Using FPInterface to Estimate Availability of Forest-Origin Biomass in British Columbia: 100 Mile House TSA

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Abstract

Based on inventory information and a 20-year harvest queue, estimates of the amount of biomass available from forest harvest residues are estimated in $10 increments of delivered cost. For the 100 Mile House Timber Supply Area, 81,000 odt/year is projected to be available at $60/odt.

Acknowledgements

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1. Executive summary

In 2011 FPInnovations used FPInterface to develop and demonstrate a method for estimating available forest-origin biomass in British Columbia's Timber Supply Areas (TSA): the test case was the Quesnel TSA. The method was subsequently refined and applied to the Williams Lake TSA (2012); the Prince George TSA (2012); the Lakes TSA (2012); the Mackenzie TSA (2013); and the 100 Mile House TSA (2014), for which the results are reported here. The biomass inventory was based on 20-year harvest and road network plans for Crown land (excluding Woodlot Licenses, Tree Farm Licenses, Community Forest Agreements, and First Nations tenures) provided by the British Columbia Ministry of Forests, Lands and Natural Resource Operations. The delivery point for biomass was the town of 100 Mile House. All planned blocks were assumed to be clearcut harvested, processed at roadside, and accessible to comminution operations.

The FPInterface analysis of biomass supply in the 100 Mile House TSA indicates an average biomass yield of 18.8 ODT/ha. This is in the form of comminuted hog fuel and comes from harvest residues only, i.e., tops, branches, and other roadside harvesting waste. Mill residues are not predicted by the model. Most of the biomass in the 100 Mile House TSA is available at a viable economic rate, delivered to the town of 100 Mile House.

Approximately 26% of this material is derived from mountain pine beetle pine-affected wood, i.e., which would not be available if the lodgepole pine were healthy. This means 13.9 ODT/ha is derived from normal harvesting waste, and an additional 4.9 ODT/ha is derived from wood affected by the mountain pine beetle infestation, averaged over all cutblocks in the study.

The biomass ratio (the ratio of recovered biomass to recovered merchantable roundwood) is 40.7%. In this case, 5 419 035 ODT of roundwood and 2 203 845 ODT of biomass are projected. This is high for typical harvesting operations, i.e., ones that do not include mountain pine beetle-killed wood, but is low for mountain pine beetle-infected areas; it represents a weighted average of both as distributed in this harvest queue.

Because the efficiency of grinding operations has improved in recent years, three price points for grinding were tested: a base case grinding scenario, at $26.82/ODT, to show consistency with past studies; a low-cost grinding scenario, at $20.10/ODT; and a mid-cost grinding scenario, at $23.25/ODT. At an economic price of $60/ODT for delivered hog fuel, the base case predicts 1.6 million ODT over the 20-year harvest horizon (81 000 ODT/year), the base case grinding scenario (low-cost scenario) predicts 2.0 million ODT over the 20 years (101 000 ODT/year), and the mid-cost grinding scenario predicts a total of 1.85 million ODT (93 000 ODT/year).

The total biomass available at any price point from combined harvest residues and mountain pine beetle waste (the portion deemed recoverable) over the 20-year harvest horizon was projected to be 2.2 million ODT.

Possibly because of the small size of the 100 Mile House TSA, most (75 to 90%) of the potentially available biomass is accessible for $60/ODT. This was not generally the case for the TSAs previously studied. In this TSA there were differences in the amounts available at $50/ODT for each grinding cost scenario, but differences shrink when the price of biomass is $60/ODT.

Also of note here is the fact that differences between the three grinding scenarios at the economic level of $60/ODT were relatively small. Again, the relatively small size of the TSA mitigates the difference in grinding costs because much of the biomass is available within a medium distance (<100-km radius) of the delivery point at the town of 100 Mile House.

Perhaps the most significant take-away message from this study is that most of the biomass is available at the economically viable rate of $60/ODT, delivered to 100 Mile House.

2. Introduction

In order to progress toward full implementation of a bioeconomy in British Columbia a key piece of information is needed—i.e., a detailed inventory of economically available biomass.

To address this need, in 2011 FPInnovations undertook a project in partnership with the Inventory Branch of the British Columbia Ministry of Forests, Lands and Natural Resource Operations (MFLNRO). The specific goals of the project were to develop a process for calculating biomass inventories in British Columbia's Timber Supply Areas (TSAs) in the Central Interior. The projections of biomass availability were based on 20-year harvest and road network plans for Crown land (excluding Woodlot Licenses, Tree Farm Licenses, Community Forest Agreements, and First Nations tenures) provided by the MFLNRO.

In 2011 FPInnovations developed and demonstrated a method for estimating and projecting available forest-origin biomass in TSAs, using FPInterface: the test case was the Quesnel TSA (Friesen & Goodison, 2011). This method was subsequently refined and applied to the Williams Lake TSA (Friesen, 2012a), the Prince George TSA (Friesen, 2012b), the Lakes TSA (Friesen, 2012c), and the Mackenzie TSA (Friesen, 2013). An analysis of the 100 Mile House TSA was run in 2014, for which the outcomes are reported here. The aim in providing this information is to help decision makers better understand biomass availability when preparing industrial proposals.

Detailed introductory statements describing the background and rationale of this project and the greater project as a whole are in Friesen & Goodison (2011).

3. Objective

As abridged from the report about the Quesnel TSA (Friesen & Goodison, 2011) the objectives for the 100 Mile House biomass analysis were:

Calculate biomass supply for volume-based tenures in the 100 Mile House TSA. Specific deliverables include:

a. An analysis showing the delivered cost of biomass from point of origin
b. An analysis showing the amount of biomass delivered at different price points—The market value of one oven-dried tonne (ODT) of biomass could not be specified at the time, but $60/ODT was set as the agreed-upon threshold at which to determine commercial biomass availability.

4. Methods

Overall process

The basic methodology for determining the biomass supply in the central interior was established during analyses of the Quesnel TSA (Friesen & Goodison, 2011) and the Williams Lake TSA (Friesen, 2012a). It is reviewed below.

The analysis focused on the TSA and was based on polygon data (tree characteristics) and a road data set supplied by the MFLNRO. It did not include any nearby Woodlot Licenses, Tree Farm Licenses, Community Forest Agreements, or any First Nations tenures. Including some of these areas would have altered the available supply of biomass.

Additionally, stands considered unmerchantable due to small stem size were not included in the analysis. The analysis focused on recovering harvest residues from merchantable stands. Purposely harvesting unmerchantable stands for biomass could add to the biomass supply, and further analysis could be undertaken to determine its profitability.

The following process map (Figure 1) graphically displays the steps taken to build the final inventory of economically available biomass for the Quesnel TSA (Friesen & Goodison, 2011). The same process was used for this analysis of the 100 Mile House TSA.

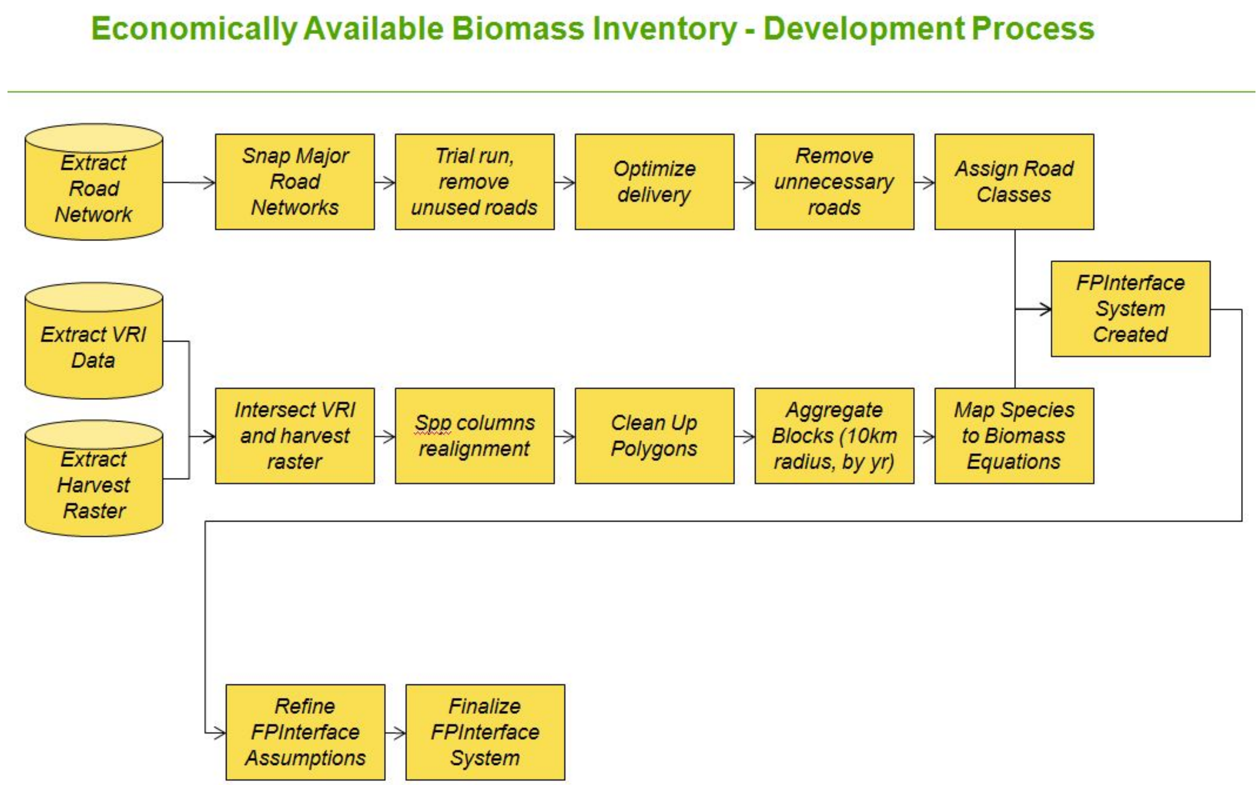

Figure 1. Steps in the method for building the final inventory of economically available biomass.

Data acquisition

Data layers for the 100 Mile House TSA (excluding Woodlot Licenses, Tree Farm Licenses, Community Forest Agreements, and any First Nations tenures), were acquired from the MFLNRO, including Vegetation Resources Inventory polygons with attributes, and road linework with attributes. The polygon data was for 20 years of harvest over ten consecutive 1-year periods and two consecutive 5-year periods.

The 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.

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 harvested in which time period. To calculate biomass amounts, FPInterface requires both tree size data (or height and 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 the species present in FPInterface.

In order to speed up the calculation, 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 Vegetation Resources Inventory and the harvest raster layers. Aggregation rules meant blocks were grouped if they had the identical harvest year and were within a 10-km radius.

FPInterface calculates cost in part by finding a transport route from the 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 the block and mill, or it may find a sub-optimal circuitous path.

Examination of the data set showed that road snapping was required. A program was used to identify gaps in the road network and close them. A few polygons (5 or fewer) were still inaccessible after snapping, but these represent far less than 1% of the total area, so it was deemed not worthwhile to find the remaining gaps manually.

Biomass equations

To perform the analysis, tree species indicated in the inventory are tied to single-tree biomass equations in FPInterface. These equations were based on “Canadian national tree above ground biomass equations” (Lambert et al., 2005). Although this equation set includes trees from all across Canada, including western and northern Canada, there were very few samples from British Columbia. More recently, Ung et al. (2008) have released tree equations for British Columbia (accepted by the MFLNRO) and these were incorporated into FPInterface for all the analyses performed after the initial one (Quesnel TSA).

FPInterface parameters

Tree species associations

Species associations were made as shown in Table 1.

Table 1. Tree species associations

FPInterface species	System label	Named	Original data set
spruce, black	SB	black spruce	SB
aspen, trembling	AT	trembling aspen	AC, AT
fir, alpine	BI	Abies lasiocarpa	B, BL, BA
cedar, western red	CW	western redcedar	CW
Douglas-fir (Interior)	FD	Douglas-fir	FD, FDI
birch, white	EP	paper birch	E, EP
hemlock, western	HW	western hemlock	H, HW
pine, lodgepole	PL	lodgepole pine	PA, PL, PLI
pine, ponderosa	PY	ponderosa pine	PY
spruce, white	SX	hybrid spruce	S, SE, SW, SX

Road classes

Unlike the dataset used in the analysis of the Quesnel TSA (Friesen & Goodison, 2011), no road classes were contained in the road data set for the 100 Mile House TSA. However, FPInterface has the ability to assign road classes based on the amount of volume hauled over each section of road. The volume hauled is for merchantable volume as calculated by FPInterface. The volume and speeds associated with each road class were assigned as listed in Table 2.

Table 2. Road class associations

FPInterface road class	Volume		Road speed		
	Minimum (m^3)	Maximum (m^3)	Posted speed (km/h)	Empty haul [a] (km/h)	Loaded haul [b] (km/h)
Paved	0	0	90	86	77
Class 1 (off highway)	5 000 001	50 000 000	70	67	60
Class 1	1 000 001	5 000 000	70	67	60
Class 2	500 001	1 000 000	50	48	43
Class 3	100 001	500 000	40	38	34
Class 4	50 001	100 000	20	19	17
Class 4 (operational)	0	0	20	19	17
Class 5 (winter)	0	50 000	20	19	17

[a] 95% of posted speed. [b] 85% of posted speed.

General parameters

The price of fuel can have significant impacts on model results. Some equipment in the model can use diesel while other equipment is eligible for marked fuel. A price of $1.25/L was assigned which was near to commercial rates for diesel but slightly higher than the price of marked fuel at the time.

The program's default values for productivities and costs of forestry equipment rely on a long history of FPInnovations studies and other information gathered by FPInnovations. If users have 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. To verify their suitability the default values were compared with the machine costs listed in the *Interior Appraisal Manual* and were found to be close approximates.

Based on a terrain classification system developed by the Canadian Pulp and Paper Association (CPPA) (Mellgren, 1980), average slope for the area was assigned to CPPA Class 3 (20 to 32%). Ground strength was rated as CPPA Class 2 (good), and ground roughness was rated as CPPA Class 2 (slightly even).

Comminution cost

Working time for British Columbia conditions was based on previous base case studies consisting of one 12-hour shift/day, 200 days/year. Grinder efficiency was set at 60%, and the amount of fuel used per productive machine-hour for the grinder was the standard 135 L/PMH. These are the standard base case parameters used in past FPInnovations studies and are included for ease of comparison to those studies. In this study, these parameters produced a grinding cost of $26.82/ODT on moderate ground.

However, recent developments in the industry have led to a lower grinding cost of about $20/ODT, therefore the parameters were changed in the low-cost scenario to 75% efficiency and fuel use of 70

L/PMH, in order to represent the new conditions. This produced a grinding cost of $20.10/ODT. Also, an intermediate scenario was attempted with 67% efficiency and 100 L/PMH, which was thought to be achievable by an experienced operator in the conditions of the 100 Mile House TSA.

Topping diameter

Although British Columbia regulations require a topping diameter of 10 cm for most merchantable species, this analysis used 12.5 cm in order to reflect more common industrial practise. Topping diameter can have a significant impact on the volume of a tree available for biomass use.

Utilization of lodgepole pine and mountain pine beetle-attacked wood: considerations

The harvesting of ,standing trees for biomass purposes is not generally considered economic in British Columbia because their recovery must cover the full costs of planning, developing, and harvesting of the stands, in addition to costs for biomass recovery[1] operations. However, because of mortality due to infestation of Interior lodgepole pine by mountain pine beetle some whole logs were included for biomass chipping. Although the timber harvesting land base (THLB) proportion attribute includes mortality attributed to mountain pine beetle infestation, because of continuing attack by the beetle and the resulting degradation of logs, 30% of lodgepole pine volume was removed from availability as merchantable volume. Half of this (15% of total lodgepole pine volume) was estimated to be available for whole log chipping or grinding at roadside, and the remainder was counted as loss (Figure 2).

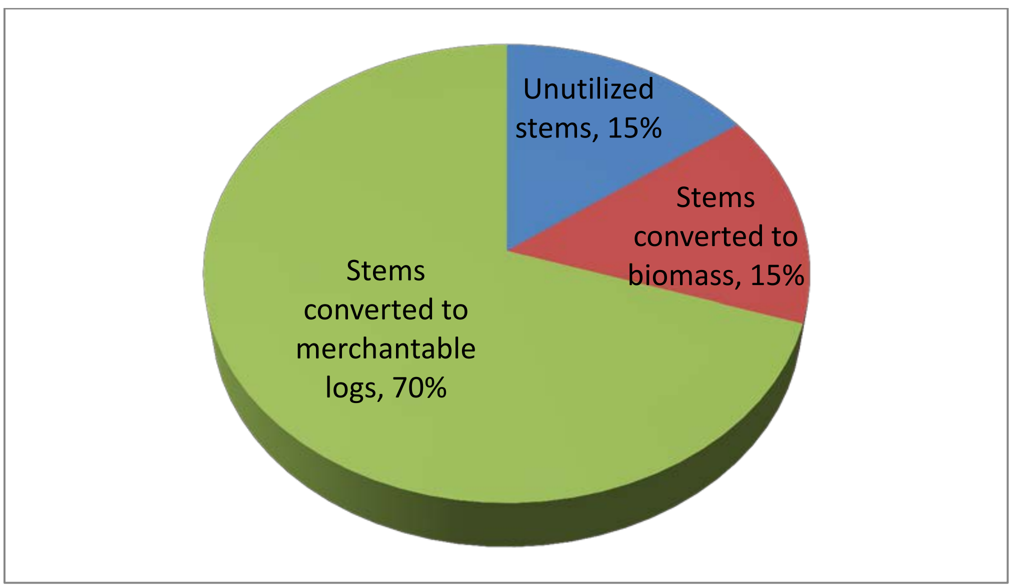

Figure 2. Utilization of mountain pine beetle-affected lodgepole pine stems: standards used in the analysis.

[1] biomass recovery = comminution plus transport of harvest residues

In the analysis of the Mackenzie TSA, one part of the methodology was changed from the biomass calculations made in the preceding reports in this series of studies (Friesen & Goodison, 2011; Friesen, 2012a, 2012b, 2012c). And this change was also applied in this analysis of the 100 Mile House TSA. That is, when 15% of total pine sawlogs is indicated for conversion to biomass, FPInterface assigns *harvest* costs as part of the acquisition of this biomass. However, because none of the biomass in the analysis is actually purposely harvested biomass, any costs attributed to obtaining biomass from mountain pine beetle-affected whole trees were reduced by $70/ODT, and the “Merchantable volume” was added to the “Residues” volume to produce Tables 5, 6, and 7. This increases the amount of biomass available at each price point.

$70/ODT was the amount chosen by which to reduce costs so that the maximum cost for acquiring “Merchantable volume” would match the maximum cost for acquiring “Residues,” i.e. $120/ODT, and approximate the cost for harvest converted to ODT.

Parameters as entered into FPInterface

Table 3 presents a summary of some of the parameters as entered into FPInterface, at a grinding cost of $26.82 (Table 3).

Table 3. FPInterface parameters: base case[a]

Run descriptor	Base case, grinding at $26.82/ODT
run name	100MH - 5mar2014
output name	100MH - 5mar2014
block system	Bl_100MH
road system	Roads-tmp1
transfer yard(s)	100MH
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	2 – good
ground roughness	2 – slightly even
average slope	20-32
slash used for biomass	Yes
full stem used for biomass	No
Pl utilization of THLB merchantable timber (%)	70
Pl unutilized merchantable used for biomass (%)	15
Pl stems for biomass chipped where?	Roadside
Pl merchantable stemwood for biomass directed where	closest yard
chips destination	closest yard
topping diameter (cm)	12.5
truck used for chips	3-axle
truck used for logs	B-train
harvesting fuel price / litre (x3)	$1.25
harvesting shifts / day (x3)	1
harvesting hours / shift (x3)	12
harvesting days / yr (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
recovery season	Winter
slash freshness	Fresh
slash pre-piled at roadside	Yes
grinder size type	horizontal 600 kW
biomass fuel price / litre (x2)	$1.25
biomass hours / shift (x2)	12
biomass shifts / day (x2)	1
biomass days / yr (x2)	200
grinder efficiency	60%
grinder fuel use (L/PMH)	135
indirect costs - biomass ($ value)	$0.00
indirect costs - harvesting ($ value)	$0.00

At a grinding cost of $20.10, the parameters highlighted in yellow were adjusted to 75% and 70 L/PMH, and at a grinding cost of $23.25 to 67% and 100 L/PMH.

Delivery locations

Because it has the largest population in the TSA and is the site of existing mills, the town of 100 Mile House was used as the delivery point for biomass.

Biomass calculations

The biomass calculations in FPInterface produce an amount 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 3 shows this breakdown with the numbers from the 20-year harvest of the base case at a grinding cost of $26.82/ODT.

