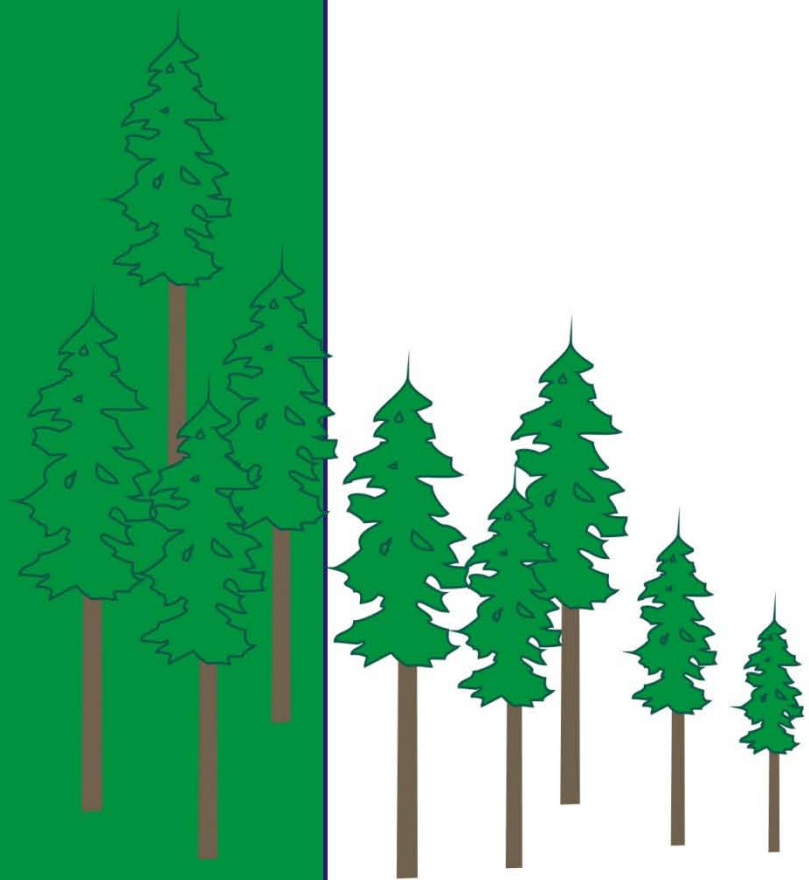
Interior

MARKET PRICING SYSTEM

Update – 2012



July 1, 2012

Timber Pricing Branch

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Interior Market Pricing System: Update – 2012

1. INTRODUCTION

The purpose of this paper is to provide an overview of the July 1, 2012 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 1199 sales over the 5 year period January 1, 2007 through December 31, 2011.

3. EQUATIONS

The 2011 MPS equations were re-estimated with the new dataset to establish the benchmark equations, shown below. No other changes were made.

[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*.

Estimated Winning Bid Equation

Variable	2011 Equation		Benchmark Equation	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
Constant	18.70405	3.640536	20.25864	4.344427
Exchange Rate ($US/$C)	-14.44597	-3.376776	-11.98664	-2.863354
Real Stand Selling Price	0.185622	7.065678	0.146812	6.298218
HemBal Fraction	-11.21857	-8.594995	-10.30185	-9.597715
Cedar Fraction	27.20245	6.309191	23.79090	9.994247
LN (Volume/1000)	1.091708	5.401925	0.907229	5.049705
Decay Fraction	-14.96586	-2.963674	-12.95699	-3.394971
Cableyard Fraction	-6.404287	-4.742974	-5.432914	-5.435066
Helicopter Logging Fraction	-53.09817	-11.19907	n/a	n/a
Fire Damaged Fraction	-6.283934	-3.052381	-10.23797	-3.829752
Cycle Time	-0.951861	-8.264312	-1.106542	-10.89048
LN (Number of Bidders)	2.762089	13.62301	3.042980	15.94909
Salvage Logging Indicator * Insect Attack Codes Indicator	-5.972180	-6.048174	n/a	n/a
Insect Attack Codes Indicator	1.593528	1.640268	0.517044	0.284290
Fort Nelson – Peace Zone	-4.800373	-6.592324	-4.550876	-6.961208
2007 Auctions	0.254521	0.349972	n/a	n/a
2008 Auctions	-3.701469	-3.864590	-4.461229	-7.618993
2009 Auctions	-6.050758	-6.824175	-6.285696	-12.08853
2010 Auctions	-4.765224	-5.675033	-5.287902	-9.481977
2011 Auctions	n/a	n/a	-3.138461	-4.596044
LN (Volume per Tree)	5.391203	11.21156	4.683911	11.11449
LN (Coniferous Volume per hectare)	2.149231	4.237573	1.832863	4.357214
Competitive Deciduous Indicator	-5.116207	-4.234152	-3.654827	-3.240486
Total Attack Fraction * (1 - Cruise Based)	-2.792379	-3.995705	-2.112761	-3.281169
Cruise Based	-6.029845	-11.57966	-5.885736	-12.99011
Adjusted R^2	0.767329		0.713784	
***LN means the natural logarithm**				

