

Final Report

Appraisal Zones and Stumpage Values

for Appraising Montana Forest Lands

(revised)

Presented to the Montana Department of Revenue

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Introduction

This report presents the timber appraisal zones and timber prices to be used in the next Montana forest land appraisal. It relies on the analysis of timber markets for the period July 2008 through June 2013. The primary data set utilized is Montana Department of Natural Resources Division of Forestry (DNRC) competitive green (non-salvage) timber sales. In addition, transactions from other public agencies are used for forest lands in far Eastern Montana.

Appraisal Zones

During the last forest appraisal, four zones were identified and these are summarized in Table 1 below. The distribution of sales used in both the past appraisal and the current sales population are shown for these zones.

Table 1
2009 and 2014 Timber Appraisal Zones

Number of sales		
	2009 Appraisal	2014 Appraisal
Northwest Zone	35	53
Southwest Zone	44	20
Central Zone*	5	7
Eastern Zone	<u>7</u>	<u>6</u>
Total	91	86

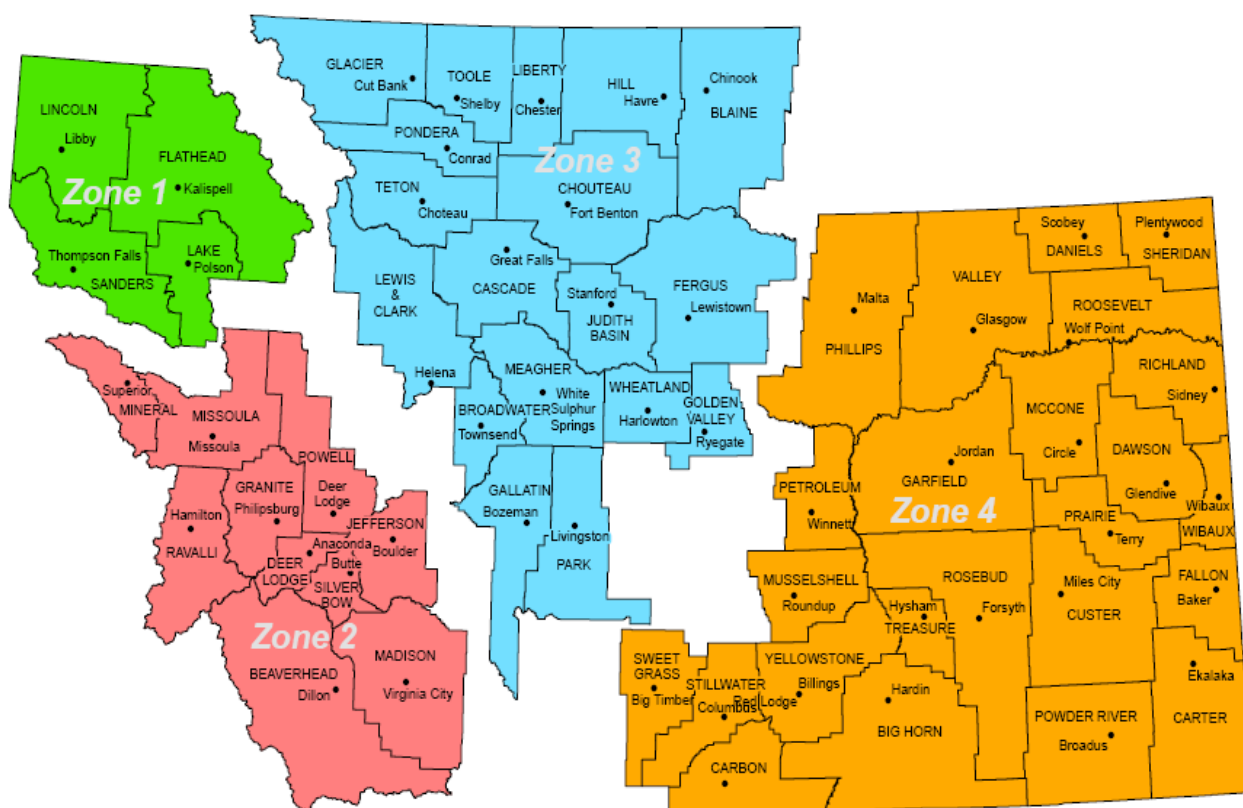
*In the 2009 zones, Lewis and Clark County was in the Southwest Zone, it has been moved to the Central Zone in the 2014 zones.