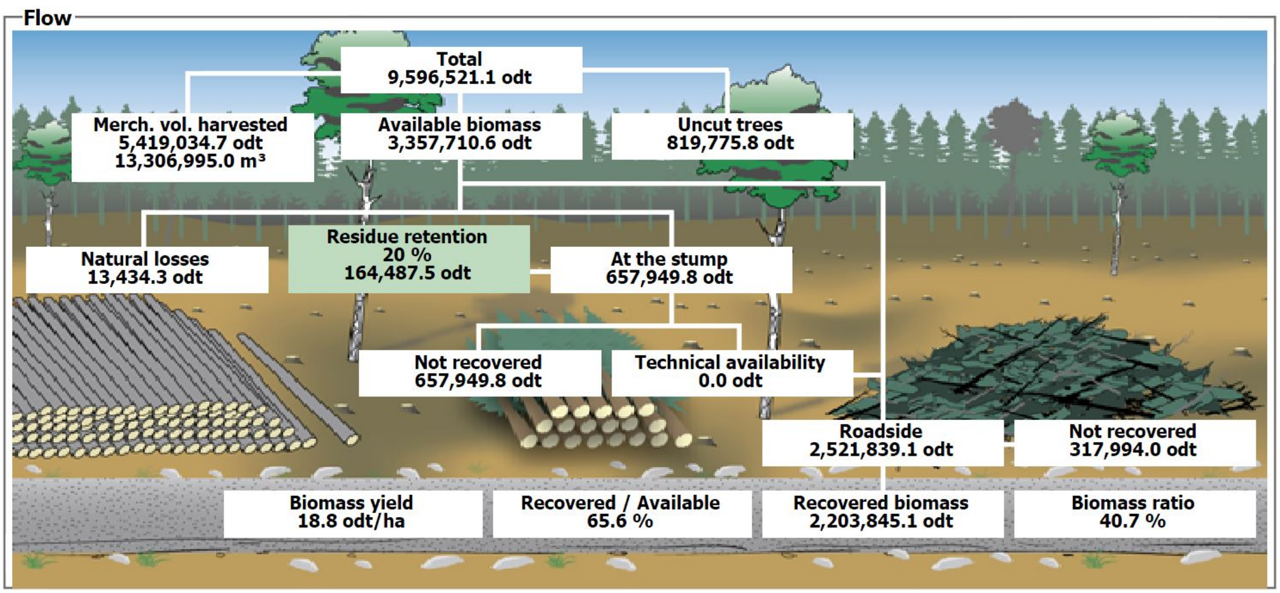

Figure 3. Recoverable biomass in the 100 Mile House TSA, at a grinding cost of $26.82/ODT.

5. Results and discussion

Summary—key results

The FPInterface analysis of biomass supply in the 100 Mile House TSA, based on inventory information and the road network supplied by the MFLNRO, indicates an average biomass yield of 18.8 ODT/ha. This is in the form of comminuted hog fuel, derived from harvest residues only, i.e., tops, branches, and other roadside harvesting waste. Mill residues are not predicted by the model.

Approximately 26% of this material was obtained from mountain pine beetle-affected wood in excess of what would be generated if the pine were healthy. This means 13.9 ODT/ha were derived from normal harvesting waste, and an additional 4.9 ODT/ha comprised extra material which was available due to the mountain pine beetle infestation of lodgepole pine, (Figure 4), averaged over all cutblocks in the study.

For the period-by-period data, the middle-cost grinding scenario ($23.25/ODT) was used. The yield per hectare in the first two 5-year periods is expected to be greater than in the last two 5-year periods (Figure 5), probably owing to a greater amount of mountain pine beetle-affected wood in the first two periods. The greater presence of lodgepole pine in the first two periods means more material is calculated as waste (usable for biomass), because mountain pine beetle-killed trees yield more waste than healthy trees.

The biomass ratio (the ratio of recovered biomass to recovered merchantable roundwood) is 40.7% (Table 4). The model predicted 5 419 035 ODT of roundwood and 2 203 845 ODT of biomass. This is high for typical harvesting operations, i.e., ones that do not include mountain pine beetle-killed wood, but is low for mountain pine beetle-infested areas; it represents a weighted average of both as distributed in this harvest queue.

When biomass supply studies were begun for the MFLNRO two years ago, typical grinding costs were about $30/ODT. However, recent advances in operational efficiency have lowered the grinding costs to about $20–25/ODT. Three scenarios were analyzed, each with a different cost for grinding. Key results from the runs for 20 years of harvest are summarized in Tables 5, 6, and 7. More detailed results are shown in Appendix 1, along with the Forest Supply reports. At the economically viable rate of $60/ODT, the result is highlighted in yellow in each table. The amount available over the 20-year horizon varies between about 80 000 and100 000 ODT/year.

The results for the different grinding costs are compared in Figure 6.

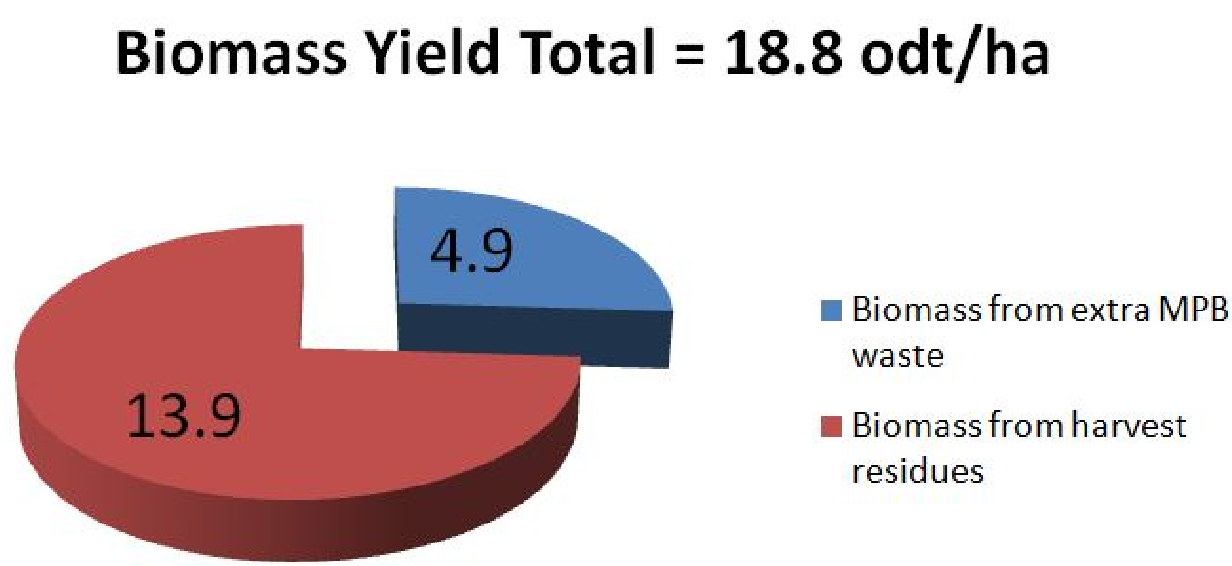

Figure 4. Projected biomass yield (ODT per hectare).

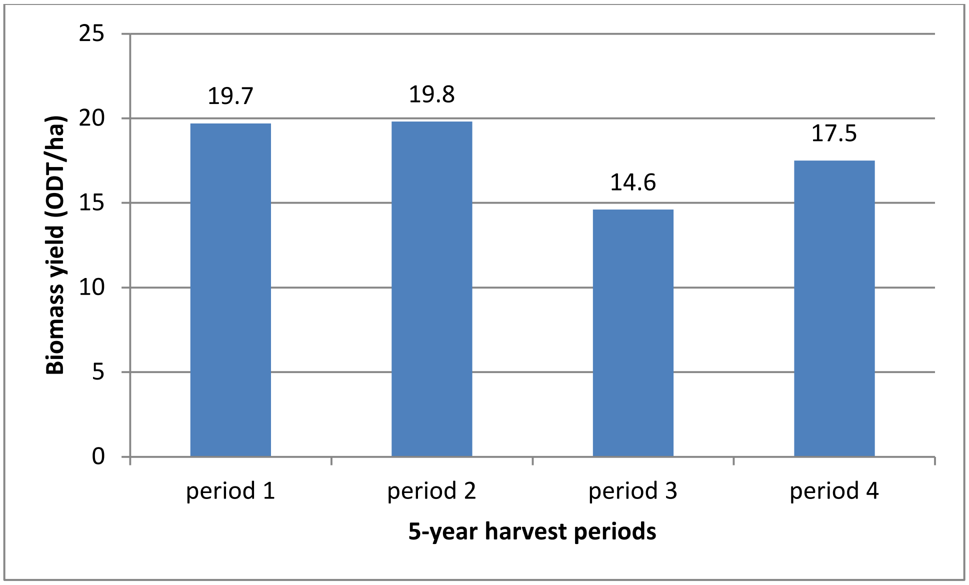

Figure 5. Biomass yield in the 100 Mile House TSA, by 5-year period. Average = 18.8 ODT/ha.

Table 4. Calculation of biomass ratio

Biomass Ratio	
2,203,845	odt of biomass
5,419,035	odt of roundwood
= 40.7 %	

Table 5. Cost availability of biomass in the 100 Mile House TSA, at a grinding cost of $26.82/ODT[a]

Base case - grinding cost = $26.82/odt

Cost $/odt	Odt available	Odt/year
$20	-	-
$30	929	46
$40	132,683	6,634
$50	823,750	41,188
$60	1,615,128	80,756
$70	2,103,904	105,195
$80	2,178,909	108,945
$90	2,203,367	110,168
$100	2,203,811	110,191
$110	2,203,845	110,192

[a] At the economically viable rate of $60/ODT, the result is highlighted in yellow.

Table 6. Cost availability of biomass in the 100 Mile House TSA, at a grinding cost of $20.10/ODT[a]

Scenario 1 - grinding cost = $20.10/odt

Cost $/odt	Odt available	Odt/year
$20	185	9
$30	34,782	1,739
$40	526,430	26,322
$50	1,352,252	67,613
$60	2,012,599	100,630
$70	2,174,334	108,717
$80	2,195,076	109,754
$90	2,203,811	110,191
$100	2,203,845	110,192

[a] At the economically viable rate of $60/ODT, the result is highlighted in yellow.

Table 7. Cost availability of biomass in the 100 Mile House TSA, at a grinding cost of $23.25/ODT[a]

Scenario 2 - grinding cost = $23.25/odt

Cost $/odt	Odt available	Odt/year
$20	23	1
$30	5,753	288
$40	293,425	14,671
$50	1,100,448	55,022
$60	1,852,290	92,615
$70	2,156,198	107,810
$80	2,190,778	109,539
$90	2,203,786	110,189
$100	2,203,845	110,192

[a] At the economically viable rate of $60/ODT, the result is highlighted in yellow.

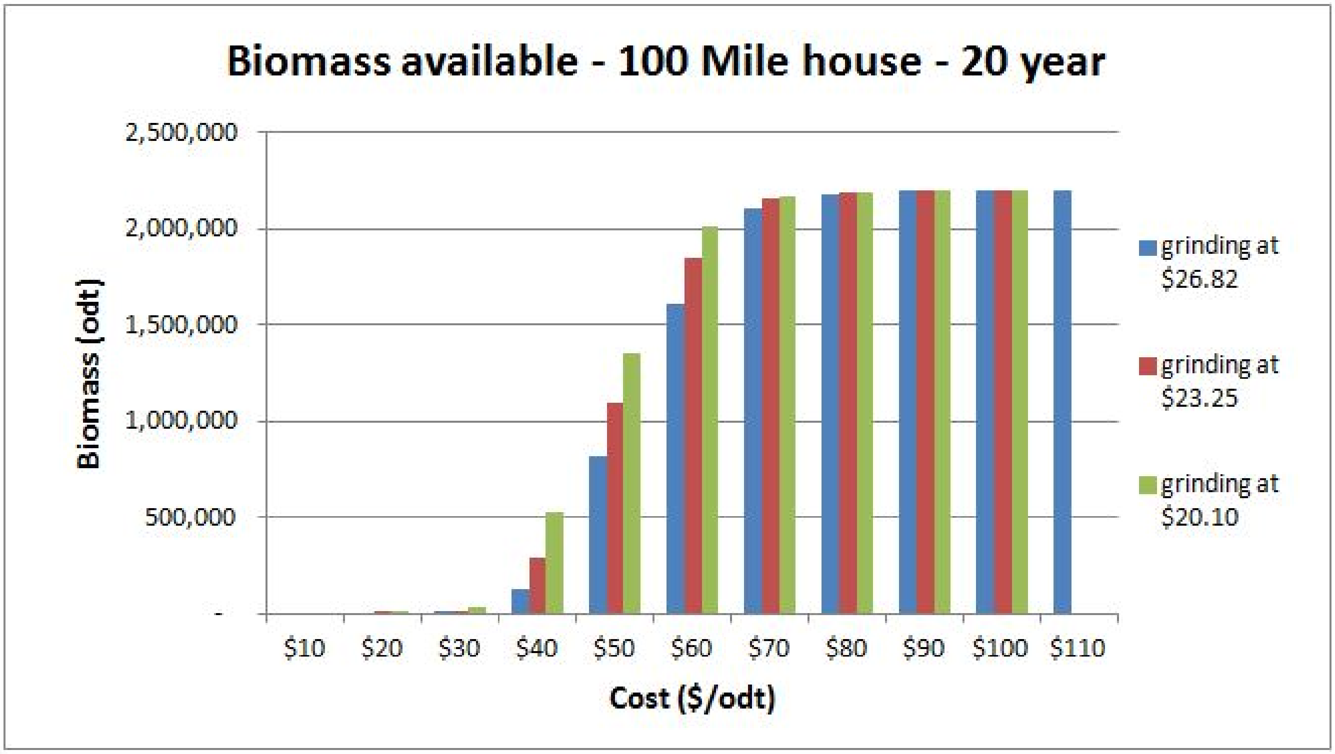

Figure 6. 20-year cost availability of biomass in the 100 Mile House TSA, by grinding cost.

Possibly because of the small size of the 100 Mile House TSA, most (75 to 90%) of the potentially available biomass is accessible for $60/ODT. This is not typical for any of the six TSA's previously studied. In this TSA there were differences in the amounts available at $50/ODT for each grinding cost, but differences shrink when the price reaches $60/ODT.

Also of note is the fact that the differences between the three scenarios at the economic level of $60/ODT are relatively small. Again, the relatively small size of the TSA mitigates the difference in grinding costs because much of the biomass is available within a medium distance (<100-km radius) from town.

The total biomass available at any price point from harvest residues and mountain pine beetle waste (the portion deemed recoverable) over the next 20 years was projected to be 2.2 million ODT.

Figure 7 shows biomass availability at $60/ODT for each period compared to total biomass available at any cost.

There is a significant falldown predicted in biomass availability in Years 11 to 20, i.e., over periods 3 and 4. This reflects the harvest queue provided by the MFLNRO and likely indicates a decline in available stock due to the recent mountain pine beetle epidemic.

It is also worth noting again that there is little difference between the amounts of biomass available at $60/ODT and the total available biomass. Most of the biomass in the 100 Mile House TSA is available at a viable economic rate if it is delivered to the town of 100 Mile House.

Figure 8 presents an isometric map of harvest blocks by biomass cost. The roads are shown on this map to provide an idea of biomass flow routes. In general, the blocks closest to the delivery point (greenest) have the lowest delivered costs.

The isometric map in Figure 9 provides another look, this time without the roads. In this figure colour gradation based on distance from the mill is more visible.

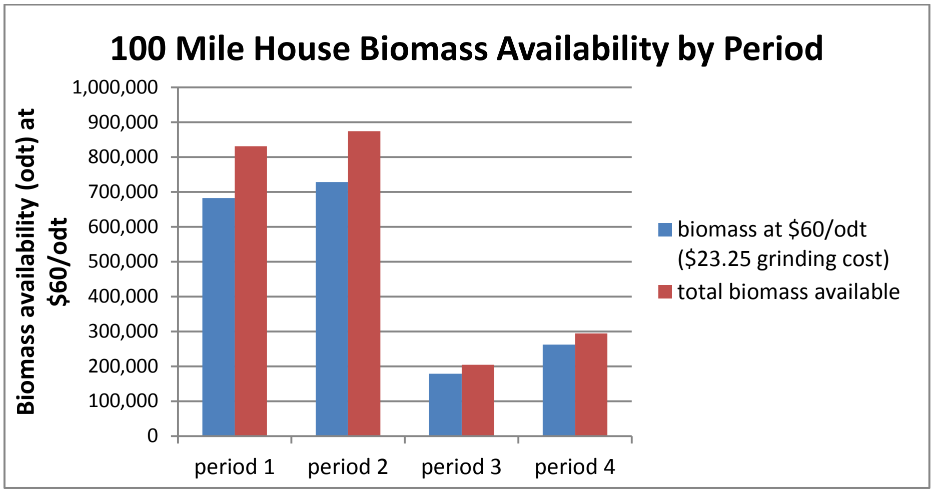

Figure 7. Availability of biomass in the 100 Mile House TSA, by 5-year harvest period, at $60/ODT.

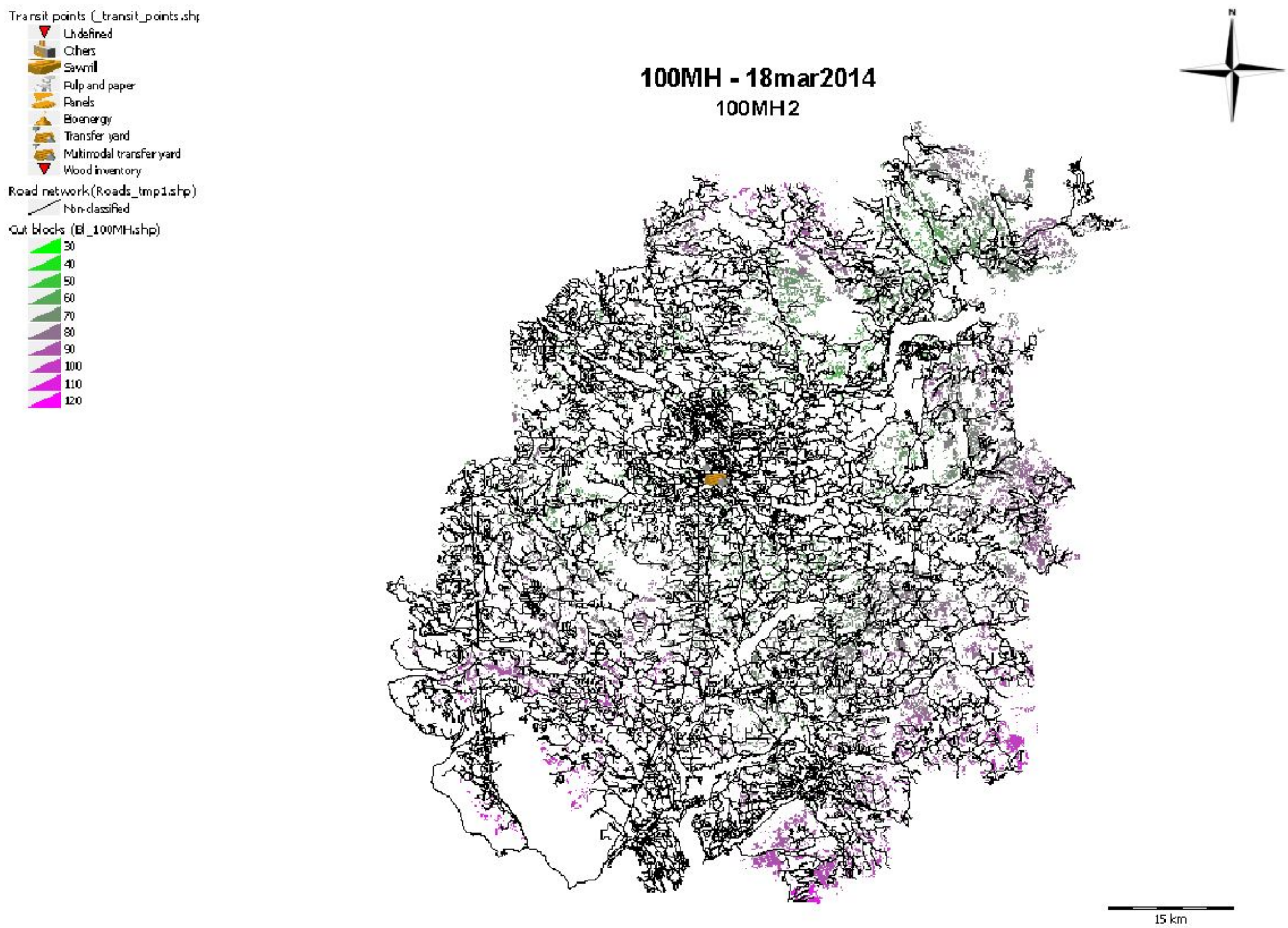

Figure 8. Cost of delivered biomass from point of origin to the town of 100 Mile House, with roads, in increments of $10 /ODT. Blocks with the lowest delivered costs are the greenest in colour. The most expensive blocks are violet in colour. The brown log pile represents the mill at 100 Mile House. The cost of biomass obtained from roadside residues is averaged with the cost of biomass obtained from mountain pine beetle stems (as calculated by the model).