Number of Bidders Equation

Variable	2011 Equation		Benchmark Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	-0.916703	-8.464061	-1.172845	-12.44324
2011 Forecast Real Winning Bid	0.052081	16.55705	n/a	n/a
Benchmark Forecast Real Winning Bid	n/a	n/a	0.061852	20.43939
District Average Number of Bidders	0.250261	14.78468	0.268752	14.47354
Partial cut fraction	-1.029159	-3.429713	-0.998218	-2.959491
Slope %	-0.009059	-5.854233	-0.010272	-6.680447
First and Second Quarter Auctions	0.131000	4.009441	0.082317	2.646677
2007 Auctions	-0.096456	-1.801492	n/a	n/a
2008 Auctions	0.222170	3.539381	0.391718	7.339940
2009 Auctions	0.135894	2.056844	0.292122	5.357042
2010 Auctions	0.202571	3.006366	0.344164	5.926712
2011 Auctions	n/a	n/a	0.364176	6.413073
Highway Haul	0.153212	4.163916	0.132352	3.152739
Cruise Based	0.242481	4.208456	0.326473	6.779434
Adjusted R^2	0.414338		0.406158	

New variables were tested to see if they would improve the statistics, compared to the benchmark equations. Likewise, variables that were no longer significant were removed. The final data set contains 1199 auction sales.

A helicopter variable is included in the Estimated Winning Bid equation in the *Interior Appraisal Manual* (IAM). See page 6.

The final equations, compared to the Benchmark Equations, are shown below.

Estimated Winning Bid

Variable	Benchmark Equation		Final Equation	
	Co-efficient	t – Statistic	Co-efficient	t – Statistic
Constant	20.25864	4.344427	21.59218	4.742837
Exchange Rate ($US/$C)	-11.98664	-2.863354	-8.995256	-2.202930
Real Stand Selling Price	0.146812	6.298218	0.128184	6.298410
HemBal Fraction	-10.30185	-9.597715	-9.739417	-9.993599
Fir Fraction * Dry Belt	n/a	n/a	-7.513999	-3.655860
Cedar Fraction	23.79090	9.994247	n/a	n/a
Cedar Fraction * (1 – Cedar Decay Fraction) * (1-Skeena Zone)	n/a	n/a	30.55413	9.354203
LN (Volume/1000)	0.907229	5.049705	0.914559	5.295644
Decay Fraction	-12.95699	-3.394971	-13.64371	-4.010296
Cable yard Fraction	-5.432914	-5.435066	-6.799818	-7.040011
Fire Damaged Fraction	-10.23797	-3.829752	-10.25956	-3.966091
Cycle Time	-1.106542	-10.89048	-1.132551	-11.51343
LN (Number of Bidders)	3.042980	15.94909	3.079783	16.63302
Insect Attack Codes Indicator	0.517044	0.284290	n/a	n/a
Fort Nelson – Peace Zone	-4.550876	-6.961208	-4.577367	-7.219039
2008 Auctions	-4.461229	-7.618993	-4.656851	-8.377871
2009 Auctions	-6.285696	-12.08853	-7.465433	-14.25957
2010 Auctions	-5.287902	-9.481977	-6.502375	-11.32133
2011 Auctions	-3.138461	-4.596044	-4.434605	-6.355386
LN (Volume per Tree)	4.683911	11.11449	4.929575	11.63092
LN (Coniferous Volume per hectare)	1.832863	4.357214	1.435285	3.265887
Competitive Deciduous Indicator	-3.654827	-3.240486	n/a	n/a
Competitive Deciduous Indicator * Deciduous Volume	n/a	n/a	-7.016940	-3.354349
Total Attack Fraction * (1 - Cruise Based)	-2.112761	-3.281169	n/a	n/a
(Red + Grey Attack Fraction) * (2007 Auctions + 2008 Auctions) * (1 – Cruise Based)	n/a	n/a	-4.108566	-5.386112
Other Pest Attack Fraction * (1 – Cruise Based)	n/a	n/a	-4.760061	-2.055066
Cruise Based	-5.885736	-12.99011	-5.367084	-15.00010
Adjusted R^2	0.713784		0.733492	
***LN means the natural logarithm**				

