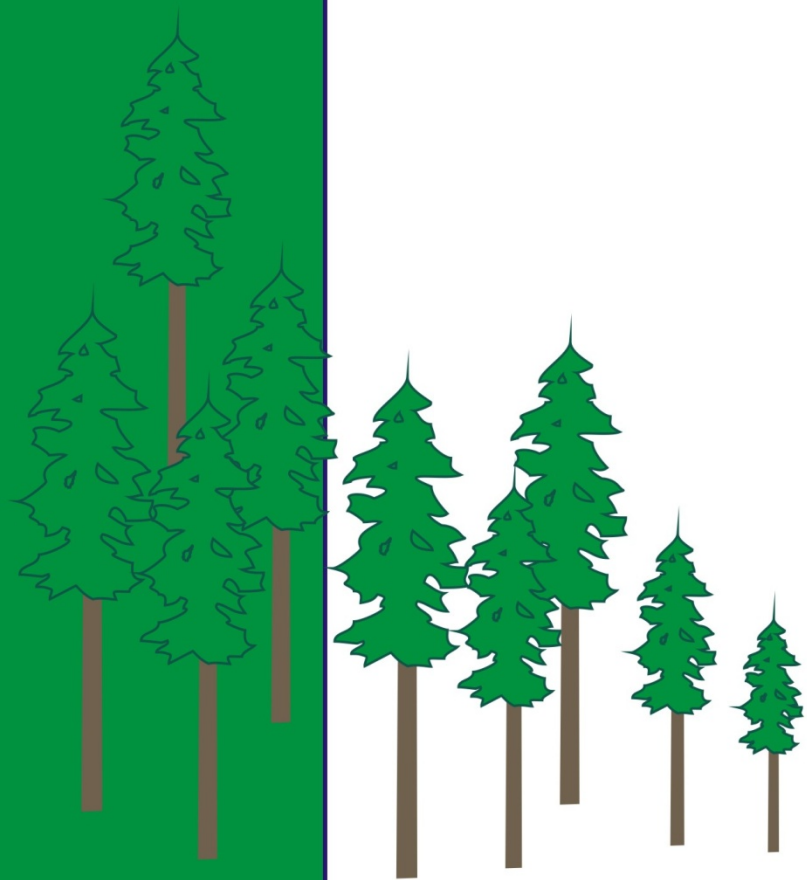
Interior

MARKET PRICING SYSTEM

Update – 2021



July 1, 2021

Timber Pricing Branch

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Interior Market Pricing System: Update – 2021

1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2021 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 3,644 sales over the 14.25 year period January 1, 2007 through March 31, 2021.

[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	2021 Final Equation	
	Co-efficient	t – Statistic
LN (Number of Bidders)	6.763534	22.25092
Constant	25.50767	7.838102
Real Stand Selling Price (Scale Based)	0.448846	30.80878
Real Stand Selling Price (Cruise Based)	0.339553	22.61923
Cedar Fraction	1.144818	0.177711
Cedar Fraction*Cedar Decay	-117.575	-4.2666
Hemlock Fraction	-13.5491	-6.81635
Balsam Fraction	-5.34434	-4.64808
Larch Fraction + Yellow Pine Fraction	-21.1251	-5.80041
[(Fir Fraction + Yellow Pine Fraction) * Dry Belt] or [District DRM or DMH]	-3.37704	-1.78494
Cable Yarding	-26.9383	-14.0324
LN(Volume/1000)	2.398205	9.084007
Decay Fraction	-12.9635	-2.25641
Fire Damaged Fraction	-20.0624	-8.23068
LN (Volume per Tree)	7.334677	12.76968
Cycle + 0.5 *(Cycle – 6.0 hours)	-1.57991	-11.8177
Zone 9	-5.98397	-6.28548
Cruise Based * (1 – RG35)	3.344919	3.439131
Decked Fraction	23.51909	13.59773
Ground Skid Slope Squared (15-50)	-0.00939	0.001944
Auction Year	-3.93627	1.481291
Grey Fraction	-1.39712	0.203759
Exchange Rate	-46.7919	2.666036
Total Interior Harvest	0.333474	0.036325
Blowdown	-26.6353	5.071456
Deciduous (Cruise Based)	-18.8148	2.629115
Camp	-1.44873	0.438058
Distance to Support Centre	-0.04956	0.006408
Partial Cut 20	-23.8248	4.349027
Other Attack	-53.0185	10.59173
Count of Sales:	3,644	
Adjusted R^2	0.754624	

LN means the natural logarithm

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

Variable	2021 Final Equation	
	Co-efficient	t - Statistic
Forecast Real Winning Bid	0.013241	28.38491
Constant	-0.31799	-6.47567
Auction Year	-0.26381	-7.91944
Cruise Based * (1 – (RG35))	0.054119	1.467508
Cruise Based * (RG35)	0.092342	4.098808
District Average Number of Bidders	0.265775	16.59266
Partial Cut Fraction	-0.34022	-2.6693
Slope	-0.00574	-7.1831
First and Second Quarter Auctions	0.080925	4.586937
Highway Haul	0.065538	2.698452
Count of sales:	3,644	
Adjusted R^2	0.259348	

LN means the natural logarithm

The new dataset is made up of 14.25 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.

