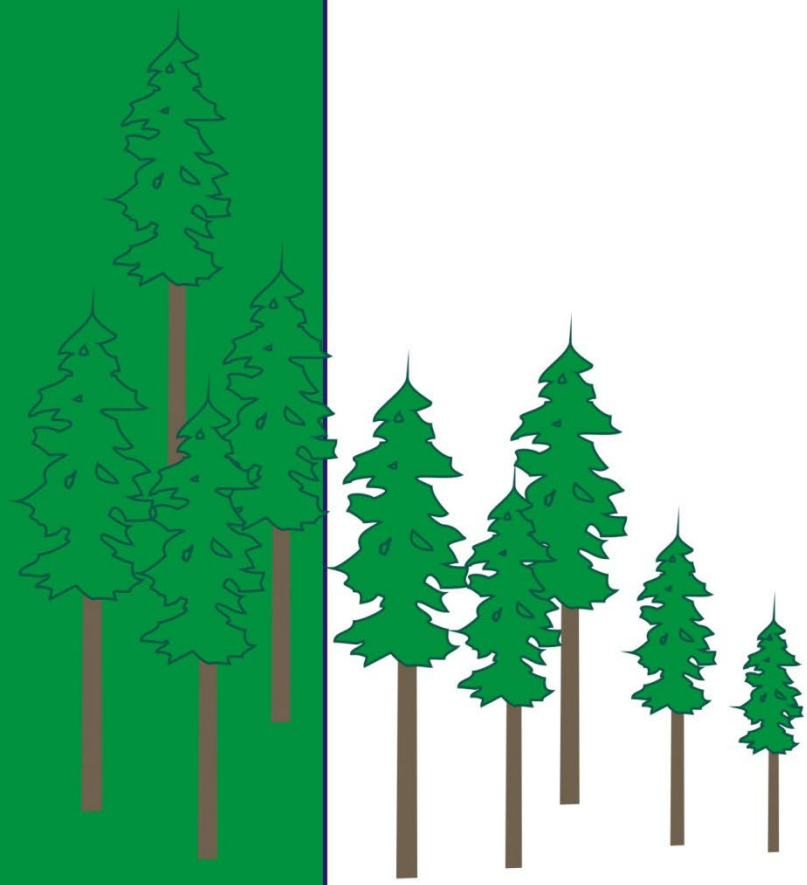
Interior

MARKET PRICING SYSTEM

Update – 2023



July 1, 2023

Timber Pricing Branch

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Interior Market Pricing System: Update – 2023

1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2023 update to the Interior Market Pricing System (MPS). [1]

2. AUCTION DATASET

The new auction dataset used in the update contains winning bids and data from 3895 sales over the 16.25 year period January 1, 2007 through March 31, 2023.

[1] This paper is not intended to provide the basis for calculating stumpage rates nor should it be used as guidance for interpreting the legal policies and procedures for calculating stumpage rates, which are contained in the *Interior Appraisal Manual*. The *Interior Appraisal Manual* contains the policies and procedures referred to in Section 105 of the *Forest Act*.