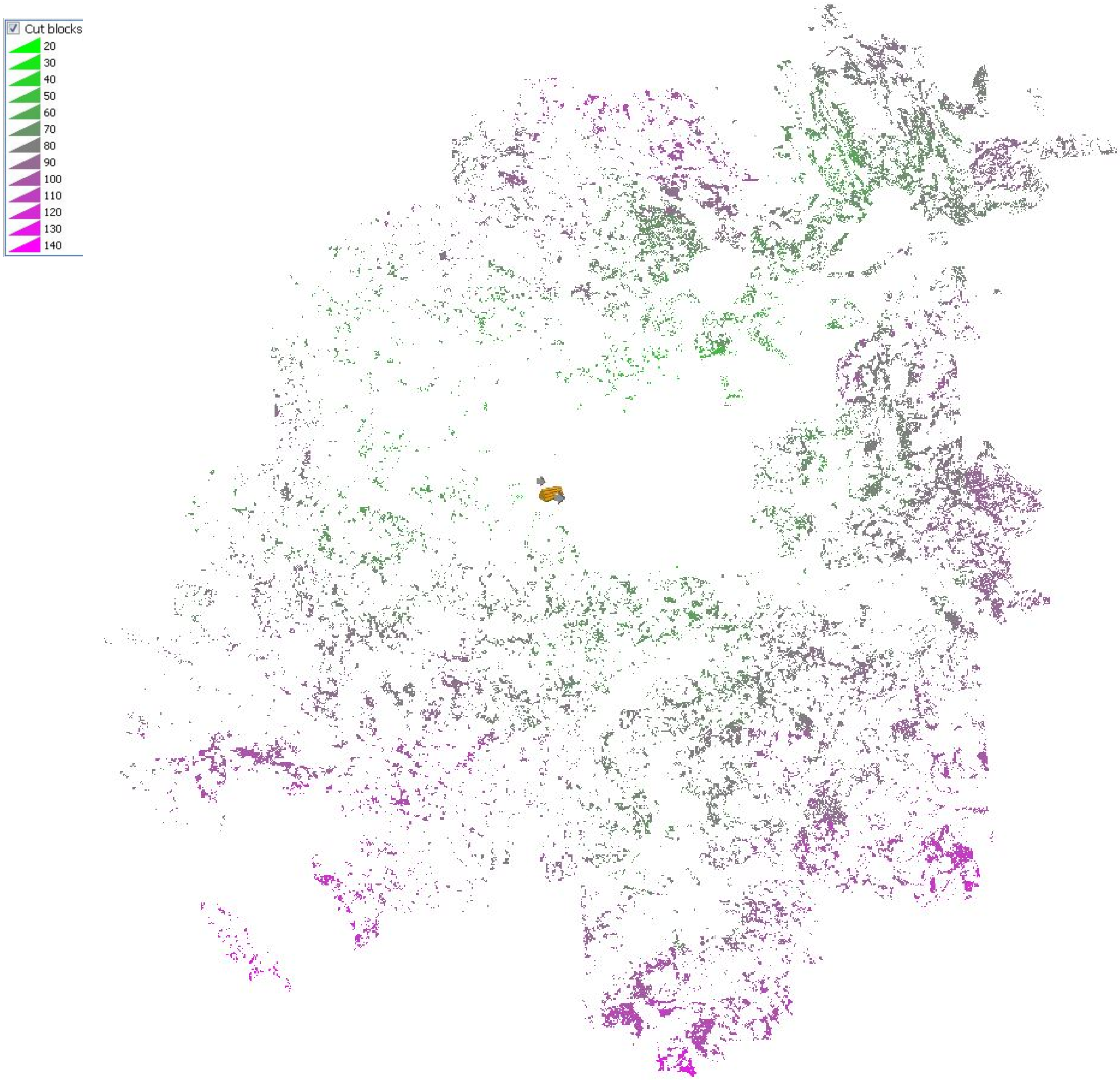

Figure 9. Cost of delivered biomass from point of origin to the town of 100 Mile House, with no roads, in increments $10 /ODT. The colour scale represents estimated cost ($/ODT) of delivered biomass from that block. Blocks with the lowest delivered costs are the greenest in colour. The most expensive blocks are violet in colour. The brown log pile represents the mill at 100 Mile House.

6. Conclusions

We used FPInterface to develop a method for projecting available forest-origin biomass for British Columbia Timber Supply Areas. The Quesnel TSA was the test case (Friesen & Goodison, 2011). Extrapolating on that experience and subsequent runs for the Williams Lake TSA (Friesen, 2012a), the model was also run for the Prince George TSA (Friesen, 2012b), the Lakes TSA (Friesen, 2012c), the Mackenzie TSA (Friesen, 2013), and the 100 Mile House TSA. The biomass inventory was based on 20-year harvest and road network plans for Crown land (excluding Woodlot Licenses, Tree Farm Licenses, Community Forest Agreements, and First Nations tenures) provided by the British Columbia Ministry of Forests, Lands and Natural Resources. The delivery point for biomass was designated at the town of 100 Mile House only. All planned blocks were assumed to be clearcut harvested, processed at roadside, and accessible to comminution operations.

The analysis of 20-year biomass supply in the 100 Mile House TSA predicts a yield of 18.8 ODT/ha of biomass in the form of hog fuel from harvest residue. The projected biomass ratio of recovered biomass to recovered roundwood is 41%. This is high for typical harvesting operations, i.e., ones that do not include mountain pine beetle-killed wood, but is usual for areas comprised of some mountain pine beetle-killed wood.

Because the efficiency of grinding operations has improved in recent years, three price points for grinding were tested: a base case to show consistency with past studies (grinding cost of $26.82/ODT), a low-cost grinding scenario ($20.10/ODT), and a mid-cost grinding scenario ($23.25/ODT). At an economic price of $60/ODT for delivered hog fuel, the base case predicts 1.6 million ODT over 20 years (81 000 ODT/year), the low-cost scenario predicts 2.0 million ODT (101 000 ODT/year), and the mid-cost scenario predicts 1.85 million ODT (93 000 ODT/year).

Although more efficient grinding practices could increase the economically available amount by 25%, the total amount is relatively small compared to the gains predicted in the analyses of some other TSAs (Friesen & Goodison, 2011; Friesen, 2012a, 2012b, 2012c, 2013). This likely reflects the smaller size of the 100 Mile House TSA.

Perhaps the most significant take-away message from this study is that most of the biomass is available at the economically viable rate of $60/ODT, delivered to 100 Mile House.

7. References

Friesen, C. (2012a). *Using FPInterface to estimate available forest-origin biomass in British Columbia: Williams Lake TSA* (Technical Report). Vancouver, British Columbia: FPInnovations.

Friesen, C. (2012b). *Using FPInterface to estimate available forest-origin biomass in British Columbia: Prince George TSA* (Technical Report). Vancouver, British Columbia: FPInnovations.

Friesen, C. (2012c). *Using FPInterface to estimate available forest-origin biomass in British Columbia: Lakes TSA* (Technical Report). Vancouver, British Columbia: FPInnovations.

Friesen, C. (2013). *Using FPInterface to estimate available forest-origin biomass in British Columbia: Mackenzie TSA* (Technical Report). Vancouver, British Columbia: FPInnovations.

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8. Appendix

Biomass and forest supply reports

- Biomass - 100MH - 5mar2014 - base case
- Biomass - 100MH - 17mar2014 scenario 1
- Biomass - 100MH - 18mar2014 scenario 2
- Biomass - 100MH - 18mar2014-mid-period1
- Biomass - 100MH - 18mar2014-mid-period2
- Biomass - 100MH - 18mar2014-mid-period3
- Biomass - 100MH - 18mar2014-mid-period4
- Forest supply - 100MH - 5mar2014 - base case
- Forest supply - 100MH - 17mar2014 - scenario 1
- Forest supply - 100MH - 18mar2014 - scenario 2
- Forest supply - 100MH - 18mar2014-mid-period1
- Forest supply - 100MH - 18mar2014-mid-period2
- Forest supply - 100MH - 18mar2014-mid-period3
- Forest supply - 100MH - 18mar2014-mid-period4

FPInterface™

Summary report
Biomass
[100MH - 5mar2014]

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	117,142.5 ha
Number of cut blocks	2397
Recovered biomass	2,203,845.1 odt
Biomass yield	18.8 odt/ha
Biomass odt / Merchantable m³	0.1596 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	34 : 1
Available energy	8,114,909 MWh
Fuel consumption	12.5 L/odt

Cost

Harvesting	17.99 $/odt
Biomass recovery	26.82 $/odt
Transfer yard	0.00 $/odt
Transportation	31.29 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.11 $/odt
Indirect costs	0.00 $/odt
Total	77.21 $/odt

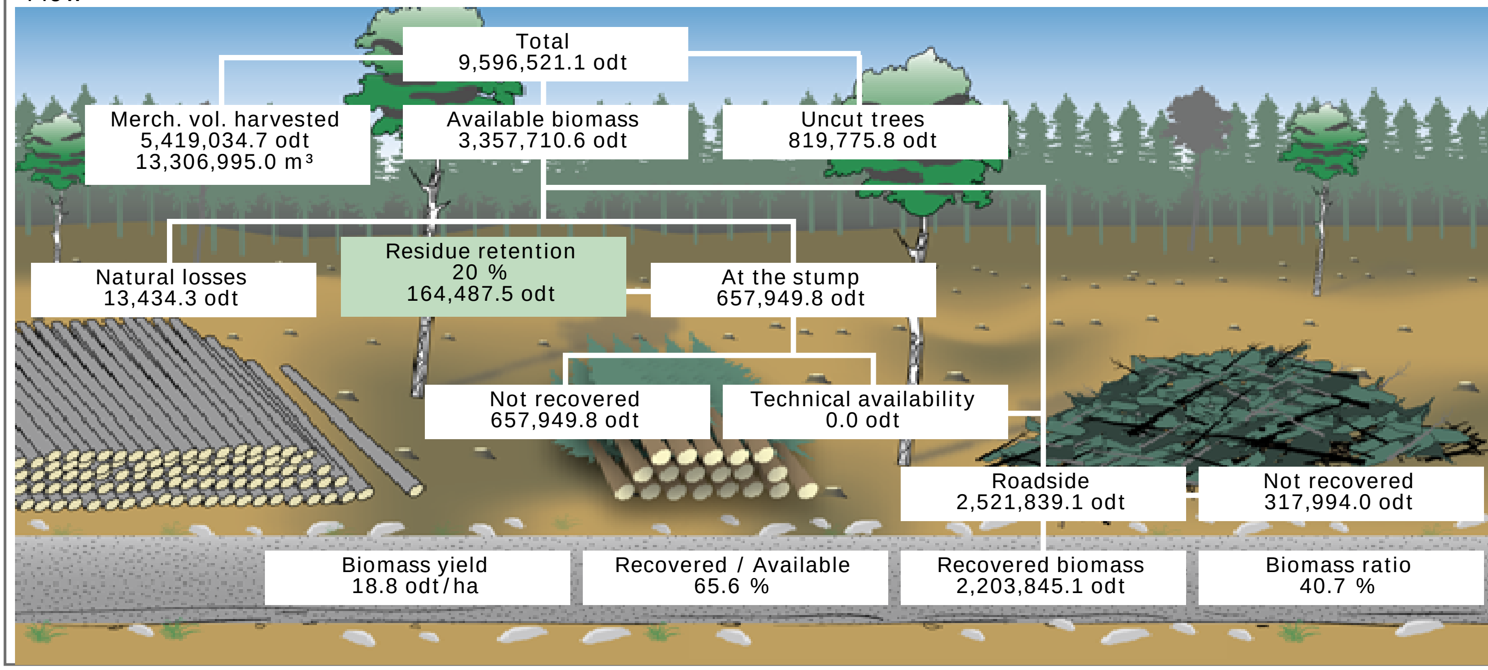
Revenue

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

Net

Profit	-77.21 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Lodgepole pine-sawlog (residues)	602,417.3	0.1073	5.14
Lodgepole pine-biomass	572,677.9	0.4760	4.89
Douglas fir (residues)	430,225.8	0.2147	3.67
Hybrid spruce (residues)	327,649.6	0.1293	2.80
Lodgepole pine-biomass (residues)	129,089.4	0.1073	1.10
Trembling aspen (residues)	94,474.7	0.1151	0.81
Abies lasiocarpa (residues)	26,498.5	0.0947	0.23
Western redcedar (residues)	10,355.1	0.1118	0.09
Paper birch (residues)	9,294.1	0.1831	0.08
Ponderosa pine (residues)	659.2	0.2619	0.01
Black spruce (residues)	260.6	0.1143	0.00
Western hemlock (residues)	243.0	0.1093	0.00
	2,203,845.1	0.1596	18.81

Recovery summary

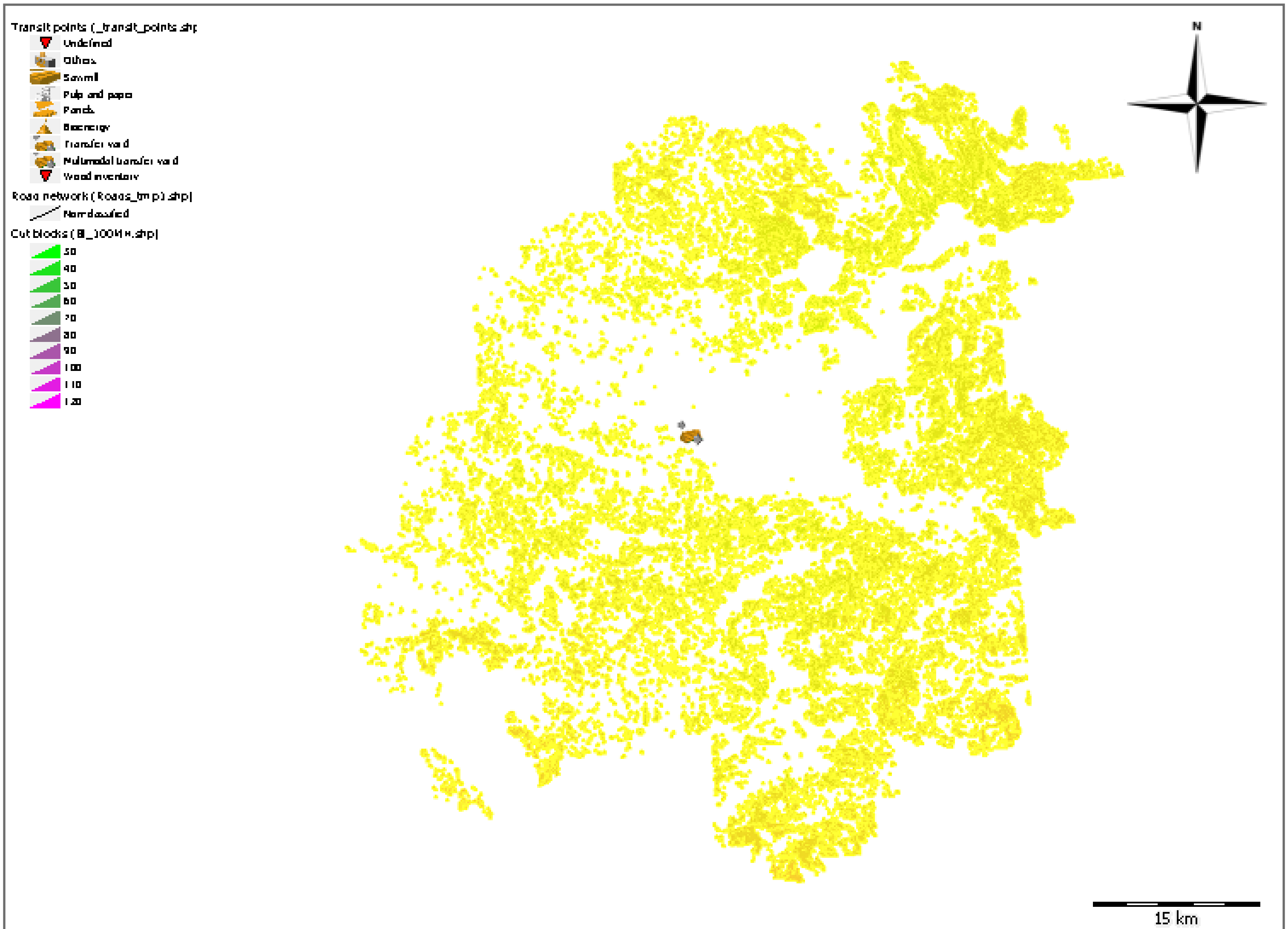
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	2,203,845.1	117,142.5	2,397
• Recovery season			
Summer	0.0	0.0	0
Winter	2,203,845.1	117,142.5	2,397
• Residue freshness			
Fresh	2,203,845.1	117,142.5	2,397
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	64,202.0	64,202.0
50 $/odt	0.0	491,744.0	491,744.0
60 $/odt	0.0	1,147,648.4	1,147,648.4
70 $/odt	0.0	1,562,662.4	1,562,662.4
80 $/odt	0.0	1,612,909.9	1,612,909.9
90 $/odt	0.0	1,631,167.2	1,631,167.2
100 $/odt	928.5	1,631,167.2	1,632,095.7
110 $/odt	68,480.8	1,631,167.2	1,699,648.0
120 $/odt	332,005.8	1,631,167.2	1,963,173.0
130 $/odt	467,480.3	1,631,167.2	2,098,647.5
140 $/odt	541,242.6	1,631,167.2	2,172,409.8
150 $/odt	565,999.4	1,631,167.2	2,197,166.6
160 $/odt	572,200.0	1,631,167.2	2,203,367.2
170 $/odt	572,644.0	1,631,167.2	2,203,811.3
180 $/odt	572,677.9	1,631,167.2	2,203,845.1
Maximum cost	176.39 $/odt	94.95 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	26,498	81
	Black spruce (residues)	Chips	261	85
	Douglas fir (residues)	Chips	430,226	61
	Hybrid spruce (residues)	Chips	327,650	70
	Lodgepole pine-biomass	Chips	572,678	63
	Lodgepole pine-biomass (residues)	Chips	129,089	63
	Lodgepole pine-sawlog (residues)	Chips	602,417	63
	Paper birch (residues)	Chips	9,294	59
	Ponderosa pine (residues)	Chips	659	64
	Trembling aspen (residues)	Chips	94,475	57
	Western hemlock (residues)	Chips	243	91
	Western redcedar (residues)	Chips	10,355	86
			2,203,845	64
			2,203,845	64



2397 selected site(s) / 2397

Area covered: 117,143 ha / 117,143 ha

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	117,142.5 ha
Number of cut blocks	2397
Recovered biomass	2,203,845.1 odt
Biomass yield	18.8 odt/ha
Biomass odt / Merchantable m³	0.1596 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	43 : 1
Available energy	8,114,909 MWh
Fuel consumption	9.9 L/odt

Cost

Harvesting	17.99 $/odt
Biomass recovery	20.10 $/odt
Transfer yard	0.00 $/odt
Transportation	31.29 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.11 $/odt
Indirect costs	0.00 $/odt
Total	70.48 $/odt

