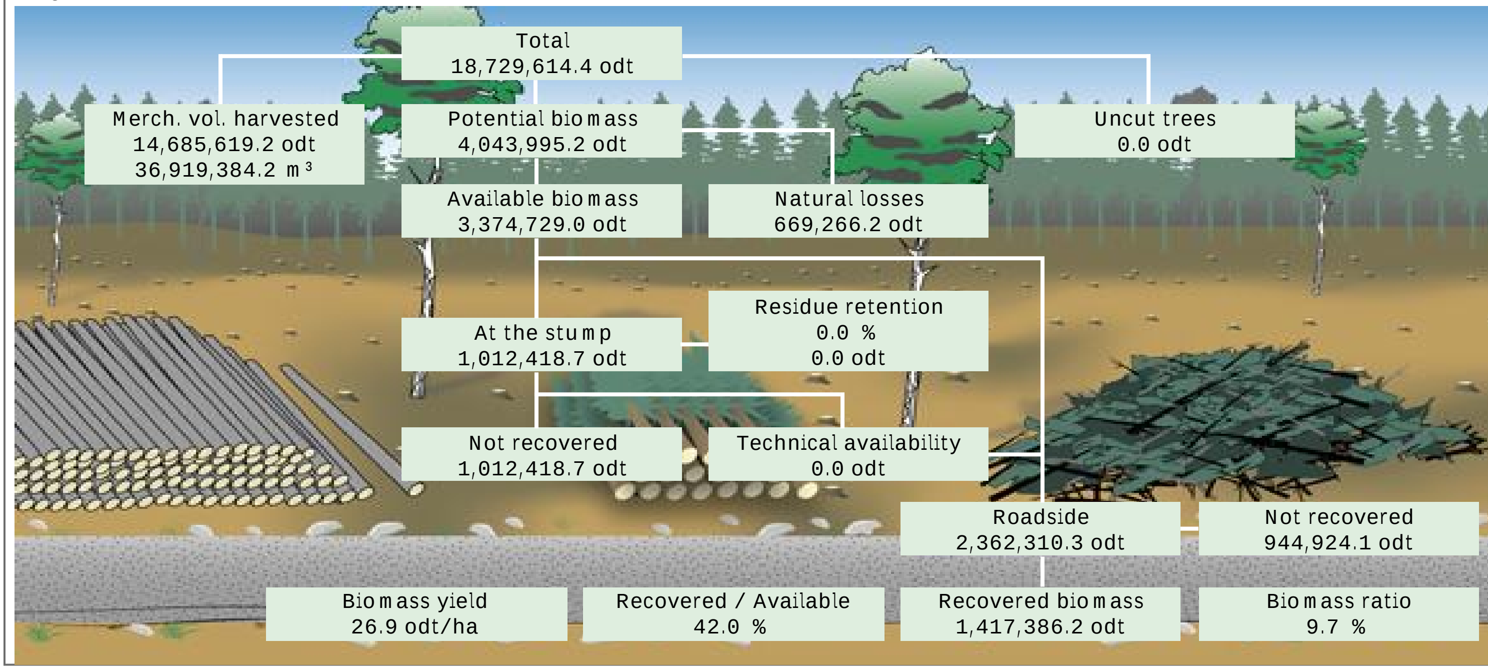
Revenue

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

Net

Profit	-99.57 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Subalpine fir (residues)	129,383.6	0.0366	2.46
Western Hemlock (residues)	455,947.9	0.0345	8.65
WR Cedar (residues)	237,018.4	0.0375	4.50
Hybrid spruce (residues)	50,310.9	0.1363	0.95
Doug Fir (residues)	496,273.6	0.0617	9.42
Red Alder (residues)	40,784.6	0.0667	0.77
Bigleaf Maple (residues)	3,050.0	0.0875	0.06
LP Pine (residues)	3,712.2	0.0279	0.07
Western white pine (residues)	618.8	0.0377	0.01
Aspen (residues)	286.2	0.0502	0.01
	1,417,386.2	0.0439	26.90

Recovery summary

	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	1,417,386.2	52,697.5	579
• Recovery season			
Summer	0.0	0.0	0
Winter	1,417,386.2	52,697.5	579
• Residue freshness			
Fresh	0.0	0.0	0
Brown	1,417,386.2	52,697.5	579
Brittle	0.0	0.0	0