3. EQUATIONS

Estimated Winning Bid Equation

Variable	2023 Final Equation	
	Co-efficient	t – Statistic
LN (Number of Bidders)	8.442205	22.410185
Constant	40.288930	9.459855
Real Stand Selling Price (Scale Based) – 2MA	0.314733	23.657864
Real Stand Selling Price (Cruise Based) – 2MA	0.173493	13.413350
Cedar Fraction	33.735843	4.981919
Cedar Fraction*Cedar Decay	-142.448135	-4.736859
Hemlock Fraction	-27.217888	-10.762968
Balsam Fraction Squared	-13.103907	-3.374963
Larch Fraction + Yellow Pine Fraction	-17.870733	-3.892741
Cable Yarding post 2013	-22.825212	-8.791620
LN(Coniferous Volume/1000)	3.295868	9.906983
Net Decay Fraction	-15.648345	-2.275732
Fire Damaged Fraction	-33.661183	-12.370325
LN (Volume per Tree)	8.164678	12.490262
Cycle + 0.5 *(Cycle – 6.0 hours)	-2.132696	-12.859031
Zone 9	-7.194583	-6.810388
Cruise Based * (1 – RG35)	9.229717	7.267477
Slope (>15)	-0.175099	-4.248206
Grey Fraction Squared	-9.999325	-6.495870
Exchange Rate - 2MA	-40.415543	-16.171892
AAC Delta (AAC – Harvest)	-0.766352	-18.408330
Net Blowdown	-24.669134	-4.236485
Net Deciduous (Cruise Based)	-17.920555	-6.396314
Camp	-2.482435	-4.460974
Distance to Support Centre	-0.213065	-7.500735
Partial Cut 20	-27.963695	-5.540010
Other Attack	-41.639206	-4.260466
Count of Sales:	3,895	
Adjusted R^2	0.763389	

LN means the natural logarithm

Number of Bidders Equation - dependent variable is LN(NB)

Variable	2023 Final Equation	
	Co-efficient	t - Statistic
Forecast Real Winning Bid	0.008883	24.282133
Constant	-0.330265	-6.925869
Cruise Based * (RG35)	0.067405	3.129325
District Average Number of Bidders	0.278916	17.081637
Partial Cut 20	-0.280164	-1.837443
Slope (>15)	-0.007924	-8.395215
First and Second Quarter Auctions	0.077967	4.456689
Highway Haul	0.055485	2.311914
Count of sales:	3,895	
Adjusted R^2	0.231911	

The new dataset is made up of 16.25 years of sales. The oldest year (2007) was preserved in order to make sure an entire market cycle is represented in the dataset, including the last major downturn. Furthermore, competing MoF policies led to lower-than-average historical BCTS sales in 2021/22 and 2022/23 which further reinforced TPB's decision to maintain a longer dataset.

The MPS regressions have seen a few changes including the change in calculating Average Monthly Values (AMVs) for the upstream lumber prices from a 3-month moving average to a 2-month moving average to increase the responsiveness of the model to the market fluctuations induced by macroeconomically unstable environment (high price variance). Other changes included the removal of a yearly dummy as well as an addition of a supply-side AAC Delta variable measuring the distance between Allowable Annual Cut (AAC) and the actual harvest (Appendix 2). Other variables that were removed due to insignificance included the Dry Fir * Dry Belt and the Decked variables. Grey and Balsam share variables were changed from being formulated via a hinge function to a simpler squared transformation. Finally, the Camp variable's radius was changed from 16 to 15 km and the partial cut was change to Partial Cut 20 in the NB regression.

To implement the new equation in the *Interior Appraisal Manual (section* 3.1), the two equations are reduced to one MPS equation. This is done by substituting the Number of Bidders equation into the Estimated Winning Bid Equation (and thereby eliminating the variable: LN (Number of Bidders). See Appendix 1 for detailed statistics on the estimated winning bid and number of bidder's equations and variable definitions.

4. SPECIFIED OPERATIONS

The auction dataset used to develop the MPS equation is comprised of 3895 auctions. There are some harvesting situations that are not accounted for in the data and equation, and therefore a specified operation cost estimate may be used for these situations in the calculation of stumpage rates.

The specified operations are shown below and described in Appendix 2.

Specified Operations	July 1, 2022 Update	July 1, 2023 Update
1. Rail Haul	Appraisal Manual	Appraisal Manual
2. Barge/Ferry	Appraisal Manual	Appraisal Manual
3. Dump, Boom, Tow, Dewater and Reload	Appraisal Manual	Appraisal Manual
4. Skyline Yarding	$1.38/$m^3$	$3.73/m3
5. Horse Logging	$8.67/$m^3$	$8.67/$m^3$
6. Market Logger Specified Operations Cost	$0.07/$m^3$ Combined in Final Tenure Obligation Adjustment	$0.11/$m^3$ Combined in Final Tenure Obligation Adjustment
7. Helicopter	$124.37	$124.00/$m^3$

5. TENURE OBLIGATION ADJUSTMENTS

As outlined in the Interior Tenure Obligations Adjustment paper (June 5, 2006), the adjustments are based on licensee data submitted in the Interior Log Cost Report.