The MPS regressions are much like previous years with a few minor changes. The Real Stand Selling Price (RSP) variable has been split into RSP(CB) for cruise-based cutting authorities and RSP(SB) for scale-based cutting authorities. The Grey Hinge variables reference years have been changed, see Variables and Definitions for Equations Table in appendix 1. Finally, the Partial Cut variable has had the ceiling removed to allow for recognition of higher levels of partial cut.

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 3,644 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	Current Adjustment (July 1, 2020)	Update July 1, 2021
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	$2.84/$m^3$	$1.21
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	$0.07/$m^3$ Combined in Final Tenure Obligation Adjustment
7. Helicopter	$113.79	$122.41/$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	Current Adjustment	Update July 1, 2021
Total Administration Cost	2017/18 Cost Base	2018/19 Cost Base
Development Cost	2017/18 Cost Base	2018/19 Cost Base
Total Road Management Cost	2017/18 Cost Base	2018/19 Cost Base
Market Logger Development Cost	$1.53/m3	$1.60/m3
Total Silviculture Cost	2017/18 Cost Base	2018/19 Cost Base
Return to Forest Management	$1.043	$1.046
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, 2021.

APPENDIX 1

DESCRIPTION OF SPECIFIED OPERATIONS

If sufficient auction data is not available for an activity employed by either BCTS or other licences, 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:

- Rail Haul
- Rail haul including truck to rail transfer and rail transport.
- Barge/Ferry
- Barge/ferry used to truck haul (private).
- Barge/ferry not used for truck haul (private).
- Dump and boom
- Tow
- Dewater and reload
- Camp costs
- Skyline Yarding
- Horse Logging
- Market Logger Specified Operations Cost
- High Development Cost (BCTS only)
- Helicopter

APPENDIX 2

VARIABLES AND DEFINITIONS FOR EQUATIONS

Variable	Definition
Auction year	If the auction sold in the 12 months ending March 2021, then Auction Year = 1.
Modified Balsam Fraction	The balsam fraction plus 2 times the balsam fraction minus 0.5 if balsam fraction is greater than 0.5.
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.
Decked Fraction	Fraction of cutting authority volume that has been decked and/or partially harvested in the timber sale licence. Cutting authority volume = total net cruise volume + volume of decked/partially harvested timber + right-of-way volume.
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).
District DRM or DMH	See 'Dry Belt'

Dry Belt	Dry Belt = 1 if the cutting authority volume is located in the Rocky Mountain (DRM) or 100 Mile House (DMH) Forest Districts. Otherwise, Dry Belt is the fraction of the Net Merchantable Area of the cutting authority that is located in Dry Belt Douglas Fir Zones as per the table in the *Cruising Manual*. If the BEC zone/subzone combination does not appear in that table, then the following logic must apply: - If the subzone is very dry (begins with x) then the zone/subzone combination is Dry Belt. - If the subzone is dry (begins with d) then the zone/subzone combination is Dry Belt only if the BEC zone is IDF, MS or PP. If the subzone is not very dry or dry (does not begin with x or d) then the zone/subzone combination is not Dry Belt.
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	Fraction of total net coniferous volume that is grey Mountain Pine Beetle attacked lodgepole pine.
Grey	Grey Fraction*(Award_Year - 2008)*(Award_Year>=2008) *CB*D_RG35
Ground Skid Slope Squared (15-50)	See 'GS_Slope' definition in Section 3.2.20 'Estimated Winning Bid Variables' of the *Interior Appraisal Manual* for more information.
HemBal Fraction	Fraction of total net coniferous volume that is hemlock and balsam.
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.
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 ($/m3).
Real Stand Selling Price	Real estimated stand lumber value ($/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	Cutting authority average slope from the appraisal summary report.
Total Interior Harvest	Total Interior harvest (million m3) in a recent 12 month period. Includes all species and tenure types. Excludes waste.
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.
YEM	Year ending March of 2021.
Zone 6	Skeena selling price zone variable. Zone 6 = 1 if cutting authority is appraised with selling price zone 6, otherwise Zone 6 = 0.
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