Supply summary

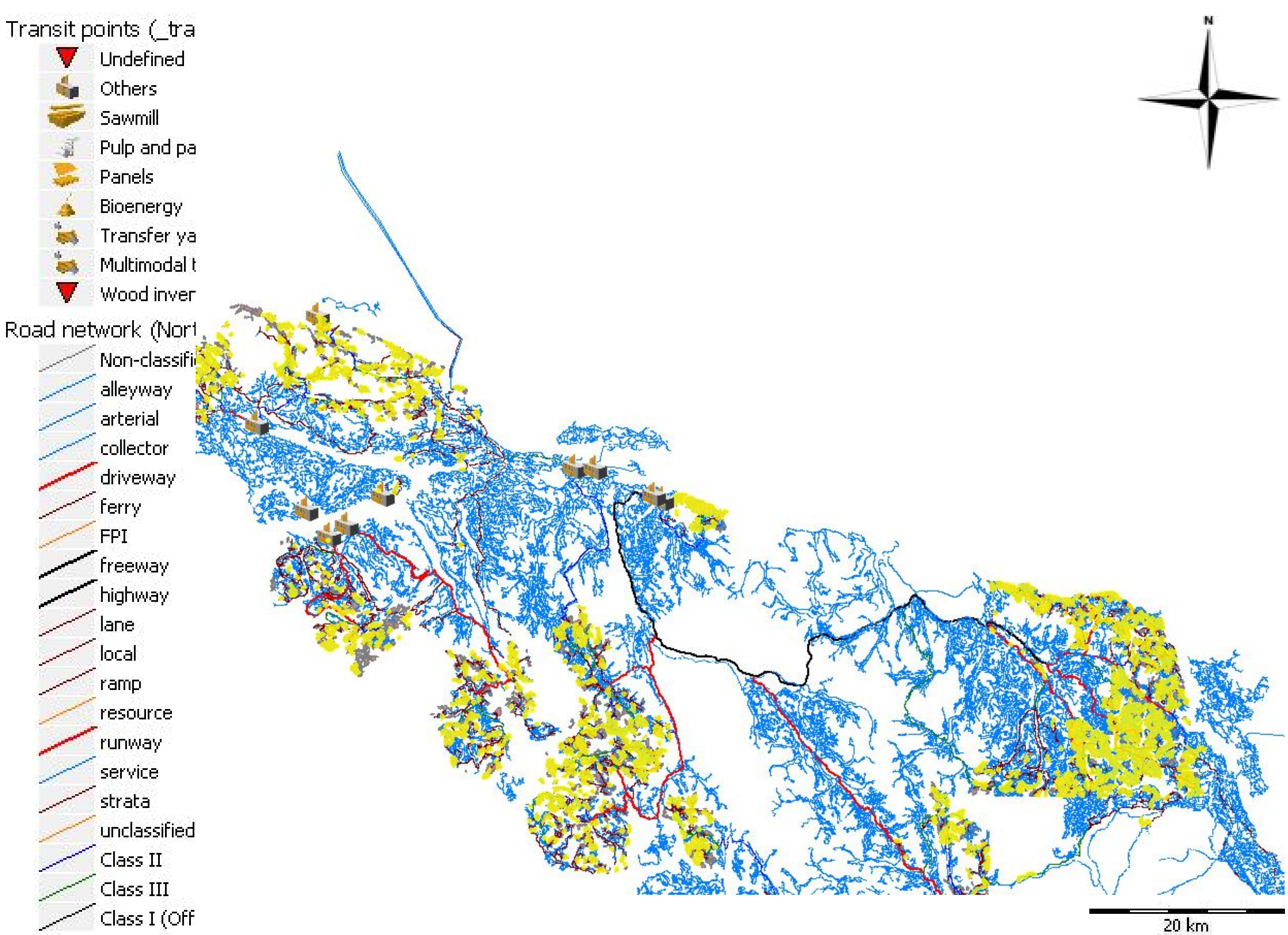
Recovered biomass to	Merchantable volume (odt)	Residues (odt)	Total biomass (odt)
10 $/odt	0.0	0.0	0.0
20 $/odt	0.0	0.0	0.0
30 $/odt	0.0	0.0	0.0
40 $/odt	0.0	1,710.0	1,710.0
50 $/odt	0.0	1,710.0	1,710.0
60 $/odt	0.0	16,325.0	16,325.0
70 $/odt	0.0	121,307.7	121,307.7
80 $/odt	0.0	268,606.4	268,606.4
90 $/odt	0.0	382,319.3	382,319.3
100 $/odt	0.0	513,109.0	513,109.0
110 $/odt	0.0	1,074,176.0	1,074,176.0
120 $/odt	0.0	1,316,343.3	1,316,343.3
130 $/odt	0.0	1,372,724.8	1,372,724.8
140 $/odt	0.0	1,389,177.1	1,389,177.1
150 $/odt	0.0	1,401,451.4	1,401,451.4
160 $/odt	0.0	1,414,386.4	1,414,386.4
170 $/odt	0.0	1,415,141.1	1,415,141.1
180 $/odt	0.0	1,417,386.2	1,417,386.2
Maximum cost	0.00 $/odt	174.93 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
<Closest destination>				
	Bigleaf Maple (residues)	Chips	345	0
	Doug Fir (residues)	Chips	981	0
	Red Alder (residues)	Chips	159	0
	Subalpine fir (residues)	Chips	61	0
	Western Hemlock (residues)	Chips	127	0
	WR Cedar (residues)	Chips	36	0
			1,710	0
Holberg				
	Doug Fir (residues)	Chips	494	25
	Hybrid spruce (residues)	Chips	15,603	24
	LP Pine (residues)	Chips	841	30
	Red Alder (residues)	Chips	1,247	17
	Subalpine fir (residues)	Chips	1,673	22
	Western Hemlock (residues)	Chips	30,964	26
	WR Cedar (residues)	Chips	50,607	27
			101,429	26
Mahatta River				
	Doug Fir (residues)	Chips	3	36
	Hybrid spruce (residues)	Chips	5,428	45
	Red Alder (residues)	Chips	158	41
	Subalpine fir (residues)	Chips	10,465	43
	Western Hemlock (residues)	Chips	35,627	43
	WR Cedar (residues)	Chips	15,594	48
			67,275	44
Quatsino				
	Hybrid spruce (residues)	Chips	261	4
	Red Alder (residues)	Chips	446	4
	Subalpine fir (residues)	Chips	159	4
	Western Hemlock (residues)	Chips	1,208	4

Destination	Product	Format	odt	Transport average distance (Km)
Quatsino				
	WR Cedar (residues)	Chips	201	3
			2,275	4
Port McNeill				
	Doug Fir (residues)	Chips	42	48
	Hybrid spruce (residues)	Chips	228	26
	LP Pine (residues)	Chips	108	35
	Red Alder (residues)	Chips	28	27
	Subalpine fir (residues)	Chips	4,709	47
	Western Hemlock (residues)	Chips	12,558	41
	WR Cedar (residues)	Chips	3,401	41
			21,075	42
Cleagh Creek				
	Doug Fir (residues)	Chips	5,845	91
	Hybrid spruce (residues)	Chips	11,886	90
	Red Alder (residues)	Chips	1,691	84
	Subalpine fir (residues)	Chips	11,648	84
	Western Hemlock (residues)	Chips	31,096	87
	WR Cedar (residues)	Chips	17,715	84
			79,880	87
Shushartie				
	Doug Fir (residues)	Chips	169	41
	Hybrid spruce (residues)	Chips	806	35
	LP Pine (residues)	Chips	1,500	34
	Red Alder (residues)	Chips	795	45
	Subalpine fir (residues)	Chips	1,342	27
	Western Hemlock (residues)	Chips	20,766	29
	WR Cedar (residues)	Chips	34,030	29
			59,407	29
Beaver Cove				
	Hybrid spruce (residues)	Chips	1,163	20

Destination	Product	Format	odt	Transport average distance (Km)
Beaver Cove				
	Subalpine fir (residues)	Chips	4,170	24
	Western Hemlock (residues)	Chips	21,943	23
	Western white pine (residues)	Chips	1	23
	WR Cedar (residues)	Chips	12,816	23
			40,093	23
Beaver Cove 2				
	Aspen (residues)	Chips	286	161
	Bigleaf Maple (residues)	Chips	2,705	198
	Doug Fir (residues)	Chips	488,739	173
	Hybrid spruce (residues)	Chips	14,937	124
	LP Pine (residues)	Chips	1,263	182
	Red Alder (residues)	Chips	36,261	167
	Subalpine fir (residues)	Chips	95,157	140
	Western Hemlock (residues)	Chips	301,658	154
	Western white pine (residues)	Chips	618	171
	WR Cedar (residues)	Chips	102,618	145
			1,044,243	161
			1,417,386	130



579 selected block(s) / 1277

Area covered: 52,698 ha / 89,279 ha

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

Statistics - Selected Items

Area	36,581.8 ha
Number of cut blocks	698
Recovered biomass	976,506.2 odt
Biomass yield	26.7 odt/ha
Biomass odt / Merchantable m^3	0.0456 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	30 : 1
Available energy	3,853,561 MWh
Fuel consumption	15.2 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	36.94 $/odt
Transfer yard	0.00 $/odt
Transportation	49.45 $/odt
Loading/unloading	10.71 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	0.97 $/odt
Indirect costs	0.00 $/odt
Total	98.07 $/odt