The tenure obligation adjustments are shown below.

Tenure Obligation	July 1, 2022 Update	July 1, 2023 Update
Total Administration Cost	2019/20 Cost Base	2020/2021 Cost Base
Development Cost	2019/20 Cost Base	2020/2021 Cost Base
Total Road Management Cost	2019/20 Cost Base	2020/2021 Cost Base
Market Logger Development Cost	$1.68/m3	$1.76/m3
Total Silviculture Cost	2019/20 Cost Base	2020/2021 Cost Base
Return to Forest Management	$1.057	$1.045
Low Grade Percent Adjustment	Mark Specific 1/(1-%low grade/100)	Mark Specific 1/(1-%low grade/100)

6. SUMMARY

The new final equation, specified operations and tenure obligation adjustments will be used in the MPS for the Interior, starting July 1, 2023.

APPENDIX 1

DESCRIPTION OF SPECIFIED OPERATIONS

If sufficient auction data is not available for an activity employed by either BCTS or other licenses, the ministry may, for those identified situations, implement a specified operations cost estimate in the calculation of the stumpage rate.

The specified operations will be used to adjust the MPS stumpage rate for the estimated incremental cost of the identified situation. The explicit assumption is that if a bidder was faced with a similar situation, he or she would lower the bid by the extra cost incurred because of the identified situation.

The situations that may be eligible for specified operations adjustment will be determined according to the following principles:

- the expectation that a bid would be influenced by this situation;
- representation (number of samples, if any, in the auction data set);
- materiality of estimated cost differential (supported by verifiable financial data); and,
- statistical analysis (including the premise that other represented situations and variables in the MPS database and equations may serve as a proxy for the situation in question).

The ministry, after considering the above and any other relevant technical information, may or may not designate the situation as an identified situation eligible for specified operations and, if eligible, will specify the dollars per cubic meter adjustment.

The ultimate objective is to have a representative auction database and hence, few, if any, specified operations adjustments.

The following are identified as specified operations for the Interior MPS. Cost estimates from the updated *Interior Appraisal Manual* are used for the following:

- Water Transportation Systems including Surface Tow System and Log Barge System
- Special Transportation Systems including Rail, Barge (Used for Truck Haul) and Barge (Not used for Truck Haul)
- Skyline and Intermediate Support Skyline
- Helicopter Logging
- Horse Logging
- High Development Cost (BCTS only)
- Uneven-Aged Forest Management

APPENDIX 2

VARIABLES AND DEFINITIONS FOR EQUATIONS

Variable	Definition
Balsam Fraction Squared	The balsam fraction squared.
Blowdown	Blowdown fraction – grey fraction (can't be < 0)
Camp	1 if eligible for CAMP under IAM Section 3.2.30
Cable Yard Fraction	Fraction of harvest method volume that is appraised as overhead cable yarding, tethered or winch-assist, or skyline methods.
Cable Yarding	Cable Yard Fraction – from 2013 to present.
Cedar Decay Fraction	Cedar decay (%) from the appraisal summary report/100.
Cedar Fraction	Fraction of total net coniferous volume that is cedar.
Cedar Fraction * Cedar Decay Fraction	Fraction of total net coniferous volume that is cedar * Cedar decay (%) from the appraisal summary report/100.
Constant	Fixed value.
Cruise Based	1 if cruise based, 0 if scale based.
CYCLE	Hauling round trip cycle time (Primary CT (hrs) + Secondary CT (hrs). See sections 3.2.13 of the Interior Appraisal Manual.
CYCLE_INC6	CYCLE – 6.0 hours. If <0, then 0.
Decay Fraction	Decay fraction minus other attack fraction (can't be < 0).
Deciduous Fraction	Fraction of the total net cruise volume that is the total net deciduous volume
Deciduous (Cruise Based)	Same as Deciduous Fraction but applies to cruise based only.
DSC (Distance to Support Centre)	Distance to Support Centre: see IAM section 3.2.29
District Average Number of Bidders	Average number of bidders for the district, in which the cutting authority area is located (see Table 3-3, section 3.2.22 Appraisal Manual).
Exchange Rate	US$/C$ (a stronger C$ leads to a higher value) in decimal form.
Fir Fraction + Yellow Pine Fraction	Fraction of total net coniferous volume that is Douglas fir and yellow pine.
Fire Damaged Fraction	Fraction of total net coniferous volume that is fire damaged.