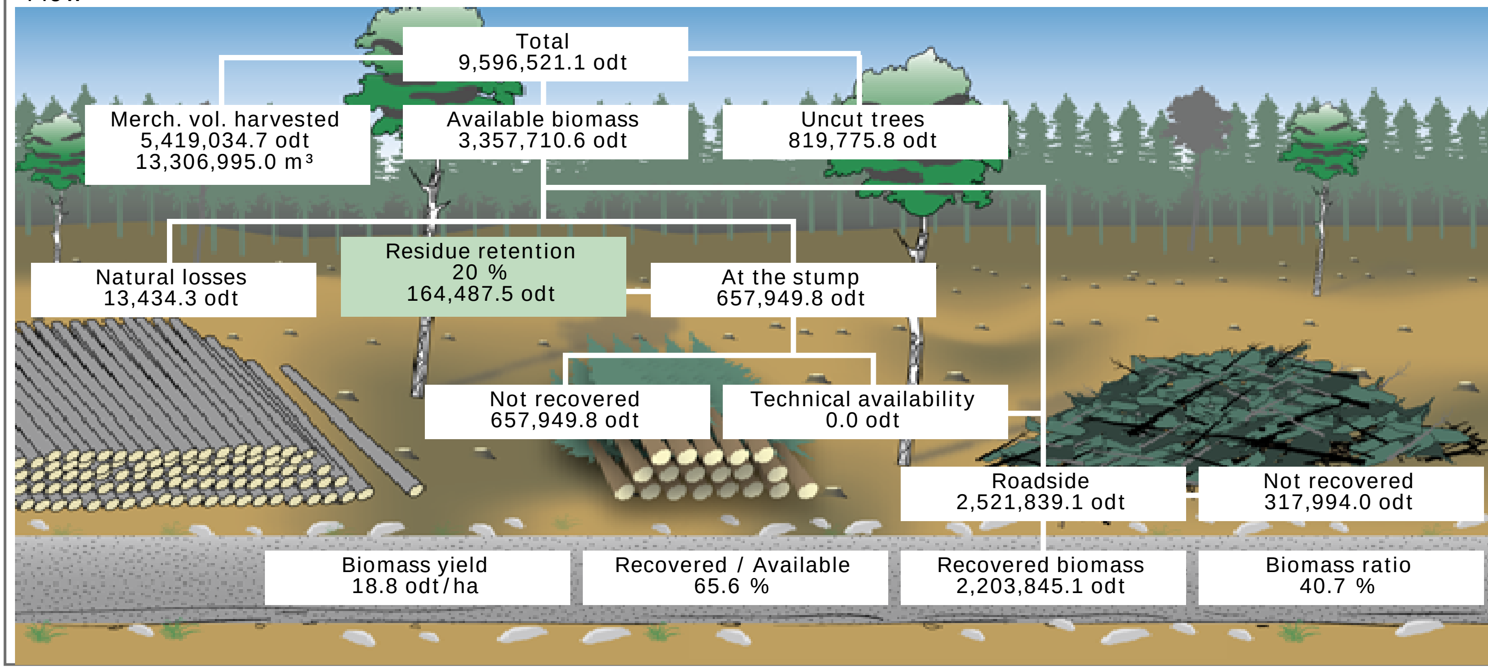
Revenue

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

Net

Profit	-70.48 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Lodgepole pine-sawlog (residues)	602,417.3	0.1073	5.14
Lodgepole pine-biomass	572,677.9	0.4760	4.89
Douglas fir (residues)	430,225.8	0.2147	3.67
Hybrid spruce (residues)	327,649.6	0.1293	2.80
Lodgepole pine-biomass (residues)	129,089.4	0.1073	1.10
Trembling aspen (residues)	94,474.7	0.1151	0.81
Abies lasiocarpa (residues)	26,498.5	0.0947	0.23
Western redcedar (residues)	10,355.1	0.1118	0.09
Paper birch (residues)	9,294.1	0.1831	0.08
Ponderosa pine (residues)	659.2	0.2619	0.01
Black spruce (residues)	260.6	0.1143	0.00
Western hemlock (residues)	243.0	0.1093	0.00
	2,203,845.1	0.1596	18.81

Recovery summary

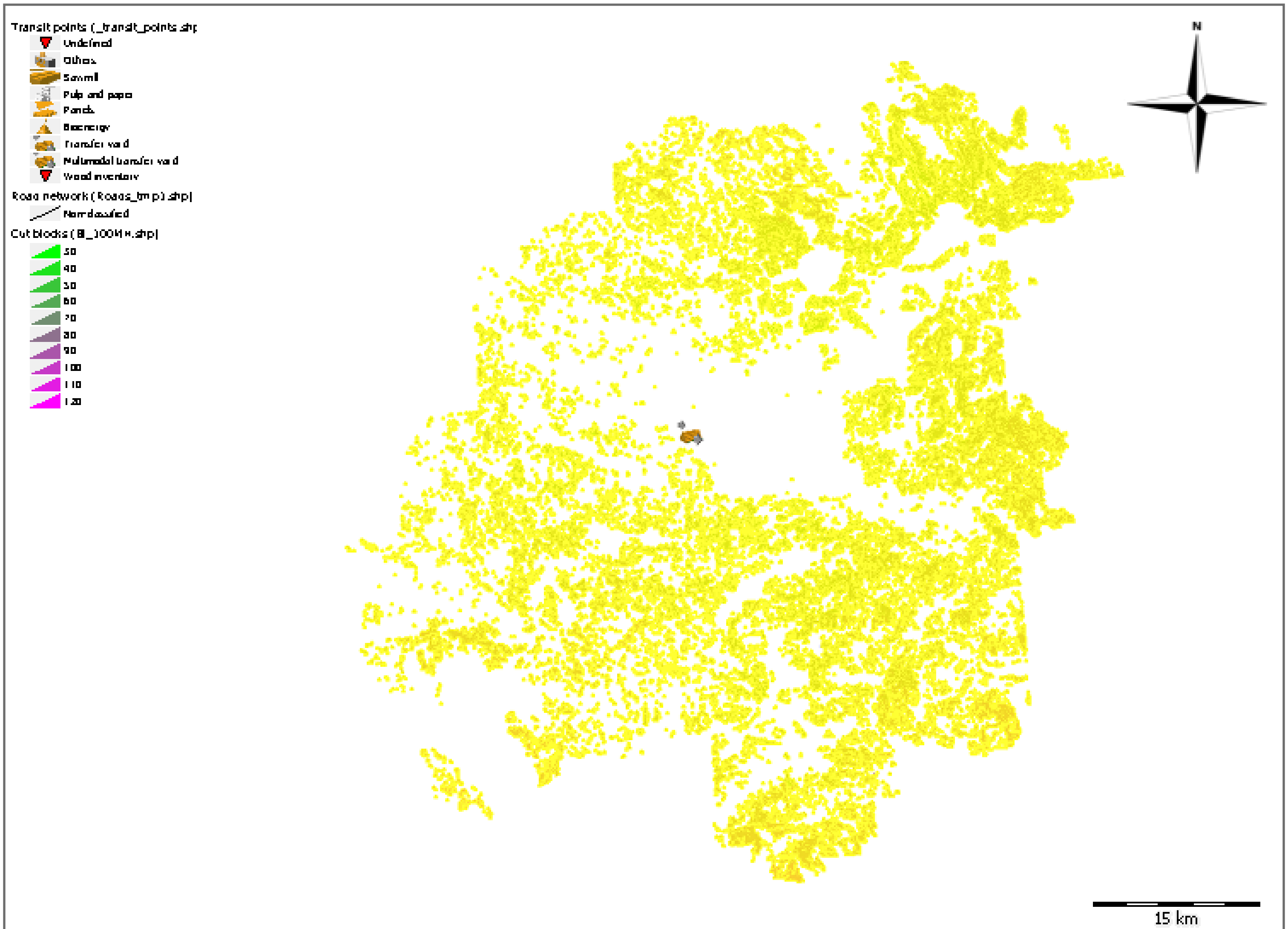
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	2,203,845.1	117,142.5	2,397
• Recovery season			
Summer	0.0	0.0	0
Winter	2,203,845.1	117,142.5	2,397
• Residue freshness			
Fresh	2,203,845.1	117,142.5	2,397
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	10,640.9	10,640.9
40 $/odt	0.0	282,648.2	282,648.2
50 $/odt	0.0	920,962.2	920,962.2
60 $/odt	0.0	1,492,880.2	1,492,880.2
70 $/odt	0.0	1,611,787.9	1,611,787.9
80 $/odt	0.0	1,624,905.5	1,624,905.5
90 $/odt	184.8	1,631,167.2	1,631,352.0
100 $/odt	24,140.9	1,631,167.2	1,655,308.1
110 $/odt	243,781.7	1,631,167.2	1,874,948.9
120 $/odt	431,290.0	1,631,167.2	2,062,457.2
130 $/odt	519,719.3	1,631,167.2	2,150,886.5
140 $/odt	562,545.8	1,631,167.2	2,193,713.0
150 $/odt	570,171.3	1,631,167.2	2,201,338.5
160 $/odt	572,644.0	1,631,167.2	2,203,811.3
170 $/odt	572,677.9	1,631,167.2	2,203,845.1
Maximum cost	169.66 $/odt	88.23 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	26,498	81
	Black spruce (residues)	Chips	261	85
	Douglas fir (residues)	Chips	430,226	61
	Hybrid spruce (residues)	Chips	327,650	70
	Lodgepole pine-biomass	Chips	572,678	63
	Lodgepole pine-biomass (residues)	Chips	129,089	63
	Lodgepole pine-sawlog (residues)	Chips	602,417	63
	Paper birch (residues)	Chips	9,294	59
	Ponderosa pine (residues)	Chips	659	64
	Trembling aspen (residues)	Chips	94,475	57
	Western hemlock (residues)	Chips	243	91
	Western redcedar (residues)	Chips	10,355	86
			2,203,845	64
			2,203,845	64



2397 selected site(s) / 2397

Area covered: 117,143 ha / 117,143 ha

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	117,142.5 ha
Number of cut blocks	2397
Recovered biomass	2,203,845.1 odt
Biomass yield	18.8 odt/ha
Biomass odt / Merchantable m³	0.1596 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	38 : 1
Available energy	8,114,909 MWh
Fuel consumption	11.1 L/odt

Cost

Harvesting	17.99 $/odt
Biomass recovery	23.25 $/odt
Transfer yard	0.00 $/odt
Transportation	31.29 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.11 $/odt
Indirect costs	0.00 $/odt
Total	73.64 $/odt

Revenue

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

Net

Profit	-73.64 $/odt

FPInterface™

Summary report
Biomass
[100MH - 18mar2014]

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	42,144.5 ha
Number of cut blocks	976
Recovered biomass	831,151.7 odt
Biomass yield	19.7 odt/ha
Biomass odt / Merchantable m³	0.1571 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	38 : 1
Available energy	3,063,276 MWh
Fuel consumption	11.1 L/odt

Cost

Harvesting	20.29 $/odt
Biomass recovery	23.25 $/odt
Transfer yard	0.00 $/odt
Transportation	31.22 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.13 $/odt
Indirect costs	0.00 $/odt
Total	75.89 $/odt

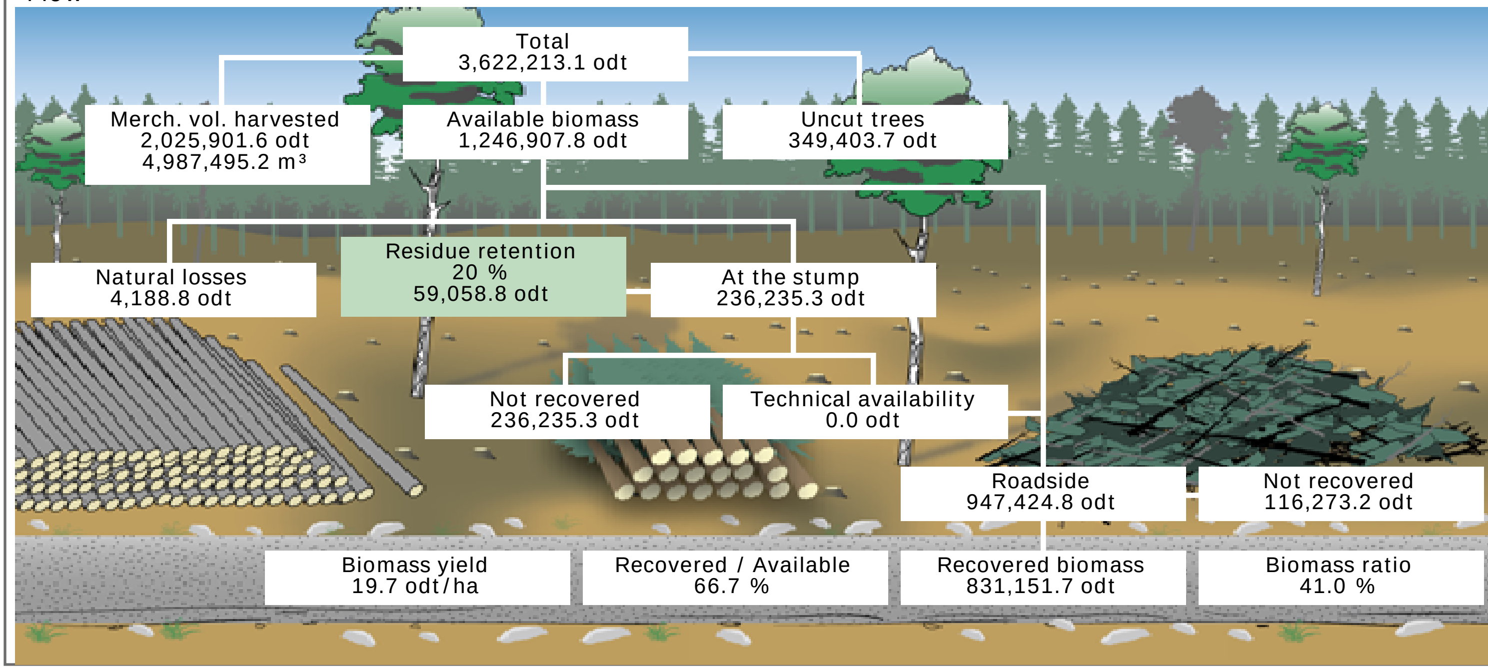
Revenue

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

Net

Profit	-75.89 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Lodgepole pine-sawlog (residues)	252,672.1	0.1046	6.00
Lodgepole pine-biomass	245,485.1	0.4743	5.82
Douglas fir (residues)	123,596.0	0.2151	2.93
Hybrid spruce (residues)	110,085.3	0.1280	2.61
Lodgepole pine-biomass (residues)	54,144.0	0.1046	1.28
Trembling aspen (residues)	30,889.9	0.1153	0.73
Abies lasiocarpa (residues)	8,817.9	0.0932	0.21
Western redcedar (residues)	3,476.5	0.1034	0.08
Paper birch (residues)	1,777.1	0.1838	0.04
Ponderosa pine (residues)	94.9	0.2520	0.00
Black spruce (residues)	73.0	0.1143	0.00
Western hemlock (residues)	39.6	0.0874	0.00
	831,151.7	0.1571	19.72

Recovery summary

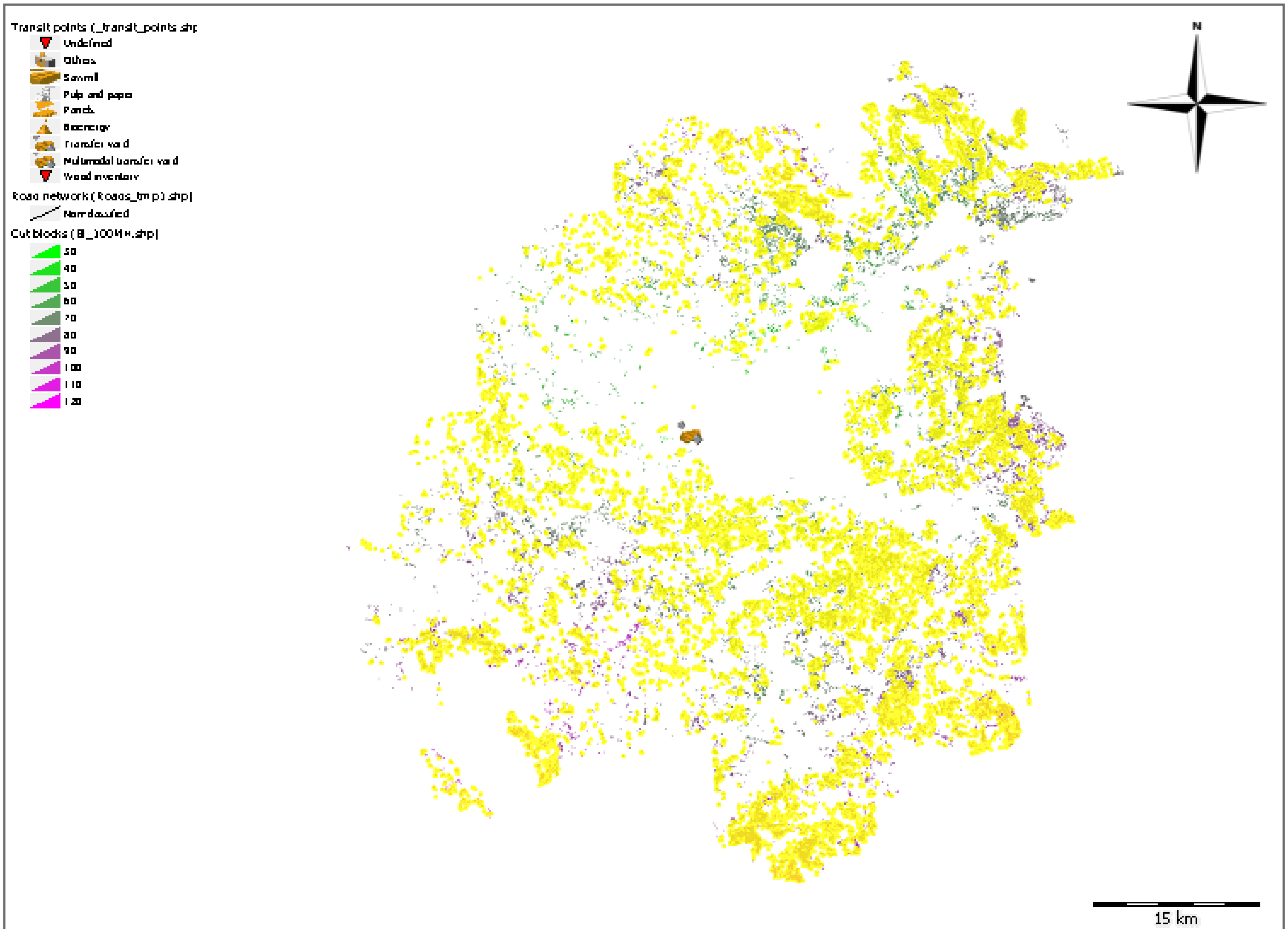
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	831,151.7	42,144.5	976
• Recovery season			
Summer	0.0	0.0	0
Winter	831,151.7	42,144.5	976
• Residue freshness			
Fresh	831,151.7	42,144.5	976
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	543.8	543.8
40 $/odt	0.0	59,134.1	59,134.1
50 $/odt	0.0	261,067.8	261,067.8
60 $/odt	0.0	466,919.4	466,919.4
70 $/odt	0.0	569,836.4	569,836.4
80 $/odt	0.0	581,405.8	581,405.8
90 $/odt	21.6	585,666.6	585,688.2
100 $/odt	2,338.8	585,666.6	588,005.3
110 $/odt	65,374.4	585,666.6	651,040.9
120 $/odt	176,584.7	585,666.6	762,251.3
130 $/odt	216,053.0	585,666.6	801,719.6
140 $/odt	236,583.0	585,666.6	822,249.5
150 $/odt	243,054.7	585,666.6	828,721.3
160 $/odt	245,485.1	585,666.6	831,151.7
Maximum cost	163.08 $/odt	91.38 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	8,818	83
	Black spruce (residues)	Chips	73	86
	Douglas fir (residues)	Chips	123,596	62
	Hybrid spruce (residues)	Chips	110,085	73
	Lodgepole pine-biomass	Chips	245,485	63
	Lodgepole pine-biomass (residues)	Chips	54,144	64
	Lodgepole pine-sawlog (residues)	Chips	252,672	64
	Paper birch (residues)	Chips	1,777	59
	Ponderosa pine (residues)	Chips	95	66
	Trembling aspen (residues)	Chips	30,890	56
	Western hemlock (residues)	Chips	40	99
	Western redcedar (residues)	Chips	3,477	91
			831,152	64
			831,152	64

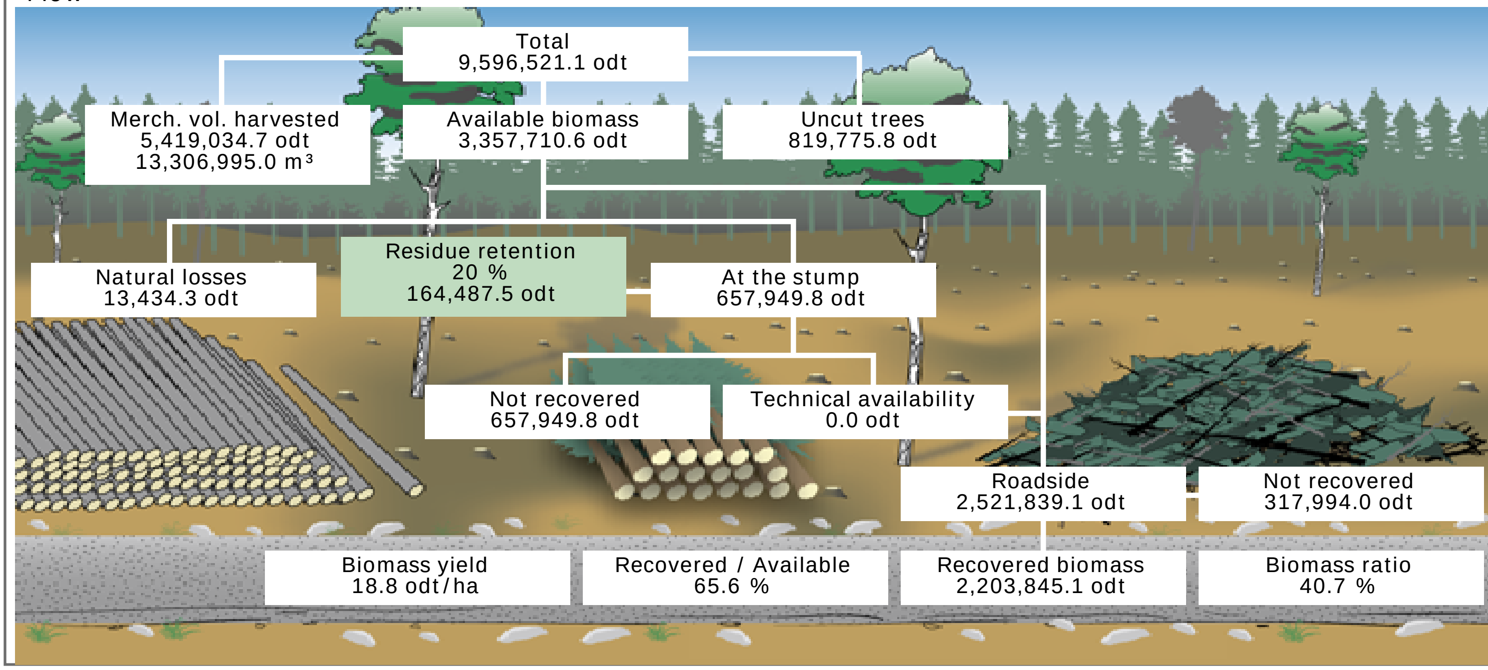


976 selected site(s) / 2397

Area covered: 42,144 ha / 117,143 ha

FPInnovations

Flow



Products

Product name	odt	odt/m³	odt/ha
Lodgepole pine-sawlog (residues)	602,417.3	0.1073	5.14
Lodgepole pine-biomass	572,677.9	0.4760	4.89
Douglas fir (residues)	430,225.8	0.2147	3.67
Hybrid spruce (residues)	327,649.6	0.1293	2.80
Lodgepole pine-biomass (residues)	129,089.4	0.1073	1.10
Trembling aspen (residues)	94,474.7	0.1151	0.81
Abies lasiocarpa (residues)	26,498.5	0.0947	0.23
Western redcedar (residues)	10,355.1	0.1118	0.09
Paper birch (residues)	9,294.1	0.1831	0.08
Ponderosa pine (residues)	659.2	0.2619	0.01
Black spruce (residues)	260.6	0.1143	0.00
Western hemlock (residues)	243.0	0.1093	0.00
	2,203,845.1	0.1596	18.81