Dependent Variable: BID*156.6/CPI
Method: Least Squares
Date: 05/11/21 Time: 13:22
Sample: 1 4326 IF IN_2021_3644=1
Included observations: 3644
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	25.50767	3.254317	7.838102	0.0000
LOG(NB)	6.763534	0.303967	22.25092	0.0000
SPI*156.6/CPI*SB	0.448846	0.014569	30.80878	0.0000
SPI*156.6/CPI*CB	0.339553	0.015012	22.61923	0.0000
CE	1.144818	6.442020	0.177711	0.8590
CE*CEDAR_DECAY	-117.5750	27.55710	-4.266595	0.0000
HE	-13.54914	1.987741	-6.816348	0.0000
BA+2*(BA-0.5)*(BA>.5)	-5.344337	1.149795	-4.648079	0.0000
LA+YE	-21.12509	3.642003	-5.800405	0.0000
(FI+YE)*DRY_OR_DRM_DMH	-3.377044	1.891967	-1.784939	0.0744
CABLE*(AWARD_YEAR<=2012)	-3.795984	1.970929	-1.925987	0.0542
CABLE*(AWARD_YEAR>=2013)	-26.93826	1.919721	-14.03238	0.0000
LOG(CVOL/1000)	2.398205	0.264003	9.084007	0.0000
FIRE	-20.06236	2.437511	-8.230675	0.0000
NET_DECAY*SB	-12.96349	5.745194	-2.256405	0.0241
LOG(VPT)	7.334677	0.574382	12.76968	0.0000
Z9	-5.983974	0.952031	-6.285479	0.0000
CYCLE+0.5*CYCLE_6PLUS	-1.579905	0.133690	-11.81767	0.0000
OTHER*(1-YEM_2021)	-6.442364	2.985991	-2.157530	0.0310
OTHER*(YEM_2021)	-53.01854	10.59173	-5.005657	0.0000
GREY*(AWARD_YEAR-2008)*(AWARD_YEAR>=2008)*CB*D_RG35	-1.397122	0.203759	-6.856722	0.0000
CB*(1-D_RG35)	3.344919	0.972606	3.439131	0.0006
DECKED	23.51909	13.59773	1.729634	0.0838
GS*GS_SLOPE_SQ_15_50	-0.009387	0.001944	-4.827701	0.0000
FX_3_1	-46.79191	2.666036	-17.55112	0.0000
HARVOL_S	0.333474	0.036325	9.180277	0.0000
NET_BLOWDOWN	-26.63531	5.071456	-5.252004	0.0000
NET_DECID*(CB+DECID_BONUS*SB)	-18.81478	2.629115	-7.156317	0.0000
AUCTION_YEAR	-3.936274	1.481291	-2.657326	0.0079
PC_20	-23.82479	4.349027	-5.478189	0.0000
(DSC_2020>100)*(DSC_2020-100)	-0.049561	0.006408	-7.734133	0.0000
CAMP_DIST_2020<=16	-1.448726	0.438058	-3.307152	0.0010

R-squared	0.756712	Mean dependent var	31.94411
Adjusted R-squared	0.754624	S.D. dependent var	23.20427
S.E. of regression	11.49433	Akaike info criterion	7.730327
Sum squared resid	477215.8	Schwarz criterion	7.784780
Log likelihood	-14052.66	Hannan-Quinn criter.	7.749721
F-statistic	362.4075	Durbin-Watson stat	1.491657
Prob(F-statistic)	0.000000	Wald F-statistic	226.9197
Prob(Wald F-statistic)	0.000000		

FINAL NUMBER OF BIDDERS

Dependent Variable: LOG_NB
Method: Least Squares
Date: 05/11/21 Time: 13:22
Sample: 1 4326 IF IN_2021_3644
Included observations: 3644
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.317994	0.049106	-6.475667	0.0000
BIDF*156.6/CPI	0.013241	0.000466	28.38491	0.0000
CB*(1-D_RG35)	0.054119	0.036878	1.467508	0.1423
CB*D_RG35	0.092342	0.022529	4.098808	0.0000
PARCUT	-0.340222	0.127458	-2.669297	0.0076
SLOPE	-0.005744	0.000800	-7.183098	0.0000
DANB_3644	0.265775	0.016018	16.59266	0.0000
HWY_TRAN	0.065538	0.024287	2.698452	0.0070
D_Q1+D_Q2	0.080925	0.017643	4.586937	0.0000
AUCTION_YEAR	-0.263808	0.033311	-7.919437	0.0000

R-squared	0.261177	Mean dependent var	0.838666
Adjusted R-squared	0.259348	S.D. dependent var	0.611821
S.E. of regression	0.526540	Akaike info criterion	1.557761
Sum squared resid	1007.506	Schwarz criterion	1.574778
Log likelihood	-2828.241	Hannan-Quinn criter.	1.563822
F-statistic	142.7374	Durbin-Watson stat	1.646752
Prob(F-statistic)	0.000000	Wald F-statistic	187.5262
Prob(Wald F-statistic)	0.000000		