First and Second Quarter Auctions	If the auction sold in January to June, D_Q1 + Q2 =1.
Forecast Real Winning Bid	Estimated winning bid from the estimated winning bid equation.
Grey	Fraction of total net coniferous volume that is grey Mountain Pine Beetle attacked lodgepole pine.
Grey Squared	Grey fraction squared.
Slope (>15)	See 'SLOPE15 definition in Section 3.2.24 'Estimated Winning Bid Variables' of the *Interior Appraisal Manual* for more information.
Hemlock Fraction	Fraction of the Total Net Coniferous Volume that is hemlock.
Highway Haul	1 if primary haul method is highway, otherwise HWY = 0.
Larch Fraction + Yellow Pine Fraction	Fraction of total net coniferous volume that is larch and yellow pine.
Other Attack	Other Attack is the fraction of the Total Net Coniferous Volume that is insect attack other than Mountain Pine Beetle attacked Lodgepole Pine. Hinged at pre Jan 2020 and post Jan 2020.
Partial Cut Fraction	Fraction of the harvest method volume that is appraised as partial cut. PC = (100-CAPCUT%)/100. See section 4.5 of Appraisal Manual for definition of CAPCUT%. The 80% limit in the definition of CAPCUT in section 4.5 does not apply.
Partial Cut 20	Partial Cut 20 is for cutting authorities with greater than 20% partial cut retention levels. See section 3.2.23 of the Appraisal Manual.
RBID	Real Winning bid ($/m3) in 2023 dollars.
Real Stand Selling Price	Real estimated stand lumber value ($/m3). Weighted average of (LRF * Lumber price by coniferous species). See Appraisal Manual section 3.2.2
Red + Grey Attack Fraction	Fraction of total net coniferous volume that is red and grey mountain pine beetle attack.
RG35	1 if Total Net Coniferous Volume of timber on the cutting authority area is comprised of 35% or greater red and grey Mountain Pine Beetle attacked Lodgepole pine, otherwise RG35 = 0.
Slope	SLOPE15 = (SLOPE-15), if slope is < then SLOPE 15 then SLOPE15 = 0.
Total Interior Harvest	Total Interior harvest (million m3) in a recent 12 month period. Includes all species and tenure types. Excludes waste.

AAC Delta	Allowed Annual Cut 12 month moving Average (net of partitioned AAC) – Total Interior Harvest volume 12 MA (million m3).
Volume	The zonal volume from Table 3-2 (See Appraisal Manual section 3.2.8) for the cutting authority unless: 1. The cutting authority is a BCTS cutting authority; if so then use the Total Net Coniferous Volume for the cutting authority. 2. The cutting authority is not a BCTS cutting authority and, the sum of all the AAC's for all the licences that the licensee has in the same TSA as the cutting authority being appraised is less than the zonal volume indicated in Table 3-3 for the selling price zone in which the cutting authority is located, if so, then use the greater of: - The Total Net Coniferous Volume, or The sum of the AAC volumes described above
Volume per Tree	Cutting authority average net volume per tree, from appraisal summary report (m3).
Volume per hectare	Natural logarithm of volume per hectare.
Zone 9	Fort Nelson – Peace selling price zone variable. Zone 9 = 1 if cutting authority is appraised with selling price zone 9, otherwise Zone 9 = 0.