Recovery summary

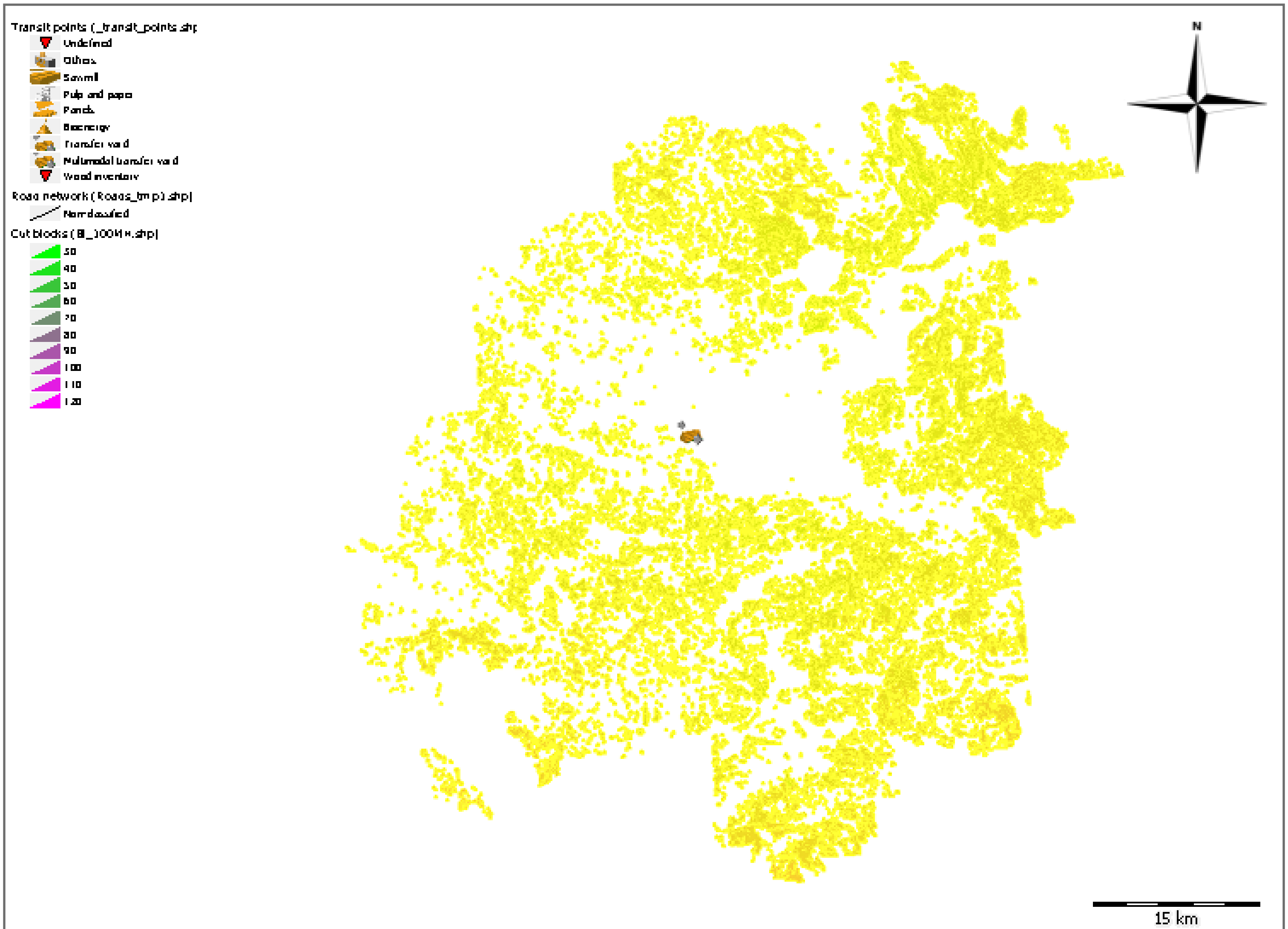
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	2,203,845.1	117,142.5	2,397
• Recovery season			
Summer	0.0	0.0	0
Winter	2,203,845.1	117,142.5	2,397
• Residue freshness			
Fresh	2,203,845.1	117,142.5	2,397
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	1,510.0	1,510.0
40 $/odt	0.0	151,183.5	151,183.5
50 $/odt	0.0	708,819.1	708,819.1
60 $/odt	0.0	1,351,749.5	1,351,749.5
70 $/odt	0.0	1,601,703.9	1,601,703.9
80 $/odt	0.0	1,622,227.5	1,622,227.5
90 $/odt	22.5	1,631,167.2	1,631,189.7
100 $/odt	4,243.1	1,631,167.2	1,635,410.3
110 $/odt	142,241.4	1,631,167.2	1,773,408.6
120 $/odt	391,628.9	1,631,167.2	2,022,796.1
130 $/odt	500,539.8	1,631,167.2	2,131,707.1
140 $/odt	554,494.3	1,631,167.2	2,185,661.5
150 $/odt	568,549.5	1,631,167.2	2,199,716.7
160 $/odt	572,618.8	1,631,167.2	2,203,786.0
170 $/odt	572,677.9	1,631,167.2	2,203,845.1
Maximum cost	172.82 $/odt	91.38 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	26,498	81
	Black spruce (residues)	Chips	261	85
	Douglas fir (residues)	Chips	430,226	61
	Hybrid spruce (residues)	Chips	327,650	70
	Lodgepole pine-biomass	Chips	572,678	63
	Lodgepole pine-biomass (residues)	Chips	129,089	63
	Lodgepole pine-sawlog (residues)	Chips	602,417	63
	Paper birch (residues)	Chips	9,294	59
	Ponderosa pine (residues)	Chips	659	64
	Trembling aspen (residues)	Chips	94,475	57
	Western hemlock (residues)	Chips	243	91
	Western redcedar (residues)	Chips	10,355	86
			2,203,845	64
			2,203,845	64



2397 selected site(s) / 2397

Area covered: 117,143 ha / 117,143 ha

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	44,159.9 ha
Number of cut blocks	1045
Recovered biomass	874,636.3 odt
Biomass yield	19.8 odt/ha
Biomass odt / Merchantable m³	0.1771 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	38 : 1
Available energy	3,222,344 MWh
Fuel consumption	11.0 L/odt

Cost

Harvesting	18.38 $/odt
Biomass recovery	23.25 $/odt
Transfer yard	0.00 $/odt
Transportation	31.17 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.07 $/odt
Indirect costs	0.00 $/odt
Total	73.87 $/odt

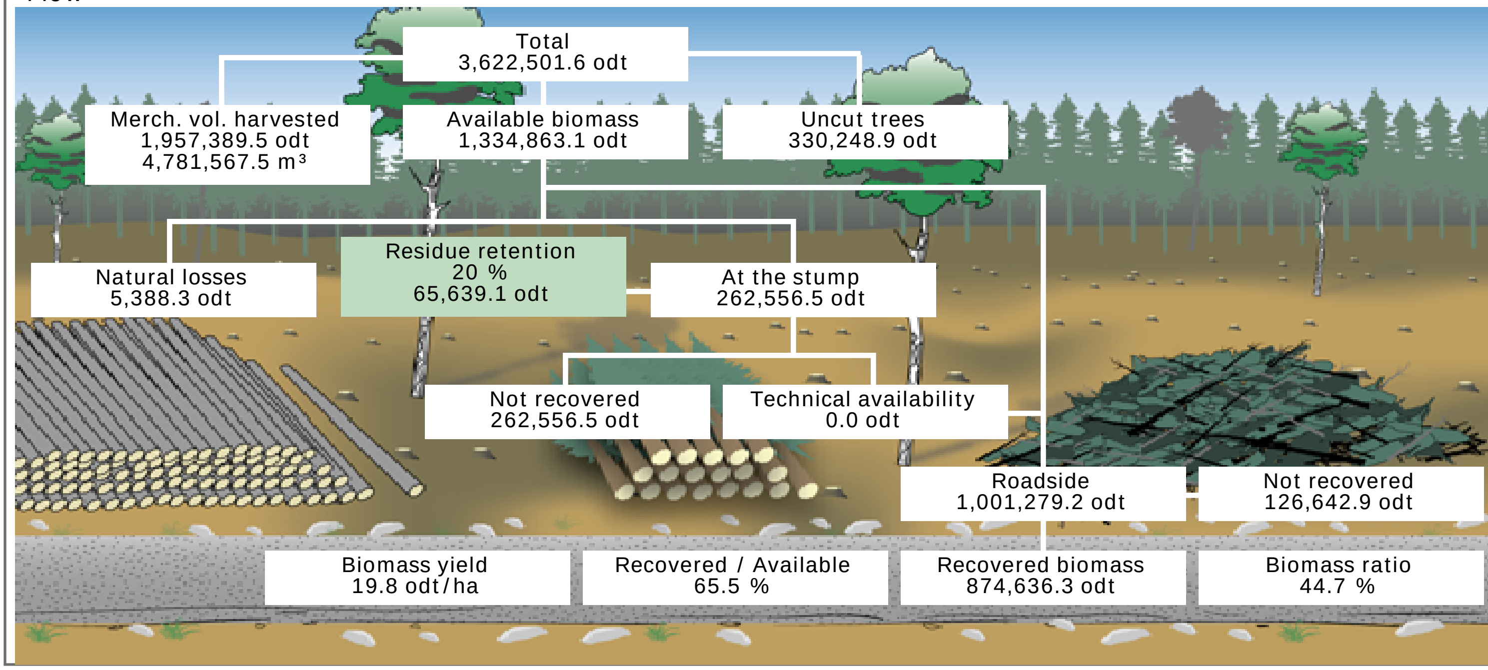
Revenue

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

Net

Profit	-73.87 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Lodgepole pine-sawlog (residues)	263,115.4	0.1226	5.96
Lodgepole pine-biomass	223,715.0	0.4865	5.07
Douglas fir (residues)	177,670.0	0.2459	4.02
Hybrid spruce (residues)	102,429.7	0.1391	2.32
Lodgepole pine-biomass (residues)	56,381.9	0.1226	1.28
Trembling aspen (residues)	40,044.7	0.1259	0.91
Abies lasiocarpa (residues)	6,531.8	0.0974	0.15
Paper birch (residues)	2,756.4	0.1898	0.06
Western redcedar (residues)	1,350.4	0.1173	0.03
Ponderosa pine (residues)	542.8	0.2696	0.01
Black spruce (residues)	84.9	0.1219	0.00
Western hemlock (residues)	13.4	0.1148	0.00
	874,636.3	0.1771	19.81

Recovery summary

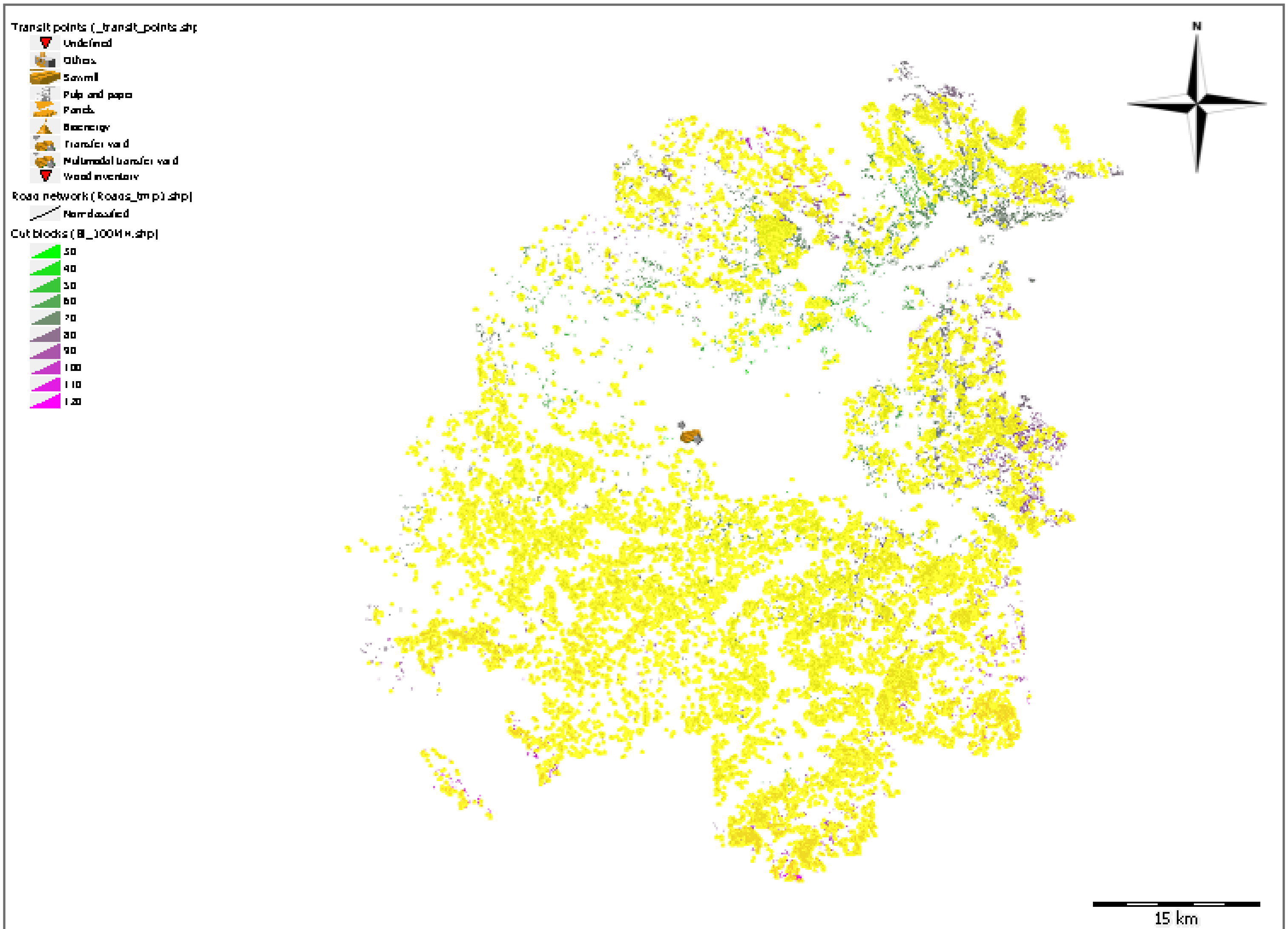
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	874,636.3	44,159.9	1,045
• Recovery season			
Summer	0.0	0.0	0
Winter	874,636.3	44,159.9	1,045
• Residue freshness			
Fresh	874,636.3	44,159.9	1,045
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	729.1	729.1
40 $/odt	0.0	63,040.1	63,040.1
50 $/odt	0.0	278,900.6	278,900.6
60 $/odt	0.0	545,868.4	545,868.4
70 $/odt	0.0	642,505.8	642,505.8
80 $/odt	0.0	647,005.4	647,005.4
90 $/odt	0.0	650,921.3	650,921.3
100 $/odt	487.3	650,921.3	651,408.6
110 $/odt	42,278.2	650,921.3	693,199.5
120 $/odt	128,121.8	650,921.3	779,043.1
130 $/odt	182,624.3	650,921.3	833,545.6
140 $/odt	214,896.4	650,921.3	865,817.7
150 $/odt	222,154.9	650,921.3	873,076.3
160 $/odt	223,655.8	650,921.3	874,577.1
170 $/odt	223,715.0	650,921.3	874,636.3
Maximum cost	172.82 $/odt	91.36 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	6,532	80
	Black spruce (residues)	Chips	85	85
	Douglas fir (residues)	Chips	177,670	62
	Hybrid spruce (residues)	Chips	102,430	69
	Lodgepole pine-biomass	Chips	223,715	62
	Lodgepole pine-biomass (residues)	Chips	56,382	63
	Lodgepole pine-sawlog (residues)	Chips	263,115	63
	Paper birch (residues)	Chips	2,756	57
	Ponderosa pine (residues)	Chips	543	63
	Trembling aspen (residues)	Chips	40,045	56
	Western hemlock (residues)	Chips	13	94
	Western redcedar (residues)	Chips	1,350	88
			874,636	63
			874,636	63



1045 selected site(s) / 2397

Area covered: 44,160 ha / 117,143 ha

FPInterface™

Summary report

Biomass

[100MH - 18mar2014]

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	14,006.8 ha
Number of cut blocks	165
Recovered biomass	204,147.7 odt
Biomass yield	14.6 odt/ha
Biomass odt / Merchantable m³	0.1351 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	37 : 1
Available energy	749,715 MWh
Fuel consumption	11.4 L/odt

Cost

Harvesting	13.31 $/odt
Biomass recovery	23.25 $/odt
Transfer yard	0.00 $/odt
Transportation	32.20 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.18 $/odt
Indirect costs	0.00 $/odt
Total	69.93 $/odt

Revenue

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

Net

Profit	-69.93 $/odt

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Statistics - Selected Items

Area	16,831.4 ha
Number of cut blocks	211
Recovered biomass	293,909.5 odt
Biomass yield	17.5 odt/ha
Biomass odt / Merchantable m³	0.1421 odt/m³
Delivered products	
• Chips	100 %
• Bundles	0 %
• Trunks and Residues	0 %
Energy balance	38 : 1
Available energy	1,079,573 MWh
Fuel consumption	11.1 L/odt

Cost

Harvesting	13.59 $/odt
Biomass recovery	23.25 $/odt
Transfer yard	0.00 $/odt
Transportation	31.21 $/odt
Loading/unloading	0.00 $/odt
Stumpage fees	0.00 $/odt
Road network - Maintenance	1.10 $/odt
Indirect costs	0.00 $/odt
Total	69.15 $/odt