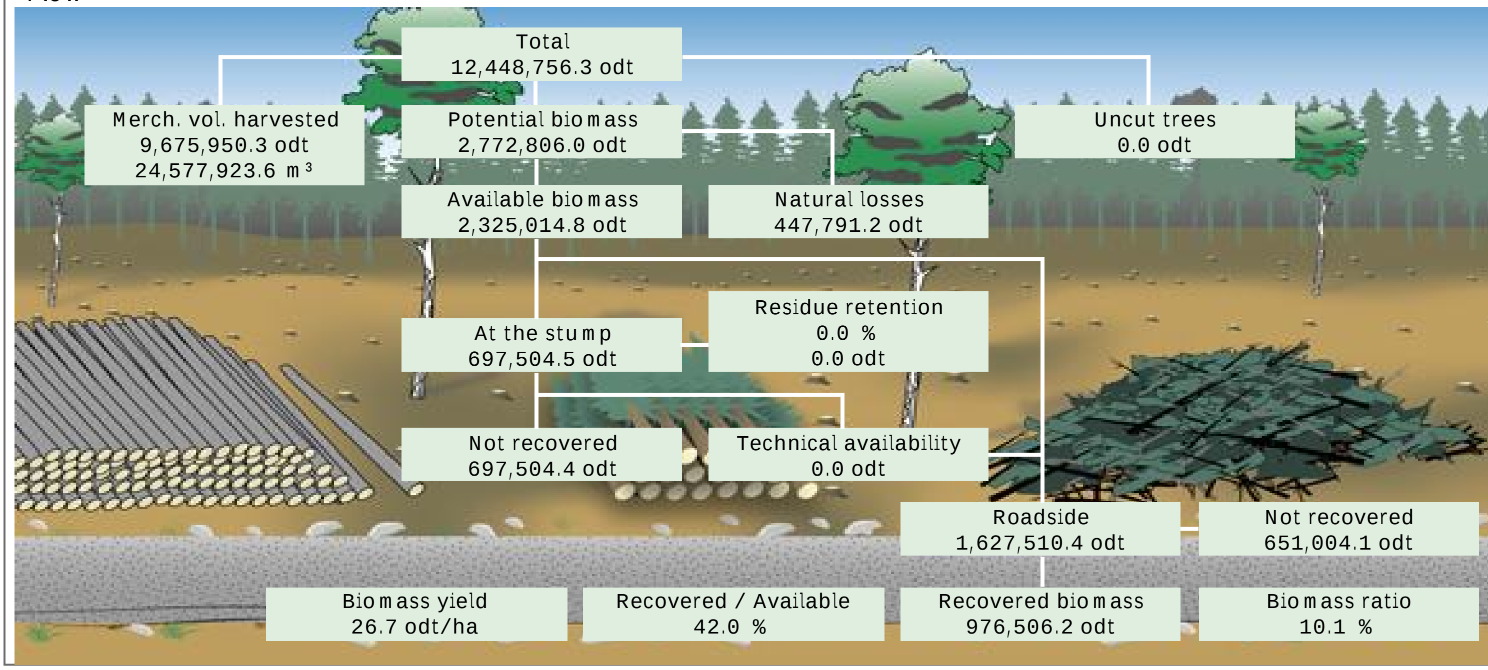
Revenue

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

Net

Profit	-98.07 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Western Hemlock (residues)	342,085.5	0.0373	9.35
WR Cedar (residues)	175,376.7	0.0393	4.79
Subalpine fir (residues)	99,996.6	0.0384	2.73
Doug Fir (residues)	276,016.9	0.0648	7.55
Red Alder (residues)	31,042.5	0.0698	0.85
Hybrid spruce (residues)	47,291.9	0.1363	1.29
LP Pine (residues)	1,709.9	0.0275	0.05
Western white pine (residues)	284.3	0.0370	0.01
Bigleaf Maple (residues)	2,231.9	0.0943	0.06
Aspen (residues)	470.0	0.0399	0.01
	976,506.2	0.0456	26.69

Recovery summary

	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	976,506.2	36,581.8	698
• Recovery season			
Summer	0.0	0.0	0
Winter	976,506.2	36,581.8	698
• Residue freshness			
Fresh	0.0	0.0	0
Brown	976,506.2	36,581.8	698
Brittle	0.0	0.0	0