APPENDIX 3 - REGRESSIONS

FINAL ESTIMATED WINNING BID

MODEL INFO:
Observations: 3895
Dependent Variable: RBID
Type: OLS linear regression

MODEL FIT:
$F(26,3868) = 484.206281$, $p = 0.000000$
$R^2 = 0.764968$
Adj. $R^2 = 0.763389$

Standard errors: Robust, *type* = HC3

	Est.	S.E.	t val.	p	VIF
(Intercept)	58.187177	3.801380	15.306858	0.000000	
LOG_NB	8.442205	0.376713	22.410185	0.000000	1.190370
RSPI_SB	0.314733	0.013304	23.657864	0.000000	4.713094
RSPI_CB	0.173493	0.012934	13.413350	0.000000	4.509428
CE	33.735843	6.771657	4.981919	0.000001	5.177176
CE_CEDECAY	-142.448135	30.072277	-4.736859	0.000002	4.737748
HE	-27.217888	2.528846	-10.762968	0.000000	2.389396
I(BA^2)	-13.103907	3.882681	-3.374963	0.000746	1.405867
LA_YE	-17.870733	4.590784	-3.892741	0.000101	1.259857
CABLE_2013	-22.825212	2.596246	-8.791620	0.000000	1.818233
LOG_CVOL_1000	3.295868	0.332681	9.906983	0.000000	1.138465
FIRE	-33.661183	2.721124	-12.370325	0.000000	1.193723
NET_DECAY_SB	-15.648345	6.876181	-2.275732	0.022917	2.953196
LOG_VPT	8.164678	0.653684	12.490262	0.000000	2.486712
Z9	-7.194583	1.056413	-6.810388	0.000000	1.452677
CYCLE_HINGE	-2.132696	0.165852	-12.859031	0.000000	1.364391
OTHER_POST2020.01	-41.639206	9.773393	-4.260466	0.000021	1.397338
I(GREY^2)	-9.999325	1.539336	-6.495870	0.000000	2.458032
CB_1_D_RG35	9.229717	1.270003	7.267477	0.000000	1.840550
SLOPE_15	-0.175099	0.041217	-4.248206	0.000022	2.718399
FX_2MA	-40.415543	2.499123	-16.171892	0.000000	1.578441
NET_BLOWDOWN	-24.669134	5.823019	-4.236485	0.000023	1.231136
NET_DECID_CB_DECID_BONUS_SB	-17.920555	2.801700	-6.396314	0.000000	1.215045
PC_20_100	-27.963695	5.047589	-5.540010	0.000000	1.076743
DSC_HINGE200	-0.213065	0.028406	-7.500735	0.000000	1.055774
CAMP_15	-2.482435	0.556478	-4.460974	0.000008	1.258267
PART_AAC_DELTA_12MR	-0.766352	0.041631	-18.408330	0.000000	1.814229

FINAL NUMBER OF BIDDERS

MODEL INFO:
Observations: 3895
Dependent Variable: LOG_NB
Type: OLS linear regression

MODEL FIT:
$F(7,3887) = 168.960377$, $p = 0.000000$
$R^2 = 0.233291$
Adj. $R^2 = 0.231911$

Standard errors: Robust, *type* = HC3

	Est.	S.E.	t val.	p	VIF
(Intercept)	-0.330265	0.047686	-6.925869	0.000000	
RWB	0.008883	0.000366	24.282133	0.000000	1.258496
CB_D_RG35	0.067405	0.021540	3.129325	0.001765	1.350587
PC_20_100	-0.280164	0.152475	-1.837443	0.066221	1.012174
SLOPE_15	-0.007924	0.000944	-8.395215	0.000000	1.168176
DANB	0.278916	0.016328	17.081637	0.000000	1.052155
HWY_TRAN	0.055485	0.024000	2.311914	0.020834	1.029991
DQ1_DQ2	0.077967	0.017494	4.456689	0.000009	1.016489