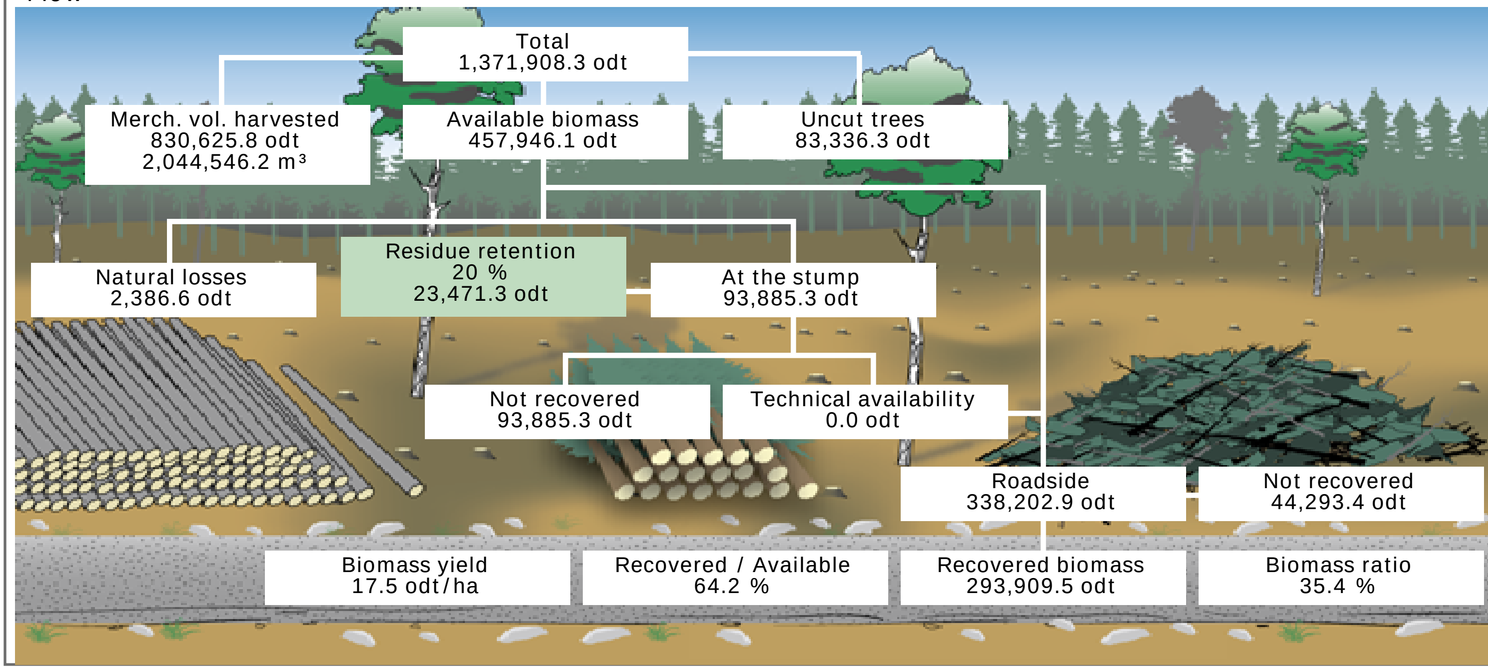
Revenue

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

Net

Profit	-69.15 $/odt

Flow



Products

Product name	odt	odt/m³	odt/ha
Douglas fir (residues)	76,355.1	0.1870	4.54
Hybrid spruce (residues)	65,468.4	0.1254	3.89
Lodgepole pine-biomass	61,152.1	0.4604	3.63
Lodgepole pine-sawlog (residues)	52,661.4	0.0850	3.13
Trembling aspen (residues)	14,846.9	0.1021	0.88
Lodgepole pine-biomass (residues)	11,284.6	0.0850	0.67
Abies lasiocarpa (residues)	6,267.6	0.0959	0.37
Western redcedar (residues)	2,915.4	0.1187	0.17
Paper birch (residues)	2,789.7	0.1800	0.17
Western hemlock (residues)	109.4	0.1167	0.01
Black spruce (residues)	39.7	0.1106	0.00
Ponderosa pine (residues)	19.1	0.1727	0.00
	293,909.5	0.1421	17.46

Recovery summary

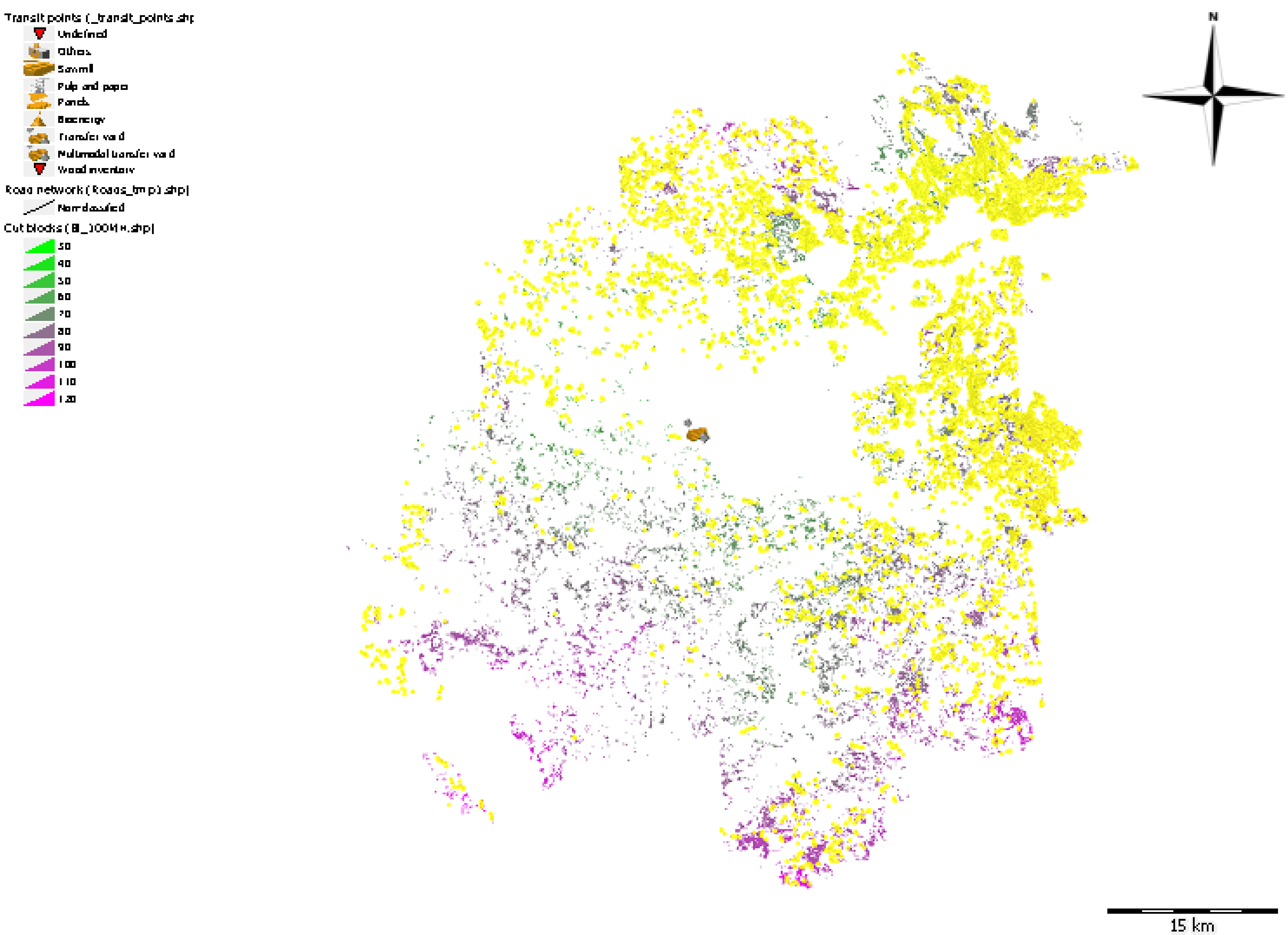
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	293,909.5	16,831.4	211
• Recovery season			
Summer	0.0	0.0	0
Winter	293,909.5	16,831.4	211
• Residue freshness			
Fresh	293,909.5	16,831.4	211
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	161.0	161.0
40 $/odt	0.0	19,420.6	19,420.6
50 $/odt	0.0	103,373.8	103,373.8
60 $/odt	0.0	201,899.5	201,899.5
70 $/odt	0.0	229,115.6	229,115.6
80 $/odt	0.0	232,215.7	232,215.7
90 $/odt	0.9	232,757.4	232,758.3
100 $/odt	1,021.0	232,757.4	233,778.4
110 $/odt	20,838.9	232,757.4	253,596.3
120 $/odt	50,671.1	232,757.4	283,428.5
130 $/odt	59,882.5	232,757.4	292,639.9
140 $/odt	60,795.5	232,757.4	293,552.9
150 $/odt	61,014.1	232,757.4	293,771.5
160 $/odt	61,152.1	232,757.4	293,909.5
Maximum cost	158.64 $/odt	90.07 $/odt	

Delivery to mills

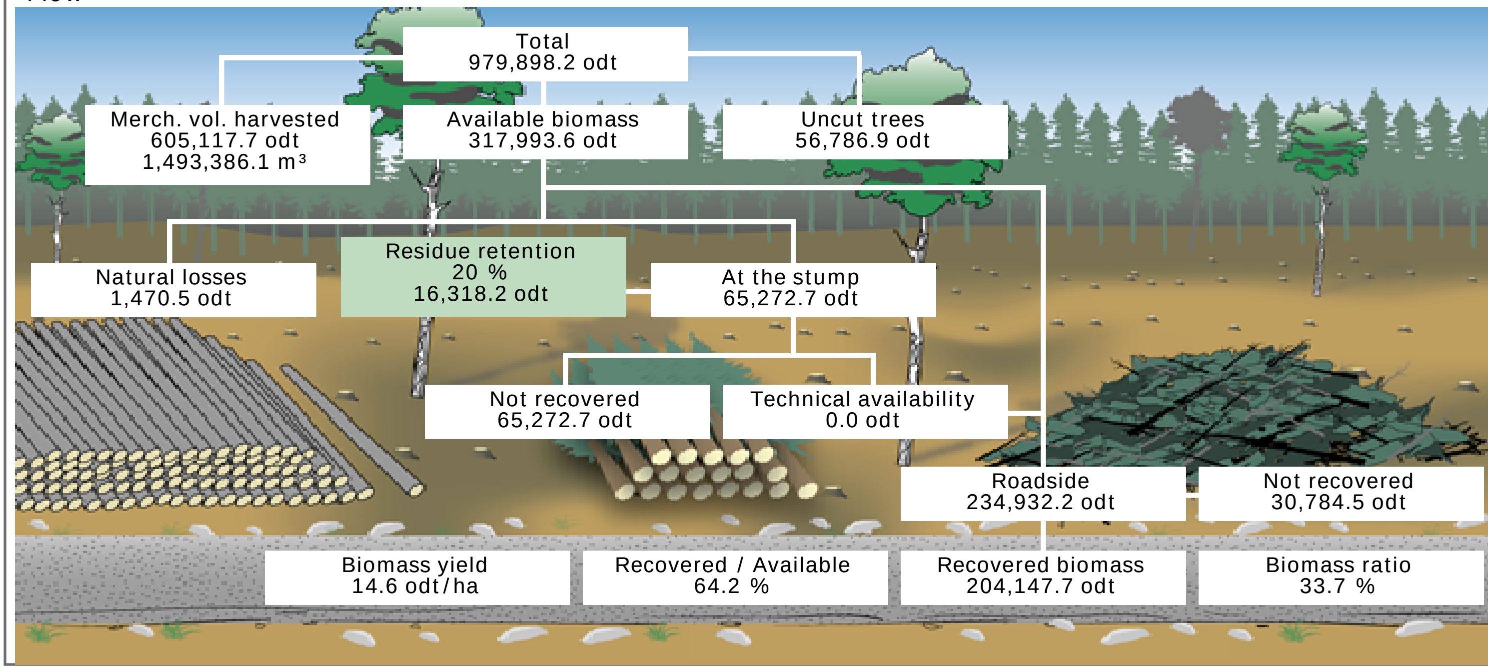
Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	6,268	80
	Black spruce (residues)	Chips	40	85
	Douglas fir (residues)	Chips	76,355	60
	Hybrid spruce (residues)	Chips	65,468	68
	Lodgepole pine-biomass	Chips	61,152	64
	Lodgepole pine-biomass (residues)	Chips	11,285	64
	Lodgepole pine-sawlog (residues)	Chips	52,661	64
	Paper birch (residues)	Chips	2,790	59
	Ponderosa pine (residues)	Chips	19	62
	Trembling aspen (residues)	Chips	14,847	57
	Western hemlock (residues)	Chips	109	89
	Western redcedar (residues)	Chips	2,915	81
			293,910	64
			293,910	64



211 selected site(s) / 2397

Area covered: 16,831 ha / 117,143 ha

Flow



Products

Product name	odt	odt/m³	odt/ha
Douglas fir (residues)	52,604.7	0.1760	3.76
Hybrid spruce (residues)	49,666.1	0.1197	3.55
Lodgepole pine-biomass	42,325.7	0.4554	3.02
Lodgepole pine-sawlog (residues)	33,968.4	0.0783	2.43
Trembling aspen (residues)	8,693.2	0.0971	0.62
Lodgepole pine-biomass (residues)	7,279.0	0.0783	0.52
Abies lasiocarpa (residues)	4,881.2	0.0926	0.35
Western redcedar (residues)	2,612.7	0.1139	0.19
Paper birch (residues)	1,970.9	0.1781	0.14
Western hemlock (residues)	80.6	0.1127	0.01
Black spruce (residues)	62.9	0.1077	0.00
Ponderosa pine (residues)	2.4	0.1527	0.00
	204,147.7	0.1351	14.57

Recovery summary

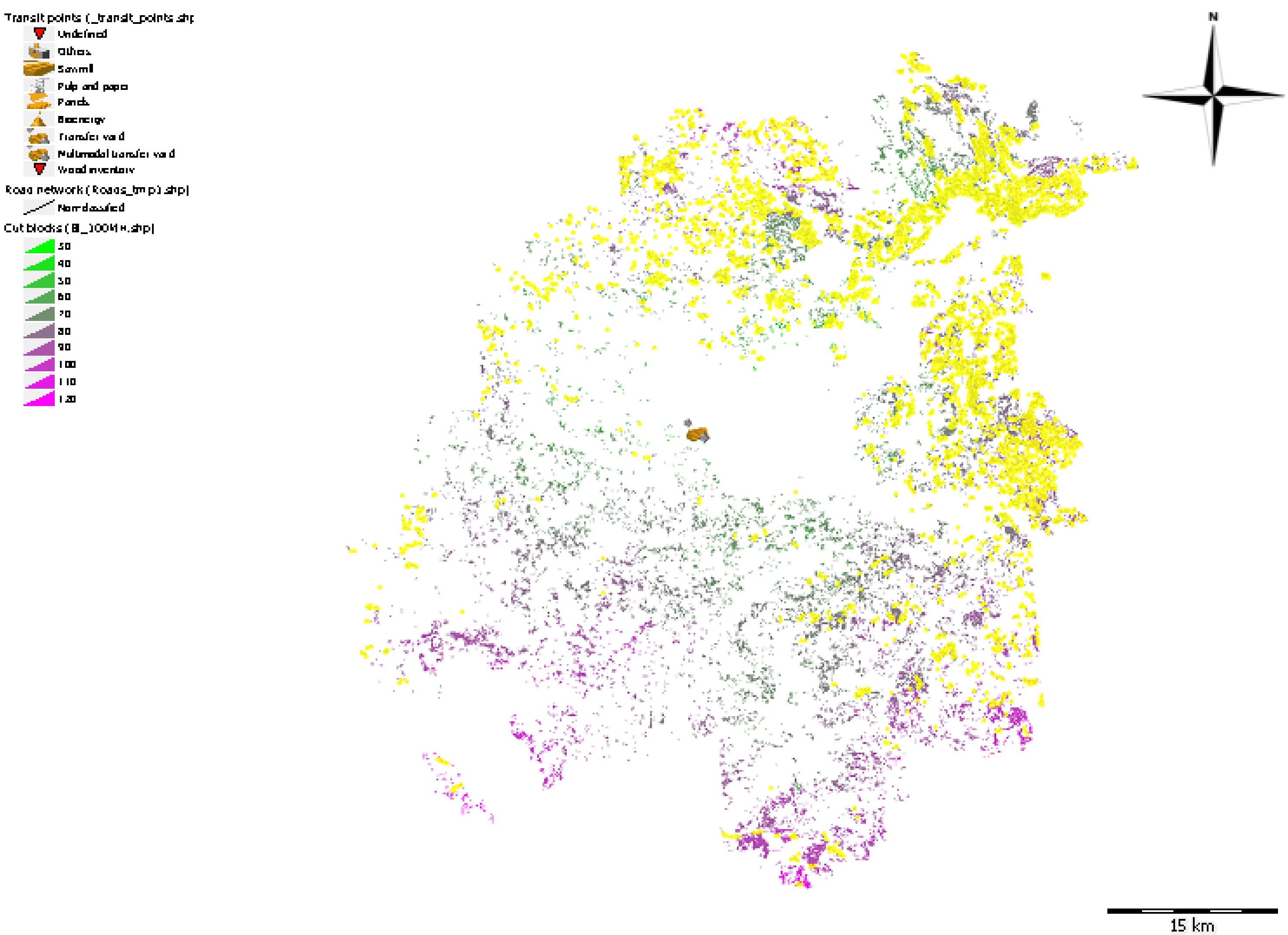
	Volume(odt)	Area(ha)	Number of cut blocks
• Biomass recovery location			
At the stump	0.0	0.0	0
Roadside	204,147.7	14,006.8	165
• Recovery season			
Summer	0.0	0.0	0
Winter	204,147.7	14,006.8	165
• Residue freshness			
Fresh	204,147.7	14,006.8	165
Brown	0.0	0.0	0
Brittle	0.0	0.0	0

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	76.0	76.0
40 $/odt	0.0	9,588.6	9,588.6
50 $/odt	0.0	65,476.9	65,476.9
60 $/odt	0.0	137,062.3	137,062.3
70 $/odt	0.0	160,246.0	160,246.0
80 $/odt	0.0	161,600.6	161,600.6
90 $/odt	0.0	161,822.0	161,822.0
100 $/odt	396.1	161,822.0	162,218.0
110 $/odt	13,750.0	161,822.0	175,571.9
120 $/odt	36,251.2	161,822.0	198,073.1
130 $/odt	41,980.1	161,822.0	203,802.0
140 $/odt	42,219.4	161,822.0	204,041.4
150 $/odt	42,325.7	161,822.0	204,147.7
Maximum cost	154.93 $/odt	85.64 $/odt	

Delivery to mills

Destination	Product	Format	odt	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa (residues)	Chips	4,881	81
	Black spruce (residues)	Chips	63	85
	Douglas fir (residues)	Chips	52,605	64
	Hybrid spruce (residues)	Chips	49,666	71
	Lodgepole pine-biomass	Chips	42,326	66
	Lodgepole pine-biomass (residues)	Chips	7,279	66
	Lodgepole pine-sawlog (residues)	Chips	33,968	66
	Paper birch (residues)	Chips	1,971	61
	Ponderosa pine (residues)	Chips	2	73
	Trembling aspen (residues)	Chips	8,693	62
	Western hemlock (residues)	Chips	81	89
	Western redcedar (residues)	Chips	2,613	84
			204,148	67
			204,148	67



165 selected site(s) / 2397

Area covered: 14,007 ha / 117,143 ha

FPInterface™

Summary report

Forest supply

[100MH - 5mar2014]

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	117,142.5 ha
Number of cut blocks	2397
Harvested volume	11,404,556 m^3
Average skidding dist.	250 m
Volume/km	0 m^3/km
Area/km	0 ha/km
Cut type	
Clearcut	117,142.5 ha
Harvesting system	
Full-tree with roadside processing	117,142.5 ha

Costs

Harvesting	27.76 $/$m^3$
Equipment transport	0.75 $/$m^3$
Road network - Construction	0.00 $/$m^3$
Road network - Repair	0.00 $/$m^3$
Road network - Improvement	0.00 $/$m^3$
Road network - Maintenance	0.46 $/$m^3$
Transportation	10.90 $/$m^3$
Loading/unloading	2.50 $/$m^3$
Transfer yard	0.00 $/$m^3$
Stumpage fees	0.00 $/$m^3$
Indirect costs	0.00 $/$m^3$
Stand establishment	N/A
Total	42.37 $/$m^3$

Revenue

Value	0.00 $/$m^3$
Reimbursements (silv.)	N/A

Net

Profit	-42.37 $/$m^3$

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	117,142.5 ha
Number of cut blocks	2397
Harvested volume	11,404,556 m^3
Average skidding dist.	250 m
Volume/km	0 m^3/km
Area/km	0 ha/km
Cut type	
Clearcut	117,142.5 ha
Harvesting system	
Full-tree with roadside processing	117,142.5 ha

Costs

Harvesting	27.76 $/m³
Equipment transport	0.75 $/m³
Road network - Construction	0.00 $/m³
Road network - Repair	0.00 $/m³
Road network - Improvement	0.00 $/m³
Road network - Maintenance	0.46 $/m³
Transportation	10.90 $/m³
Loading/unloading	2.50 $/m³
Transfer yard	0.00 $/m³
Stumpage fees	0.00 $/m³
Indirect costs	0.00 $/m³
Stand establishment	N/A
Total	42.37 $/m³

Revenue

Value	0.00 $/m³
Reimbursements (silv.)	N/A

Net

Profit	-42.37 $/m³

Products

Name	Format	m³	m³/ha	m³/stem	%/total
Lodgepole pine-sawlog	Logs	5,614,986	47.9	0.238	45
Hybrid spruce	Logs	2,533,604	21.6	0.323	20
Douglas fir	Logs	2,004,805	17.1	0.252	16
Lodgepole pine-biomass (Biomass *)	Logs	1,203,211	10.3	0.238	10
Trembling aspen	Logs	820,980	7.0	0.265	7
Abies lasiocarpa	Logs	279,759	2.4	0.383	2
Western redcedar	Logs	92,652	0.8	0.387	1
Paper birch	Logs	50,751	0.4	0.325	0
Ponderosa pine	Logs	2,517	0.0	0.150	0
Black spruce	Logs	2,280	0.0	0.379	0
Western hemlock	Logs	2,223	0.0	0.375	0
		12,607,767	107.6	0.289	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