Supply summary

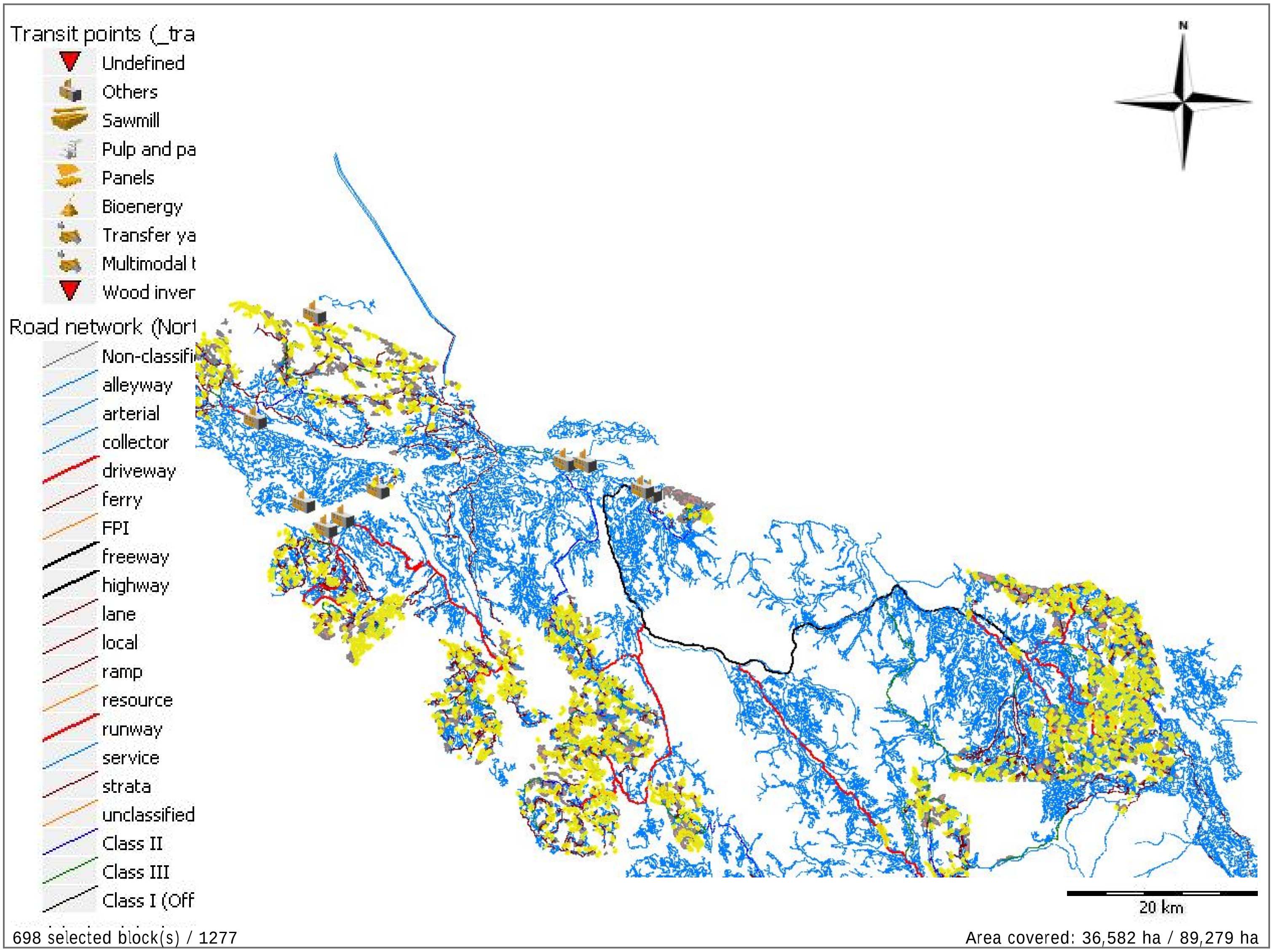
Recovered biomass to	Merchantable volume (odt)	Residues (odt)	Total biomass (odt)
10 $/odt	0.0	0.0	0.0
20 $/odt	0.0	0.0	0.0
30 $/odt	0.0	0.0	0.0
40 $/odt	0.0	749.5	749.5
50 $/odt	0.0	749.5	749.5
60 $/odt	0.0	4,571.9	4,571.9
70 $/odt	0.0	85,070.8	85,070.8
80 $/odt	0.0	203,547.3	203,547.3
90 $/odt	0.0	344,503.5	344,503.5
100 $/odt	0.0	473,577.9	473,577.9
110 $/odt	0.0	745,210.8	745,210.8
120 $/odt	0.0	886,085.7	886,085.7
130 $/odt	0.0	931,763.2	931,763.2
140 $/odt	0.0	948,925.8	948,925.8
150 $/odt	0.0	968,103.2	968,103.2
160 $/odt	0.0	973,761.1	973,761.1
170 $/odt	0.0	976,506.2	976,506.2
Maximum cost	0.00 $/odt	160.25 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
<Closest destination>				
	Bigleaf Maple (residues)	Chips	36	0
	Doug Fir (residues)	Chips	608	0
	Red Alder (residues)	Chips	106	0
			750	0
Holberg				
	Doug Fir (residues)	Chips	1,807	24
	Hybrid spruce (residues)	Chips	10,109	20
	LP Pine (residues)	Chips	239	30
	Red Alder (residues)	Chips	525	17
	Subalpine fir (residues)	Chips	1,745	20
	Western Hemlock (residues)	Chips	22,861	26
	WR Cedar (residues)	Chips	30,318	31
			67,603	27
Mahatta River				
	Doug Fir (residues)	Chips	66	11
	Hybrid spruce (residues)	Chips	8,551	41
	LP Pine (residues)	Chips	2	10
	Red Alder (residues)	Chips	506	28
	Subalpine fir (residues)	Chips	14,512	38
	Western Hemlock (residues)	Chips	47,769	40
	WR Cedar (residues)	Chips	21,316	46
			92,721	41
Quatsino				
	Hybrid spruce (residues)	Chips	173	6
	Red Alder (residues)	Chips	130	3
	Subalpine fir (residues)	Chips	130	6
	Western Hemlock (residues)	Chips	841	6
	WR Cedar (residues)	Chips	317	6
			1,591	6

Destination	Product	Format	odt	Transport average distance (Km)
Port McNeill				
	Doug Fir (residues)	Chips	274	54
	Hybrid spruce (residues)	Chips	25	53
	LP Pine (residues)	Chips	51	33
	Red Alder (residues)	Chips	208	36
	Subalpine fir (residues)	Chips	4,970	55
	Western Hemlock (residues)	Chips	9,807	49
	WR Cedar (residues)	Chips	3,885	49
			19,220	50
Cleagh Creek				
	Doug Fir (residues)	Chips	5,264	90
	Hybrid spruce (residues)	Chips	14,238	80
	LP Pine (residues)	Chips	12	113
	Red Alder (residues)	Chips	3,641	80
	Subalpine fir (residues)	Chips	9,456	83
	Western Hemlock (residues)	Chips	32,453	85
	WR Cedar (residues)	Chips	18,779	82
			83,843	83
Shushartie				
	Doug Fir (residues)	Chips	512	41
	Hybrid spruce (residues)	Chips	131	24
	LP Pine (residues)	Chips	808	33
	Red Alder (residues)	Chips	101	41
	Subalpine fir (residues)	Chips	1,003	16
	Western Hemlock (residues)	Chips	13,337	24
	WR Cedar (residues)	Chips	20,776	29
			36,667	27
Beaver Cove				
	Hybrid spruce (residues)	Chips	12	27
	Subalpine fir (residues)	Chips	1,025	24
	Western Hemlock (residues)	Chips	3,808	24

Destination	Product	Format	odt	Transport average distance (Km)
Beaver Cove				
	WR Cedar (residues)	Chips	1,739	24
			6,585	24
Beaver Cove 2				
	Aspen (residues)	Chips	470	200
	Bigleaf Maple (residues)	Chips	2,196	180
	Doug Fir (residues)	Chips	267,487	170
	Hybrid spruce (residues)	Chips	14,053	115
	LP Pine (residues)	Chips	598	182
	Red Alder (residues)	Chips	25,825	159
	Subalpine fir (residues)	Chips	67,157	134
	Western Hemlock (residues)	Chips	211,209	146
	Western white pine (residues)	Chips	284	172
	WR Cedar (residues)	Chips	78,247	135
			667,527	153
			976,506	120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N
20 km
698 selected block(s) / 1277
Area covered: 36,582 ha / 89,279 ha

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

Statistics - Selected Items

Area	2,369.6 ha
Number of cut blocks	15
Recovered biomass	59,985.4 odt
Biomass yield	25.3 odt/ha
Biomass odt / Merchantable m^3	0.0519 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	59 : 1
Available energy	230,365 MWh
Fuel consumption	7.4 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	34.27 $/odt
Transfer yard	0.00 $/odt
Transportation	13.52 $/odt
Loading/unloading	11.38 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	0.01 $/odt
Indirect costs	0.00 $/odt
Total	59.19 $/odt