Table 1 indicates a substantial shift in the statewide distribution of timber transactions. The four-county Northwest Zone accounted for 38% of the transactions in the 2009 appraisal and this grew to 61% of the transactions in the 2014 appraisal. The Southwest Zone accounted for 48% of the sales in the 2009 Appraisal and fell to 23% in the current study.

More importantly, if there was no zone realignment, the old Central Zone had only two transactions in the five-year period, and they were both in Fergus County. As a result, there has been a modest boundary adjustment for the 2014 appraisal zones. Lewis and Clark County has been moved from the Southwest Montana Zone to the Central Zone. This modest boundary adjustment in zones is necessitated for three reasons. There has been a substantial change in the location of milling infrastructure over the last ten years in Montana which has in turn affected the spatial pattern of log flows from the point of harvesting to the processing mills. In addition, general timber characteristics of Lewis and Clark county timber are similar to those of other timber in the Central Zone. Finally, The Montana DNRC shifted sales toward the more valuable timber regions in order to make their legislated production goals in the face of weak timber markets.

The new zone configuration is shown on the next page in Figure 1.

2014 Forest Zones



Timber Values in Each Zone

Table 3 below summarizes the appraised timber values. It is expressed in 4th quarter 2013 dollars. The methodology for determining the zones and prices per zone is summarized in a technical appendix.

Table 3

Timber Values in Each Zone (\$/MBF 4th Qtr. 2013 dollars)

Northwest Montana	\$188.15
Southwest Montana	181.15
Central Montana	103.55
Eastern Montana	14.61

Even after adjusting the prices in the past appraisal upward to the contemporary purchasing power of money, the average price across the four zones is less than half the average price in the last appraisal and the largest overall drop falls in the Eastern Appraisal Zone.

Change in Timber Prices

Table 4 below shows an overall summary of the net of inflation changes in timber prices for the same Zones.

Table 4

Percentage Changes in Timber Prices from Previous to Current Appraisal

Prices from the 2009 Appraisal were converted to 4th quarter 2013 dollars

Northwest Zone	49% decrease
Southwest Zone	43% decrease
Central Zone	46% decrease
Eastern Zone	89% decrease

In a relative sense, timber values used in the appraisal formula were no doubt much higher during the worst period of economic activity in the timber markets for the 80 or so years. It appears that now during a period of fairly strong recovery, timber values will be considerably lower than they were when many forest land owners were financially stressed. The forest tax system was intended to adjust with changing market conditions, but the five-year appraisal cycle has not allowed this to happen in recent years. In addition, the price differences between the Northwest and Southwest Zones are closer than they have been in the past, this may necessitate possible merging or modification of these zones in future appraisals.

Appendix

Developing a Statistical Model to Determine Timber Prices for the Northwest, Southwest and Central Zones

A summary of the statistical model which predicts the inflation adjusted winning bid per ton of the sales in the Northwest, Southwest and Central appraisal zones is presented in this section. The winning bid includes two payments which are required for state timber purchases; a stumpage price and a forest improvement fee. The latter fee funds ongoing operations of the Division of Forestry and is earmarked for forest management activities. The independent variables are: CONSTANT, RKEEPR, RPAV25U, RFRAPRT and LNDBH. Some explanation of each of the variables should be useful. Since the equation is a “linear” equation, CONSTANT is the intercept. RKEEPR is an estimate of the delivered log value using log prices for various log species. The Montana Bureau of Business and Economic Research (BBER) reports log prices for two different Montana zones for various species on a quarterly basis. For each sale a delivered log value is calculated based upon both the current log price for each species in the sale and its respective zonal location. It is inflation adjusted. RPAV25U is a sale location variable. The state estimates the total distance (paved roads and unpaved roads) between the logging location and a likely processing mill. It is the sum of the paved haul distance plus 2.5 times the unpaved distance. It is also inflation adjusted since the regression coefficient is interpreted as dollars per ton. RFRAPRT is the inflation adjusted Framing Price Index converted to dollars per ton. It is available from the

Western Wood Products Association. Finally, LNDBH is the natural log of the average diameter of the timber in each sale.