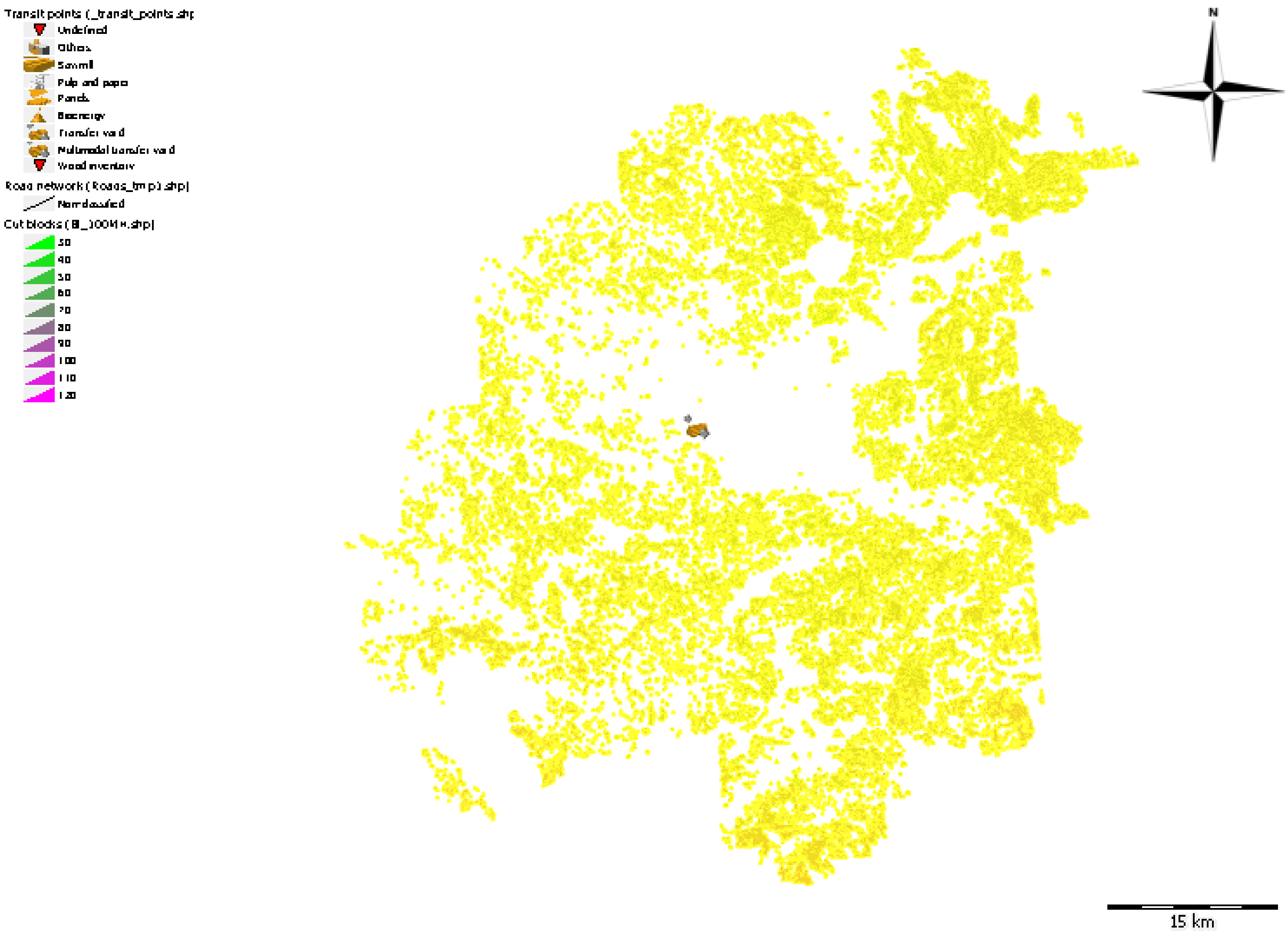
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	279,759	81
	Black spruce	Logs	2,280	85
	Douglas fir	Logs	2,004,805	61
	Hybrid spruce	Logs	2,533,604	71
	Lodgepole pine-sawlog	Logs	5,614,986	63
	Paper birch	Logs	50,751	59
	Ponderosa pine	Logs	2,517	64
	Trembling aspen	Logs	820,980	58
	Western hemlock	Logs	2,223	92
	Western redcedar	Logs	92,652	87
			11,404,556	65
			11,404,556	65

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	11,404,556	117,142.5
	11,404,556	117,142.5

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



2397 selected site(s) / 2397

Area covered: 117,143 ha / 117,143 ha

Products

Name	Format	m³	m³/ha	m³/stem	%/total
Lodgepole pine-sawlog	Logs	5,614,986	47.9	0.238	45
Hybrid spruce	Logs	2,533,604	21.6	0.323	20
Douglas fir	Logs	2,004,805	17.1	0.252	16
Lodgepole pine-biomass (Biomass *)	Logs	1,203,211	10.3	0.238	10
Trembling aspen	Logs	820,980	7.0	0.265	7
Abies lasiocarpa	Logs	279,759	2.4	0.383	2
Western redcedar	Logs	92,652	0.8	0.387	1
Paper birch	Logs	50,751	0.4	0.325	0
Ponderosa pine	Logs	2,517	0.0	0.150	0
Black spruce	Logs	2,280	0.0	0.379	0
Western hemlock	Logs	2,223	0.0	0.375	0
		12,607,767	107.6	0.289	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

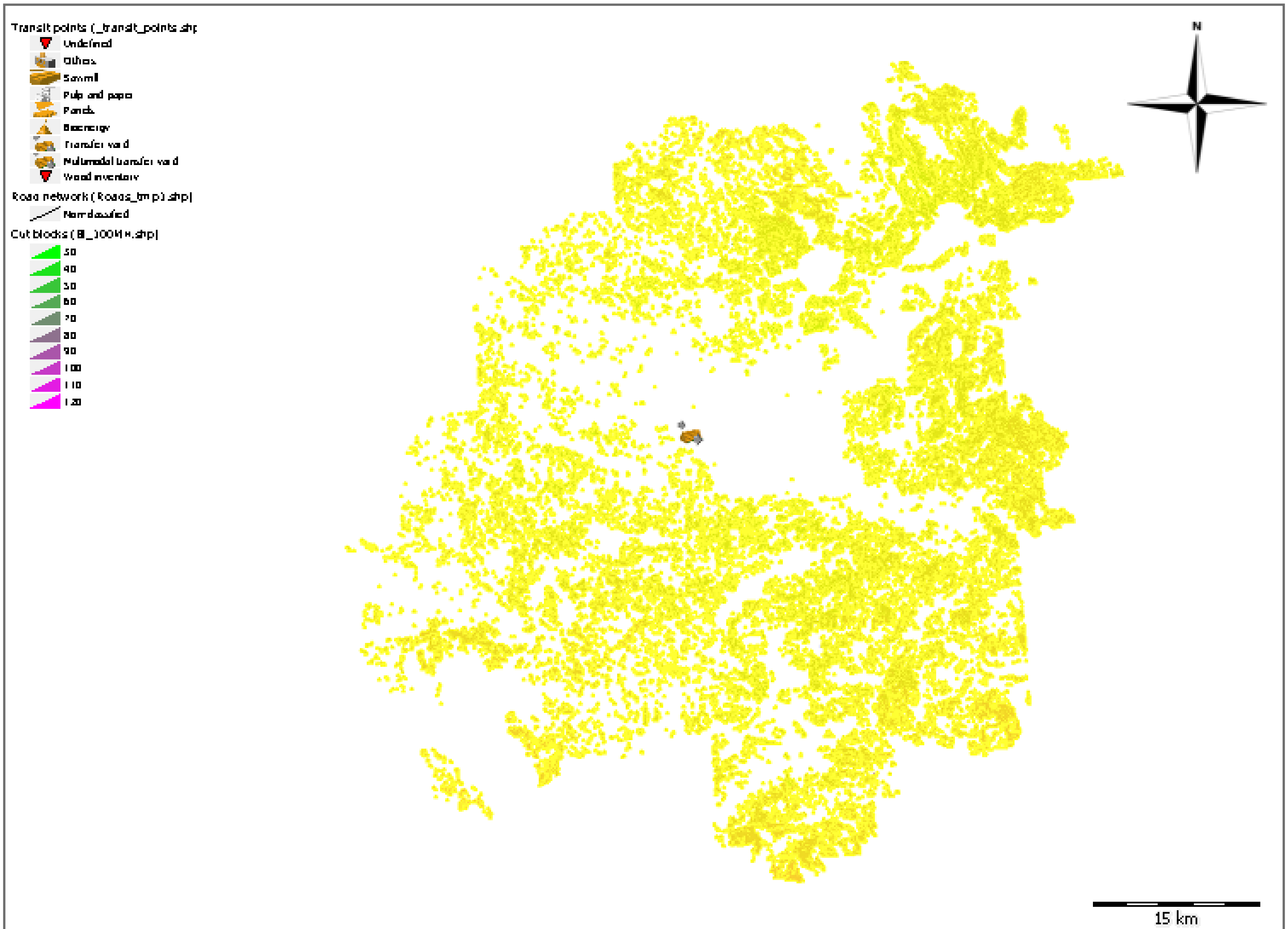
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	279,759	81
	Black spruce	Logs	2,280	85
	Douglas fir	Logs	2,004,805	61
	Hybrid spruce	Logs	2,533,604	71
	Lodgepole pine-sawlog	Logs	5,614,986	63
	Paper birch	Logs	50,751	59
	Ponderosa pine	Logs	2,517	64
	Trembling aspen	Logs	820,980	58
	Western hemlock	Logs	2,223	92
	Western redcedar	Logs	92,652	87
			11,404,556	65
			11,404,556	65

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	11,404,556	117,142.5
	11,404,556	117,142.5

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



2397 selected site(s) / 2397

Area covered: 117,143 ha / 117,143 ha

FPInterface™

Summary report
Forest supply
[100MH - 18mar2014]

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	117,142.5 ha
Number of cut blocks	2397
Harvested volume	11,404,556 m^3
Average skidding dist.	250 m
Volume/km	0 m^3/km
Area/km	0 ha/km

Cut type

Clearcut	117,142.5 ha

Harvesting system

Full-tree with roadside processing	117,142.5 ha

Costs

Harvesting	27.76 $/$m^3$
Equipment transport	0.75 $/$m^3$
Road network - Construction	0.00 $/$m^3$
Road network - Repair	0.00 $/$m^3$
Road network - Improvement	0.00 $/$m^3$
Road network - Maintenance	0.46 $/$m^3$
Transportation	10.90 $/$m^3$
Loading/unloading	2.50 $/$m^3$
Transfer yard	0.00 $/$m^3$
Stumpage fees	0.00 $/$m^3$
Indirect costs	0.00 $/$m^3$
Stand establishment	N/A
Total	42.37 $/$m^3$

Revenue

Value	0.00 $/$m^3$
Reimbursements (silv.)	N/A

Net

Profit	-42.37 $/$m^3$

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	42,144.5 ha
Number of cut blocks	976
Harvested volume	4,257,897 m^3
Average skidding dist.	250 m
Volume/km	0 m^3/km
Area/km	0 ha/km
Cut type	
Clearcut	42,144.5 ha
Harvesting system	
Full-tree with roadside processing	42,144.5 ha

Costs

Harvesting	27.65 $/$m^3$
Equipment transport	0.75 $/$m^3$
Road network - Construction	0.00 $/$m^3$
Road network - Repair	0.00 $/$m^3$
Road network - Improvement	0.00 $/$m^3$
Road network - Maintenance	0.47 $/$m^3$
Transportation	11.09 $/$m^3$
Loading/unloading	2.50 $/$m^3$
Transfer yard	0.00 $/$m^3$
Stumpage fees	0.00 $/$m^3$
Indirect costs	0.00 $/$m^3$
Stand establishment	N/A
Total	42.46 $/$m^3$

Revenue

Value	0.00 $/$m^3$
Reimbursements (silv.)	N/A

Net

Profit	-42.46 $/$m^3$

Products

Name	Format	m³	m³/ha	m³/stem	% / total
Lodgepole pine-sawlog	Logs	2,415,365	57.3	0.246	51
Hybrid spruce	Logs	860,047	20.4	0.330	18
Douglas fir	Logs	575,145	13.6	0.250	12
Lodgepole pine-biomass (Biomass *)	Logs	517,578	12.3	0.246	11
Trembling aspen	Logs	267,959	6.4	0.265	6
Abies lasiocarpa	Logs	94,611	2.2	0.398	2
Western redcedar	Logs	33,634	0.8	0.442	1
Paper birch	Logs	9,667	0.2	0.322	0
Black spruce	Logs	639	0.0	0.379	0
Western hemlock	Logs	453	0.0	0.526	0
Ponderosa pine	Logs	377	0.0	0.158	0
		4,775,475	113.3	0.297	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

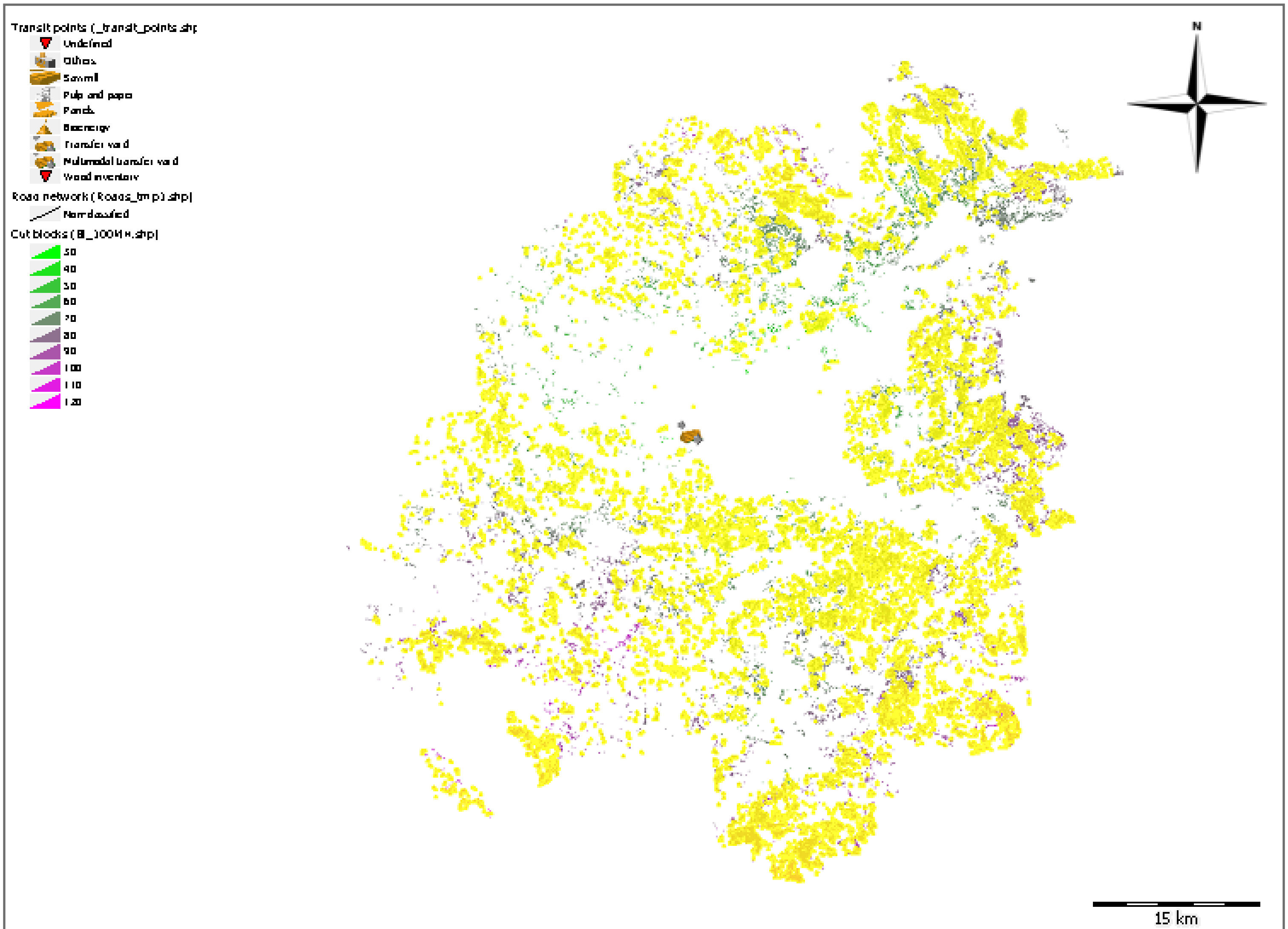
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	94,611	83
	Black spruce	Logs	639	86
	Douglas fir	Logs	575,145	61
	Hybrid spruce	Logs	860,047	74
	Lodgepole pine-sawlog	Logs	2,415,365	63
	Paper birch	Logs	9,667	59
	Ponderosa pine	Logs	377	66
	Trembling aspen	Logs	267,959	57
	Western hemlock	Logs	453	99
	Western redcedar	Logs	33,634	91
			4,257,897	65
			4,257,897	65

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	4,257,897	42,144.5
	4,257,897	42,144.5

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



976 selected site(s) / 2397

Area covered: 42,144 ha / 117,143 ha

Products

Name	Format	m³	m³/ha	m³/stem	%/total
Lodgepole pine-sawlog	Logs	5,614,986	47.9	0.238	45
Hybrid spruce	Logs	2,533,604	21.6	0.323	20
Douglas fir	Logs	2,004,805	17.1	0.252	16
Lodgepole pine-biomass (Biomass *)	Logs	1,203,211	10.3	0.238	10
Trembling aspen	Logs	820,980	7.0	0.265	7
Abies lasiocarpa	Logs	279,759	2.4	0.383	2
Western redcedar	Logs	92,652	0.8	0.387	1
Paper birch	Logs	50,751	0.4	0.325	0
Ponderosa pine	Logs	2,517	0.0	0.150	0
Black spruce	Logs	2,280	0.0	0.379	0
Western hemlock	Logs	2,223	0.0	0.375	0
		12,607,767	107.6	0.289	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

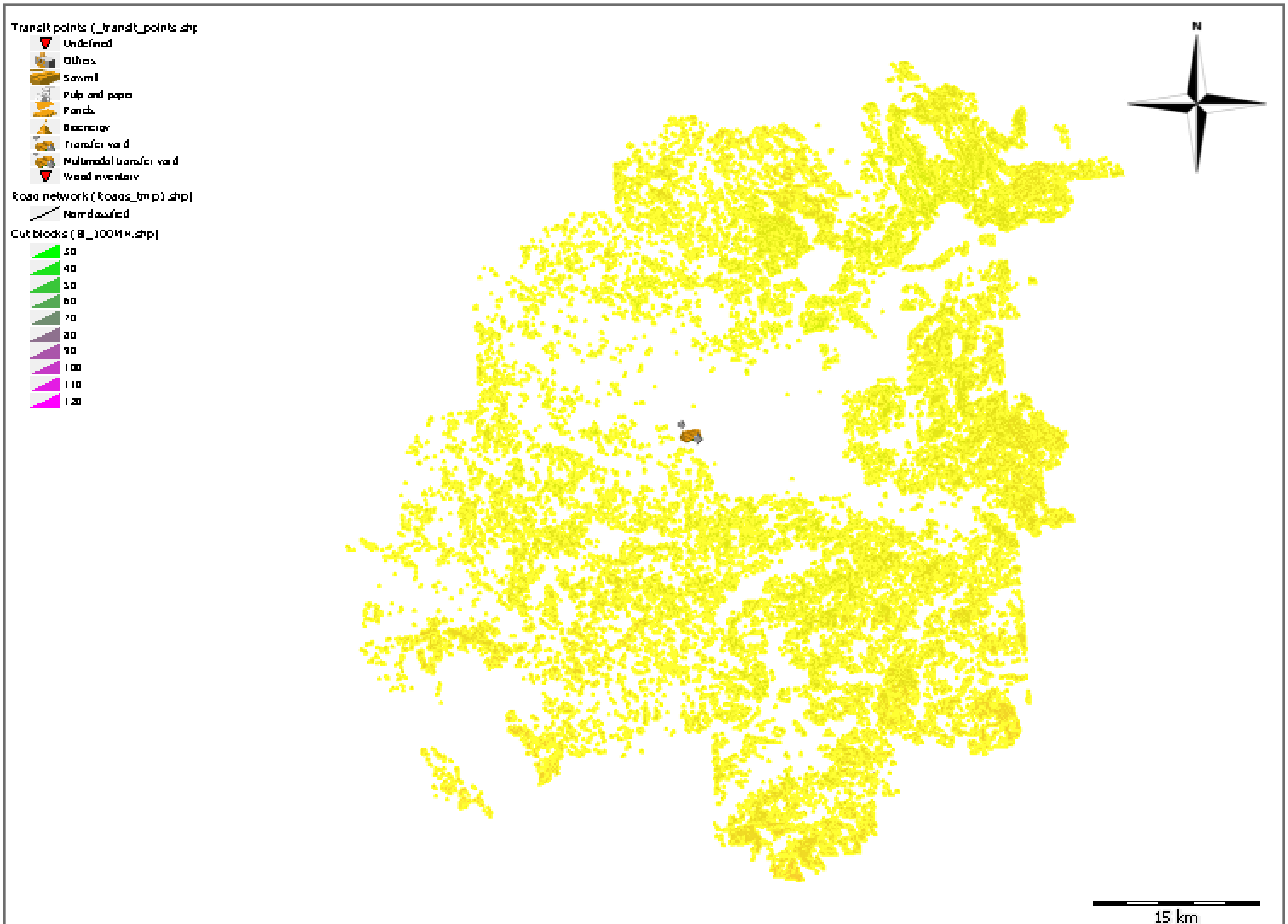
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	279,759	81
	Black spruce	Logs	2,280	85
	Douglas fir	Logs	2,004,805	61
	Hybrid spruce	Logs	2,533,604	71
	Lodgepole pine-sawlog	Logs	5,614,986	63
	Paper birch	Logs	50,751	59
	Ponderosa pine	Logs	2,517	64
	Trembling aspen	Logs	820,980	58
	Western hemlock	Logs	2,223	92
	Western redcedar	Logs	92,652	87
			11,404,556	65
			11,404,556	65