Number of Bidders Equation

Variable	Benchmark Equation		Final Equation	
	Co-efficient	t - Statistic	Co-efficient	t - Statistic
Constant	-1.172845	-12.44324	-1.154166	-12.20970
Benchmark Forecast Real Winning Bid	0.061852	20.43939	n/a	n/a
Final Forecast Real Winning Bid	n/a	n/a	0.059377	20.08446
District Average Number of Bidders	0.268752	14.47354	0.277652	14.93401
Partial cut fraction	-0.998218	-2.959491	-0.889357	-2.627811
Slope %	-0.010272	-6.680447	-0.009987	-6.474260
First and Second Quarter Auctions	0.082317	2.646677	0.082497	2.640339
2008 Auctions	0.391718	7.339940	0.376475	7.046623
2009 Auctions	0.292122	5.357042	0.279668	5.117194
2010 Auctions	0.344164	5.926712	0.335633	5.759428
2011 Auctions	0.364176	6.413073	0.360599	6.322648
Highway Haul	0.132352	3.152739	0.131030	3.107282
Cruise Based	0.326473	6.779434	0.304728	6.348797
Adjusted R^2	0.414338		0.400788	

To implement the new equation in the *Interior Appraisal Manual*, 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)). The two equations together result in greater statistical accuracy and reliability compared to the 2012 benchmark equations. See Appendix 1 for detailed statistics on the estimated winning bid and number of bidders equations and variable definitions.

4. SPECIFIED OPERATIONS

The auction dataset used to develop the MPS equation is comprised of 1199 auctions. There are some harvesting situations that are not accounted for in the equation and therefore a specified operation cost estimate is used in the calculation of stumpage rates.

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

Specified Operations	Current Adjustment	Update July 1, 2012
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. Camp Costs	$2.40/$m^3$ $4.50/m3 if rail	$1.33/$m^3$ $2.50/m3 if rail
5. Skyline Yarding	$3.21/$m^3$	$1.39/$m^3$
6. Horse Logging	$8.67/$m^3$	$8.67/$m^3$
7. Market Logger Specified Operations Cost	$0.16/$m^3$	$0.08/$m^3$
8. Helicopter*	In EWB (-62.02)	-62.79

*In the five year period from 2007 to 2011, there was only one helicopter sale. That data point was removed so helicopter must now be treated as a specified operation. The helicopter variable remains in the updated EWB final equation. When taking into account CPI in the cost base versus the EWB base year, the helicopter coefficient in the EWB is -62.79. The end result of this is exactly the same as if it had been treated as a standard specified operation.

5. TENURE OBLIGATION ADJUSTMENTS

As outlined in the Interior Tenure Obligations Adjustment paper (dated 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, 2012
Total Administration Cost	2008/09 Cost Base	2009/10 Cost Base
Development Cost	2008/09 Cost Base	2009/10 Cost Base
Total Road Management Cost	2008/09 Cost Base	2009/10 Cost Base
Market Logger Road Cost	$1.26/$m^3$	$1.29/$m^3$
Total Silviculture Cost	2008/2009 Cost Base	2009/10 Cost Base
Return to Forest Management	1.041	1.031
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, 2012.