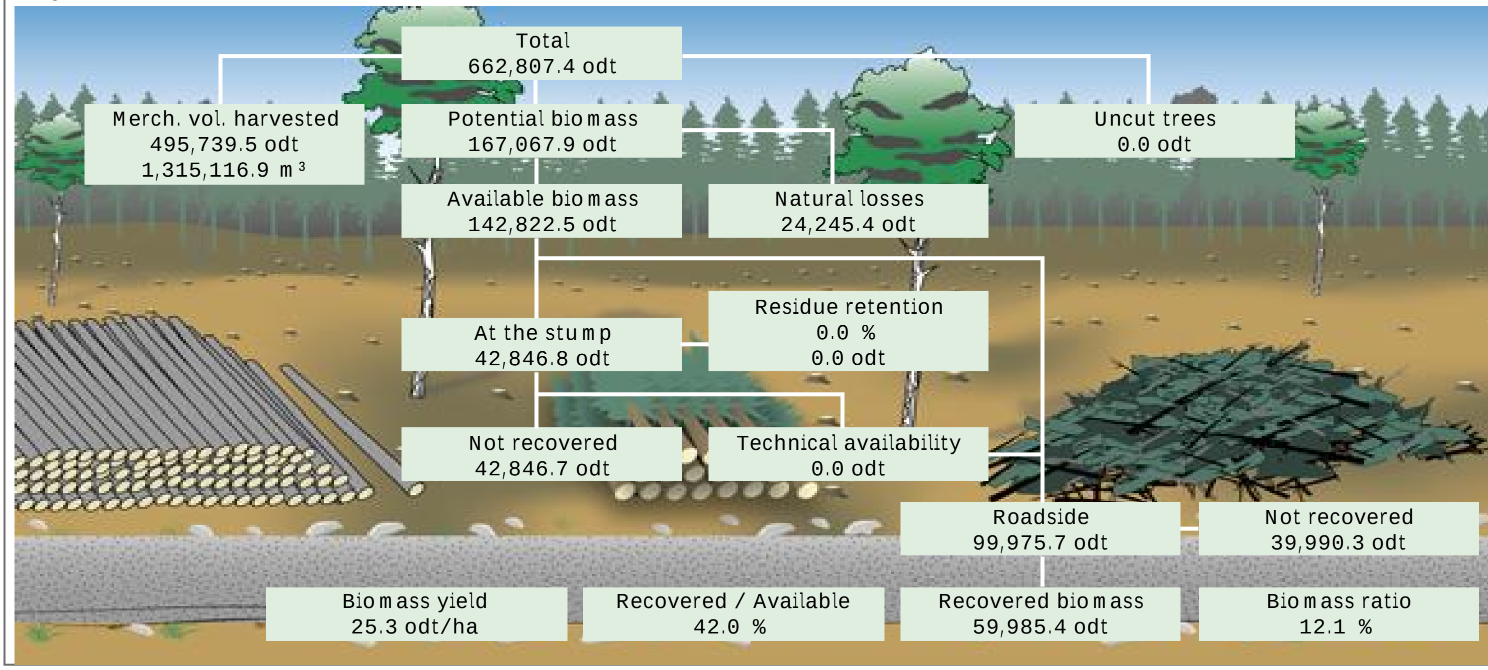
Revenue

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

Net

Profit	-59.19 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
WR Cedar (residues)	23,152.1	0.0459	9.77
Western Hemlock (residues)	23,740.8	0.0438	10.02
Hybrid spruce (residues)	12,367.2	0.1363	5.22
LP Pine (residues)	427.0	0.0328	0.18
Doug Fir (residues)	162.9	0.0674	0.07
Red Alder (residues)	60.4	0.0734	0.03
Subalpine fir (residues)	75.0	0.0463	0.03
	59,985.4	0.0519	25.31

Recovery summary

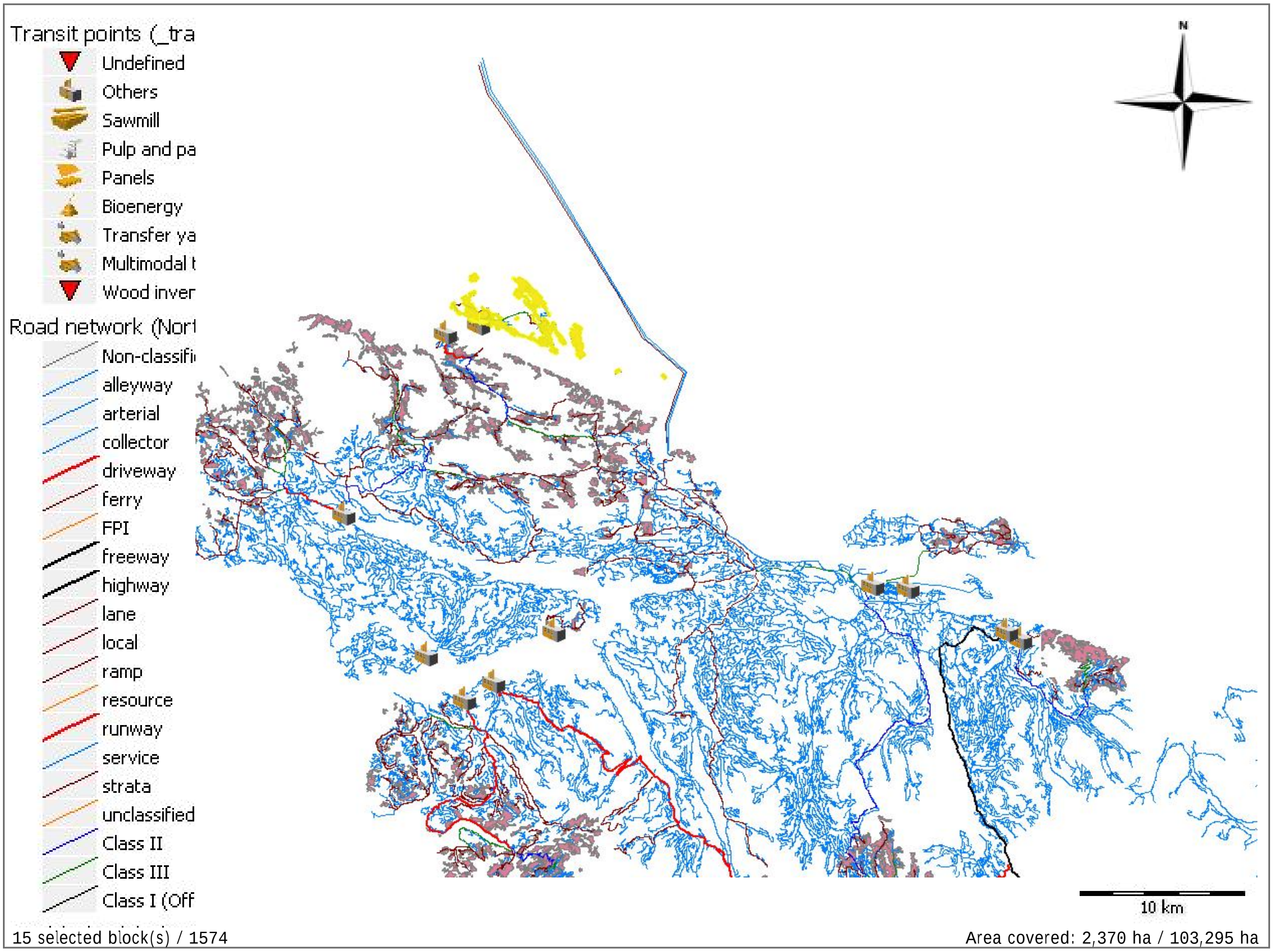
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	59,985.4	2,369.6	15
• Recovery season			
Summer	0.0	0.0	0
Winter	59,985.4	2,369.6	15
• Residue freshness			
Fresh	0.0	0.0	0
Brown	59,985.4	2,369.6	15
Brittle	0.0	0.0	0