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	11,404,556	117,142.5
	11,404,556	117,142.5

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



2397 selected site(s) / 2397

Area covered: 117,143 ha / 117,143 ha

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	44,159.9 ha
Number of cut blocks	1045
Harvested volume	4,019,147 m^3
Average skidding dist.	250 m
Volume/km	0 m^3/km
Area/km	0 ha/km
Cut type	
Clearcut	44,159.9 ha
Harvesting system	
Full-tree with roadside processing	44,159.9 ha

Costs

Harvesting	28.83 $/$m^3$
Equipment transport	0.75 $/$m^3$
Road network - Construction	0.00 $/$m^3$
Road network - Repair	0.00 $/$m^3$
Road network - Improvement	0.00 $/$m^3$
Road network - Maintenance	0.44 $/$m^3$
Transportation	11.02 $/$m^3$
Loading/unloading	2.50 $/$m^3$
Transfer yard	0.00 $/$m^3$
Stumpage fees	0.00 $/$m^3$
Indirect costs	0.00 $/$m^3$
Stand establishment	N/A
Total	43.54 $/$m^3$

Revenue

Value	0.00 $/$m^3$
Reimbursements (silv.)	N/A

Net

Profit	-43.54 $/$m^3$

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	14,006.8 ha
Number of cut blocks	165
Harvested volume	1,324,914 m³
Average skidding dist.	250 m
Volume/km	0 m³/km
Area/km	0 ha/km
Cut type	
Clearcut	14,006.8 ha
Harvesting system	
Full-tree with roadside processing	14,006.8 ha

Costs

Harvesting	26.22 $/m³
Equipment transport	0.75 $/m³
Road network - Construction	0.00 $/m³
Road network - Repair	0.00 $/m³
Road network - Improvement	0.00 $/m³
Road network - Maintenance	0.49 $/m³
Transportation	10.62 $/m³
Loading/unloading	2.50 $/m³
Transfer yard	0.00 $/m³
Stumpage fees	0.00 $/m³
Indirect costs	0.00 $/m³
Stand establishment	N/A
Total	40.57 $/m³

Revenue

Value	0.00 $/m³
Reimbursements (silv.)	N/A

Net

Profit	-40.57 $/m³

Products

Name	Format	m³	m³/ha	m³/stem	%/total
Lodgepole pine-sawlog	Logs	433,707	31.0	0.362	31
Hybrid spruce	Logs	414,820	29.6	0.385	29
Douglas fir	Logs	298,829	21.3	0.356	21
Lodgepole pine-biomass (Biomass *)	Logs	92,937	6.6	0.362	7
Trembling aspen	Logs	89,505	6.4	0.367	6
Abies lasiocarpa	Logs	52,732	3.8	0.405	4
Western redcedar	Logs	22,940	1.6	0.375	2
Paper birch	Logs	11,065	0.8	0.351	1
Western hemlock	Logs	715	0.1	0.359	0
Black spruce	Logs	585	0.0	0.432	0
Ponderosa pine	Logs	16	0.0	0.321	0
		1,417,851	101.2	0.396	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

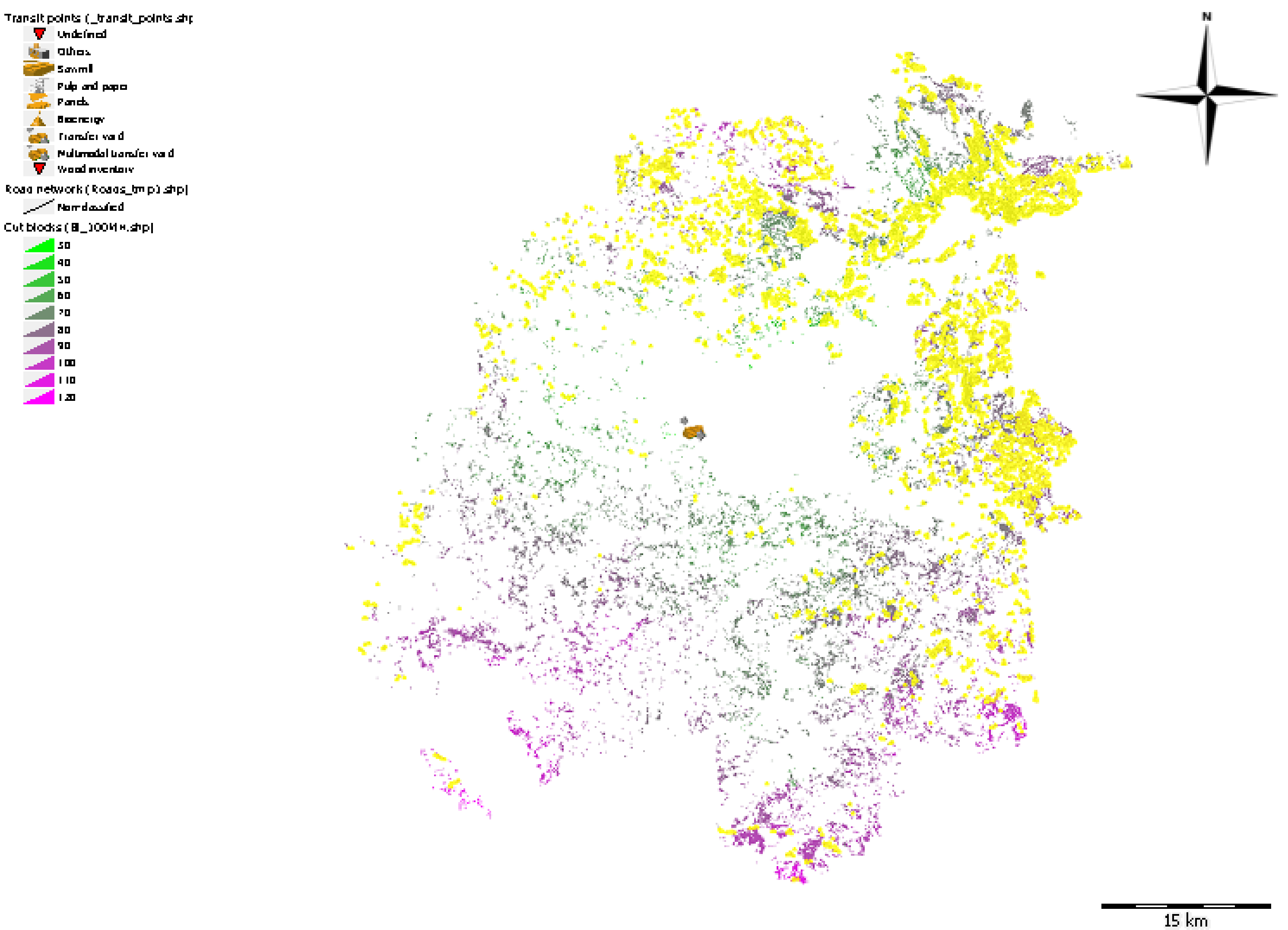
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	52,732	81
	Black spruce	Logs	585	85
	Douglas fir	Logs	298,829	65
	Hybrid spruce	Logs	414,820	71
	Lodgepole pine-sawlog	Logs	433,707	66
	Paper birch	Logs	11,065	62
	Ponderosa pine	Logs	16	73
	Trembling aspen	Logs	89,505	63
	Western hemlock	Logs	715	90
	Western redcedar	Logs	22,940	85
			1,324,914	68
			1,324,914	68

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	1,324,914	14,006.8
	1,324,914	14,006.8

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



165 selected site(s) / 2397

Area covered: 14,007 ha / 117,143 ha

Products

Name	Format	m³	m³/ha	m³/stem	%/total
Lodgepole pine-sawlog	Logs	2,146,029	48.6	0.202	48
Hybrid spruce	Logs	736,532	16.7	0.278	16
Douglas fir	Logs	722,555	16.4	0.205	16
Lodgepole pine-biomass (Biomass *)	Logs	459,863	10.4	0.202	10
Trembling aspen	Logs	318,137	7.2	0.227	7
Abies lasiocarpa	Logs	67,034	1.5	0.358	1
Paper birch	Logs	14,521	0.3	0.296	0
Western redcedar	Logs	11,513	0.3	0.358	0
Ponderosa pine	Logs	2,014	0.0	0.145	0
Black spruce	Logs	697	0.0	0.332	0
Western hemlock	Logs	117	0.0	0.349	0
		4,479,010	101.4	0.242	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

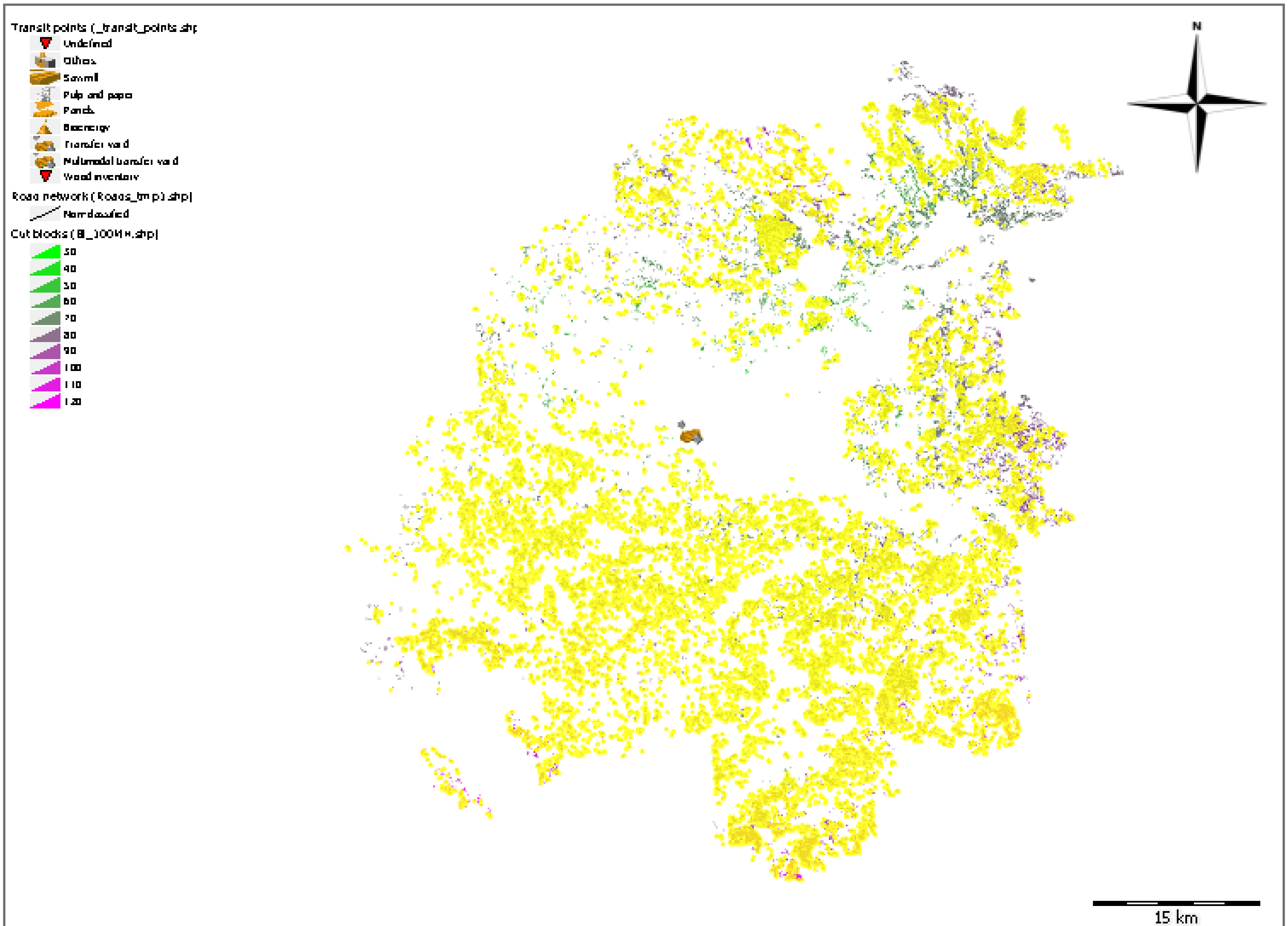
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	67,034	80
	Black spruce	Logs	697	85
	Douglas fir	Logs	722,555	61
	Hybrid spruce	Logs	736,532	69
	Lodgepole pine-sawlog	Logs	2,146,029	62
	Paper birch	Logs	14,521	58
	Ponderosa pine	Logs	2,014	64
	Trembling aspen	Logs	318,137	57
	Western hemlock	Logs	117	95
	Western redcedar	Logs	11,513	88
			4,019,147	63
			4,019,147	63

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	4,019,147	44,159.9
	4,019,147	44,159.9

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



1045 selected site(s) / 2397

Area covered: 44,160 ha / 117,143 ha

Territory:	Unknown territory
Sector:	Unknown sector
Cut block:	<Multiple selection>

Cut blocks

Area	16,831.4 ha
Number of cut blocks	211
Harvested volume	1,802,598 m³
Average skidding dist.	250 m
Volume/km	0 m³/km
Area/km	0 ha/km
Cut type	
Clearcut	16,831.4 ha
Harvesting system	
Full-tree with roadside processing	16,831.4 ha

Costs

Harvesting	26.67 $/m³
Equipment transport	0.75 $/m³
Road network - Construction	0.00 $/m³
Road network - Repair	0.00 $/m³
Road network - Improvement	0.00 $/m³
Road network - Maintenance	0.46 $/m³
Transportation	10.38 $/m³
Loading/unloading	2.50 $/m³
Transfer yard	0.00 $/m³
Stumpage fees	0.00 $/m³
Indirect costs	0.00 $/m³
Stand establishment	N/A
Total	40.75 $/m³

Revenue

Value	0.00 $/m³
Reimbursements (silv.)	N/A

Net

Profit	-40.75 $/m³

Products

Name	Format	m³	m³/ha	m³/stem	%/total
Lodgepole pine-sawlog	Logs	619,886	36.8	0.323	32
Hybrid spruce	Logs	522,204	31.0	0.347	27
Douglas fir	Logs	408,276	24.3	0.320	21
Trembling aspen	Logs	145,379	8.6	0.332	8
Lodgepole pine-biomass (Biomass *)	Logs	132,833	7.9	0.323	7
Abies lasiocarpa	Logs	65,382	3.9	0.372	3
Western redcedar	Logs	24,566	1.5	0.351	1
Paper birch	Logs	15,497	0.9	0.342	1
Western hemlock	Logs	938	0.1	0.342	0
Black spruce	Logs	359	0.0	0.408	0
Ponderosa pine	Logs	111	0.0	0.266	0
		1,935,430	115.0	0.356	100

** The merchantable product is for biomass and therefore its volume is not considered in the delivery to mills of this report, but rather in the delivery to mills of the biomass summary report.*

Delivery to mills

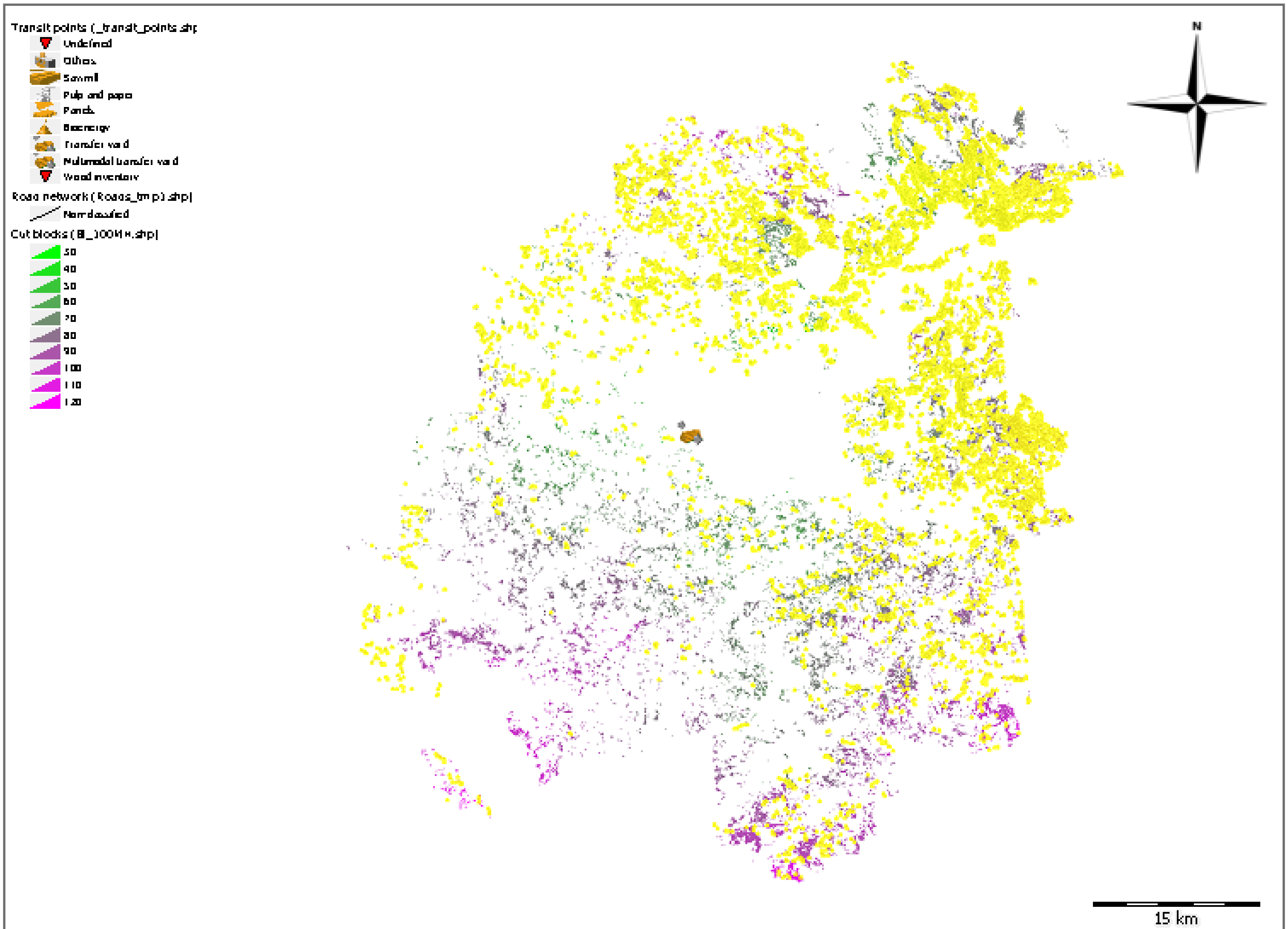
Destination	Product	Format	m³	Transport average distance (Km)
Transit point # 1				
	Abies lasiocarpa	Logs	65,382	80
	Black spruce	Logs	359	85
	Douglas fir	Logs	408,276	60
	Hybrid spruce	Logs	522,204	68
	Lodgepole pine-sawlog	Logs	619,886	64
	Paper birch	Logs	15,497	59
	Ponderosa pine	Logs	111	62
	Trembling aspen	Logs	145,379	58
	Western hemlock	Logs	938	89
	Western redcedar	Logs	24,566	82
			1,802,598	64
			1,802,598	64

Harvesting season

	m³	ha
Summer	0	0.0
Fall	0	0.0
Winter	1,802,598	16,831.4
	1,802,598	16,831.4

Terrain conditions

CPPA class	Ground strength (%)	Roughness (%)	Slope (%)
1	-	-	-
2	100	100	-
3	-	-	100
4	-	-	-
5	-	-	-



211 selected site(s) / 2397

Area covered: 16,831 ha / 117,143 ha

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