APPENDIX 1

FINAL ESTIMATED WINNING BID

Dependent Variable: BID*109.3/CPI
Method: Least Squares
Date: 05/08/12 Time: 16:22
Sample: 1 1719 IF IN_1199=1
Included observations: 1199

	Coefficient	Std. Error	t-Statistic	Prob.
Constant	21.59218	4.552589	4.742837	0.0000
Exchange Rate ($US/$C)	-8.995256	4.083315	-2.202930	0.0278
Real Stand Selling Price	0.128184	0.020352	6.298410	0.0000
HemBal Fraction	-9.739417	0.974566	-9.993599	0.0000
Fir Fraction * Dry Belt	-7.513999	2.055330	-3.655860	0.0003
LN (Volume/1000)	0.914559	0.172700	5.295644	0.0000
Decay Fraction	-13.64371	3.402172	-4.010296	0.0001
Fire Damaged Fraction	-10.25956	2.586820	-3.966091	0.0001
LN (number of Bidders)	3.079783	0.185161	16.63302	0.0000
LN (Volume per tree)	4.929575	0.423834	11.63092	0.0000
LN (Coniferous Volume per hectare)	1.435285	0.439478	3.265887	0.0011
Cycle Time	-1.132551	0.098368	-11.51343	0.0000
Fort Nelson – Peace Zone	-4.577367	0.634069	-7.219039	0.0000
2008 Auctions	-4.656851	0.555851	-8.377871	0.0000
2009 Auctions	-7.465433	0.523538	-14.25957	0.0000
2010 Auctions	-6.502375	0.574347	-11.32133	0.0000
2011 Auctions	-4.434605	0.697771	-6.355386	0.0000
Competitive Deciduous Indicator * Deciduous Volume	-7.016940	2.091893	-3.354349	0.0008
(Red + Grey Attack Fraction) * (2007 Auctions + 2008 Auctions) * (1-Cruise Based)	-4.108566	0.762807	-5.386112	0.0000
Other Pest Attack Fraction * (1-Cruise Based)	-4.760061	2.316257	-2.055066	0.0401
Cruise Based	-5.367084	0.357803	-15.00010	0.0000
Cable yard Fraction	-6.799818	0.965882	-7.040011	0.0000
Cedar Fraction * (1-Cedar Decay Fraction) * (1-Skeena Zone)	30.55413	3.266353	9.354203	0.0000

R-squared	0.738387	Mean dependent var	14.42384
Adjusted R-squared	0.733492	S.D. dependent var	8.033748
S.E. of regression	4.147372	Akaike info criterion	5.701823
Sum squared resid	20228.02	Schwarz criterion	5.799448
Log likelihood	-3395.243	Hannan-Quinn criter.	5.738599
F-statistic	150.8719	Durbin-Watson stat	1.708659
Prob(F-statistic)	0.000000		

FINAL NUMBER OF BIDDERS

Dependent Variable: LOG(NB)
Method: Least Squares
Date: 05/08/12 Time: 16:23
Sample: 1 1719 IF IN_1199=1
Included observations: 1199

	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-1.154166	0.094529	-12.20970	0.0000
Forecast Real Winning Bid	0.059377	0.002956	20.08446	0.0000
Cruise Based	0.304728	0.047998	6.348797	0.0000
District Average Number of Bidders	0.277652	0.018592	14.93401	0.0000
Partial Cut Fraction	-0.889357	0.338440	-2.627811	0.0087
Slope %	-0.009987	0.001543	-6.474260	0.0000
First and Second Quarter Auctions	0.082497	0.031245	2.640339	0.0084
Highway haul	0.131030	0.042169	3.107282	0.0019
2008 Auctions	0.376475	0.053426	7.046623	0.0000
2009 Auctions	0.279668	0.054653	5.117194	0.0000
2010 Auctions	0.335633	0.058275	5.759428	0.0000
2011 Auctions	0.360599	0.057033	6.322648	0.0000

R-squared	0.406290	Mean dependent var	0.880202
Adjusted R-squared	0.400788	S.D. dependent var	0.683260
S.E. of regression	0.528903	Akaike info criterion	1.573936
Sum squared resid	332.0500	Schwarz criterion	1.624871
Log likelihood	-931.5748	Hannan-Quinn criter.	1.593124
F-statistic	73.84467	Durbin-Watson stat	1.917674
Prob(F-statistic)	0.000000		