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	33,025.1	33,025.1
70 $/odt	0.0	58,356.1	58,356.1
80 $/odt	0.0	58,356.1	58,356.1
90 $/odt	0.0	58,356.1	58,356.1
100 $/odt	0.0	59,387.8	59,387.8
110 $/odt	0.0	59,985.4	59,985.4
Maximum cost	0.00 $/odt	104.11 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Port McNeill				
	Hybrid spruce (residues)	Chips	1,102	53
	LP Pine (residues)	Chips	4	52
	Western Hemlock (residues)	Chips	288	58
	WR Cedar (residues)	Chips	236	57
			1,629	55
FPI_2				
	Doug Fir (residues)	Chips	163	4
	Hybrid spruce (residues)	Chips	11,265	9
	LP Pine (residues)	Chips	423	14
	Red Alder (residues)	Chips	60	3
	Subalpine fir (residues)	Chips	75	9
	Western Hemlock (residues)	Chips	23,453	8
	WR Cedar (residues)	Chips	22,917	9
			58,356	9
			59,985	10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N
10 km
15 selected block(s) / 1574
Area covered: 2,370 ha / 103,295 ha

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

Statistics - Selected Items

Area	7,995.4 ha
Number of cut blocks	198
Recovered biomass	197,211.6 odt
Biomass yield	24.7 odt/ha
Biomass odt / Merchantable m^3	0.0428 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	47 : 1
Available energy	749,295 MWh
Fuel consumption	9.3 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	34.27 $/odt
Transfer yard	0.00 $/odt
Transportation	23.27 $/odt
Loading/unloading	11.31 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	0.30 $/odt
Indirect costs	0.00 $/odt
Total	69.15 $/odt

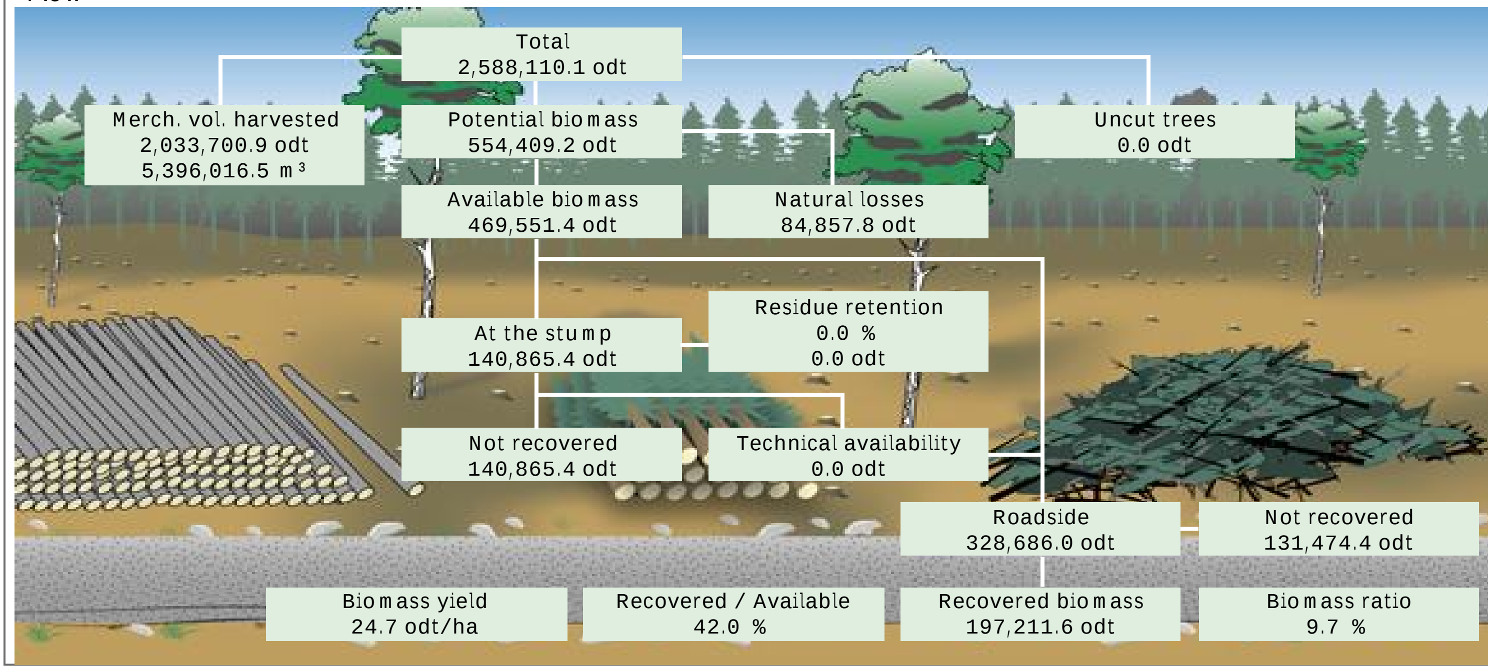
Revenue

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

Net

Profit	-69.15 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Subalpine fir (residues)	26,173.3	0.0377	3.27
WR Cedar (residues)	58,196.0	0.0411	7.28
Red Alder (residues)	10,450.3	0.0823	1.31
Western Hemlock (residues)	80,082.7	0.0375	10.02
Hybrid spruce (residues)	10,471.0	0.1363	1.31
LP Pine (residues)	310.2	0.0387	0.04
Doug Fir (residues)	11,405.5	0.0754	1.43
Bigleaf Maple (residues)	122.6	0.1297	0.02
	197,211.6	0.0428	24.67

Recovery summary

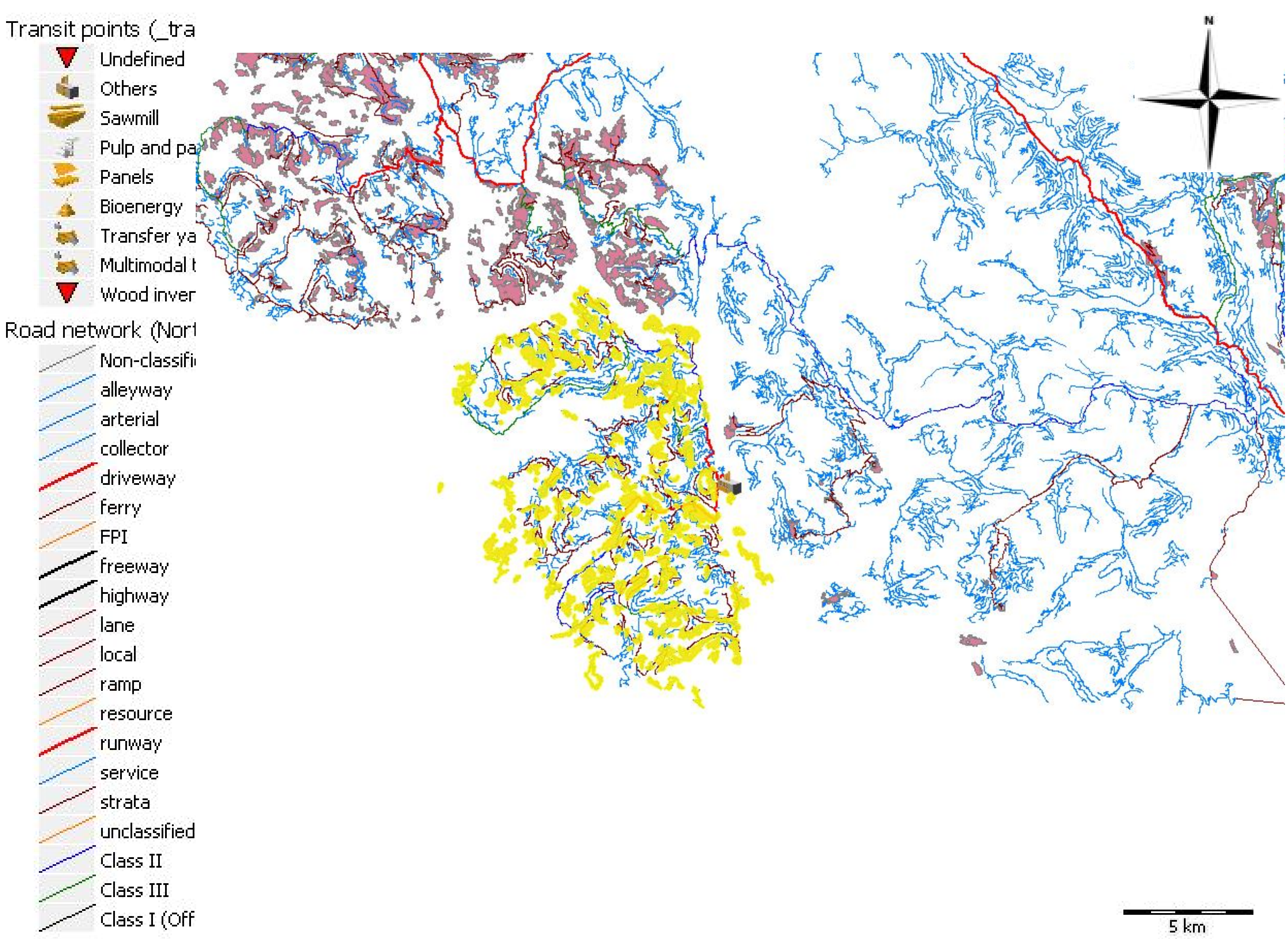
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	197,211.6	7,995.4	198
• Recovery season			
Summer	0.0	0.0	0
Winter	197,211.6	7,995.4	198
• Residue freshness			
Fresh	0.0	0.0	0
Brown	197,211.6	7,995.4	198
Brittle	0.0	0.0	0

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	43,688.6	43,688.6
70 $/odt	0.0	106,075.2	106,075.2
80 $/odt	0.0	167,917.5	167,917.5
90 $/odt	0.0	197,211.6	197,211.6
Maximum cost	0.00 $/odt	89.90 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
FPI_1				
	Bigleaf Maple (residues)	Chips	123	22
	Doug Fir (residues)	Chips	11,405	27
	Hybrid spruce (residues)	Chips	10,471	30
	LP Pine (residues)	Chips	310	36
	Red Alder (residues)	Chips	10,450	25
	Subalpine fir (residues)	Chips	26,173	31
	Western Hemlock (residues)	Chips	80,083	31
	WR Cedar (residues)	Chips	58,196	30
			197,212	30
			197,212	30



198 selected block(s) / 1574

Area covered: 7,995 ha / 103,295 ha

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

Statistics - Selected Items

Area	296.8 ha
Number of cut blocks	12
Recovered biomass	7,543.9 odt
Biomass yield	25.4 odt/ha
Biomass odt / Merchantable m^3	0.0520 odt/m^3
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	58 : 1
Available energy	28,555 MWh
Fuel consumption	7.4 L/odt

Cost

Harvesting	0.00 $/odt
Biomass recovery	34.27 $/odt
Transfer yard	0.00 $/odt
Transportation	15.34 $/odt
Loading/unloading	10.66 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	0.05 $/odt
Indirect costs	0.00 $/odt
Total	60.32 $/odt