VARIABLES AND DEFINITIONS FOR EQUATIONS

Variable	Definition
2012 Equation	
Real Stand Selling Price	Estimated stand lumber value ($/m3) in 1997 dollars. Weighted average of (LRF * Lumber price by coniferous species). See Appraisal Manual section 3.2.
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.
Volume	Total net coniferous cruise volume (m^3). a. If the cutting authority being appraised is a BCTS licence, use the total net coniferous volume is from the cutting authority area cruise compilation. b. If the license is indicated in the small volume table and procedures approved by the Director, the initial small volume (ISV)is the greater of: i. The volume of the cutting authority being appraised, or ii. The volume indicated in the small volume table and procedures approved by the Director for the license under which the cutting authority has been issued. If the ISV is less than the applicable zonal volume from Table 3-3 for the cutting authority being appraised, then use the ISV. If not use the zonal volume from Table 3-3. c. Otherwise use the applicable zonal volume from table 3-3 for the cutting authority being appraised.
Cable Fraction	Fraction of the total harvest method volume that is appraised as overhead cable yarding.
Helicopter Fraction	Fraction of the total harvest method volume that is appraised as helicopter yarding.
Fire Damage Fraction	Fraction of the total net coniferous cruise volume that is fire damaged.
Cycle Time	Hauling round trip cycle time (Primary CT (hrs) + Secondary CT (hrs)). See section 3.5.1.1 and 3.5.1.3 of Appraisal Manual.
HemBal Fraction	Fraction of the total net coniferous volume that is Hemlock and Balsam.

Cedar Fraction	Fraction of the total net coniferous volume that is Cedar.
Volume per Tree	Cutting permit average volume per tree from the cruise (m3).
Slope %	Cutting permit average slope from the cruise.
District average number of bidders	Average number of bidders by district from the auction dataset. (see Table 3-2)
Decay Fraction	Prorated coniferous species decay (%) from the cruise / 100.
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.
2007 Auctions	If auction sold in 2007 then AUC 2007 = 1.
2008 Auctions	If the auction sold in 2008, then AUC 2008 =1.
2009 Auctions	If the auction sold in 2009, then AUC 2009 =1.
2010 Auctions	If the auction sold in 2010 then AUC 2010 =1.
2011 Auctions	If the auction sold in 2011 then AUC 2011 =1.
Exchange Rate	Exchange rate ($US per $C). Bank of Canada three month average rate beginning five months prior to the stumpage rate effective date, as published by Timber Pricing Branch. Note: if the Canadian dollar is “below par”, this number is less than one.
Highway Haul	1 if the primary haul method is highway, otherwise HWY = 0.
Consumer Price Index (CPI)	Monthly B.C. Consumer Price Index (CANSIM 326-0020, 2002 = 100) X 1.1787
Consumer Price Index Factor (CPIF)	CPIF = CPI/109.3
Competitive Deciduous Indicator	If upset stumpage rate is determined under section 7.5.1(5) Competitive Deciduous = 1, otherwise CD = 0.
Volume per hectare	Net coniferous volume per hectare (m^3/ha)
Cruise Based	Cruise based billing for Mountain Pine Beetle damage variable. MPB Cruise Based = 1 if IAM section 6.9 is applicable, otherwise MPB Cruise Based = 0. Signifies the bid and resulting estimated winning bid applies to all grades.
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 winning bid equation

Fir Fraction	Fraction of total net coniferous volume that is Douglas Fir.
Dry Belt	Fraction of area in Dry Belt Douglas Fir Zones as per the definition in the *Cruising Manual*.
Deciduous	Fraction of deciduous volume of total net cruise volume.
Red + Grey Attack Fraction	Fraction of total net coniferous cruise volume that is red and grey insect attack.
Other Attack Fraction	Fraction of total net coniferous cruise volume that is other insect attack.
Cedar Decay Fraction	Cedar decay (%) from the cruise /100
2011 & Benchmark Equations	
Salvage Logging Indicator	Where greater than one third of the net coniferous cruise volume is attacked by mountain pine beetle or other pests, salvage = 1, otherwise salvage = 0.
Insect Attack Codes Indicator	If the volume of pest attack is unavailable, Insect Attack Codes Indicator = 1.
Total Attack Fraction	Fraction of the total net coniferous volume that is lodgepole pine green, red, and grey attack plus the fraction of the total net cruise volume that is other insect attack.

APPENDIX 2

DESCRIPTION OF SPECIFIED OPERATIONS

If sufficient auction data is not available, the ministry will, for those identified situations, implement specified operations.

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 metre 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, Boom, Tow, Dewater, Reload
- Dump, boom
- Tow
- Dewater and reload
- Camp costs
- Skyline Yarding
- Horse Logging
- Market Logger Specified Operations Cost
- High Development Cost (BCTS only)
- Helicopter (see page 6)