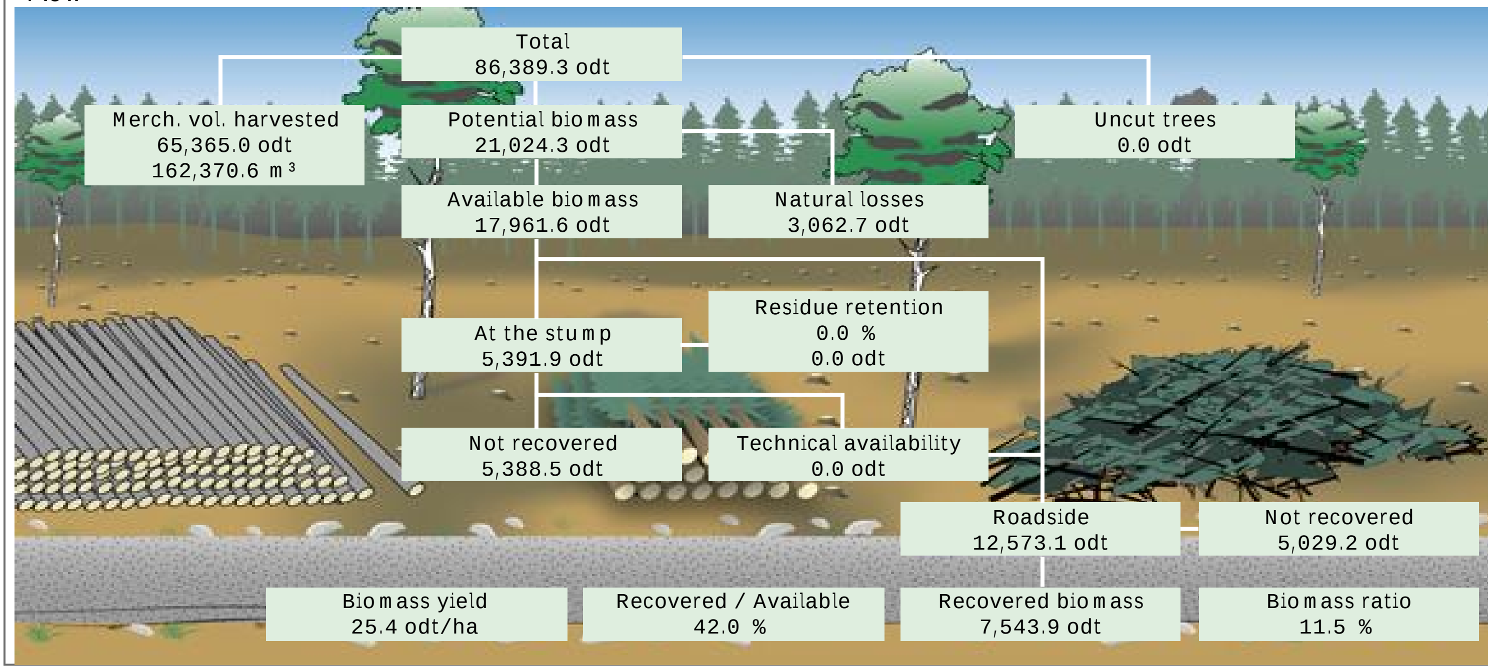
Revenue

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

Net

Profit	-60.32 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
WR Cedar (residues)	1,239.2	0.0424	4.17
Hybrid spruce (residues)	1,633.4	0.1363	5.50
Western Hemlock (residues)	3,650.3	0.0407	12.30
Doug Fir (residues)	1,021.0	0.0720	3.44
	7,543.9	0.0520	25.42

Recovery summary

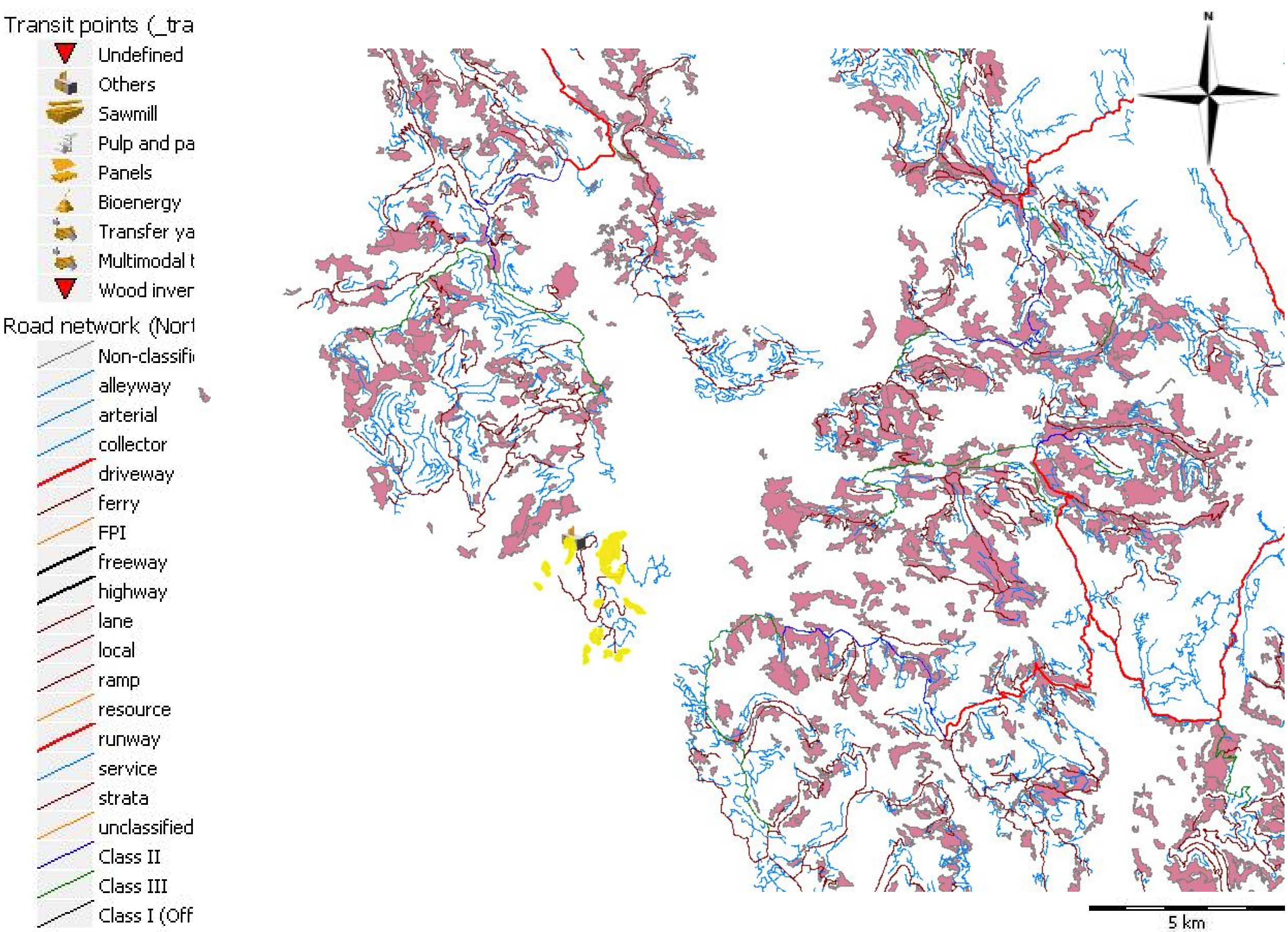
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	7,543.9	296.8	12
• Recovery season			
Summer	0.0	0.0	0
Winter	7,543.9	296.8	12
• Residue freshness			
Fresh	0.0	0.0	0
Brown	7,543.9	296.8	12
Brittle	0.0	0.0	0

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	3,399.6	3,399.6
70 $/odt	0.0	7,543.9	7,543.9
Maximum cost	0.00 $/odt	62.58 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
FPI_3				
	Doug Fir (residues)	Chips	1,021	11
	Hybrid spruce (residues)	Chips	1,633	9
	Western Hemlock (residues)	Chips	3,650	10
	WR Cedar (residues)	Chips	1,239	10
			7,544	10
			7,544	10



12 selected block(s) / 1574

Area covered: 297 ha / 103,295 ha

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