Table A below contains the statistical summary of the linear regression model.

Table A

The Regression Model for Northwest, Southwest and Central Zones

Predicting **RADBID** the Inflation Adjusted Bid (\$/Ton in 2009 dollars)

Mean = 27.05986

Stand. Deviation = 9.335214

Number of Observations = 80

Residuals Sum of Squares = 2843.003

Standard Error of e = 6.156842

Fit R-Squared = .58705

Adjusted R-Squared = .56502

Model Test F(4,75) (Prob) = 26.65 (.0000)

<u>Variable</u>	<u>Coefficient</u>	<u>Standard Error</u>	<u>t-ratio</u>	<u>Mean of</u>
CONSTANT	-19.72961	14.33774	-1.376	
RKEEPR	.06859	.01959	3.501	270.1156
RPAV25U	-.08578	.016659	-5.120	59.7175
RFRAPRT	.36294	.081518	4.452	46.1910
LBDBH	6.55143	5.39708	1.214	2.5305

Table B shows how the model presented in Table A is used to calculate the prices for each zone. The zones were established in the earlier interim study (jackson, 2013).

Table B
Using the Model to calculate Price for the Northwest, Southwest and Central Zones

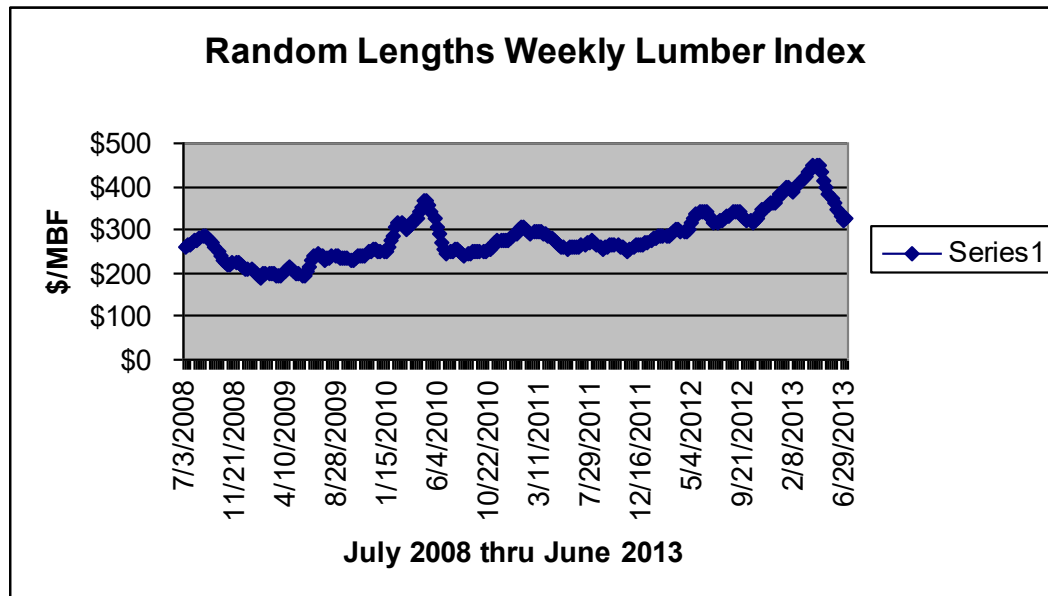
coeff name	Value	NwZone	SwZone	CenZone	mbf/ton	\$/mbf	Pr Index
Constant	-19.7269						
Rekeepr	0.068659	279.72	266.7	247.63			
PaRpavUp	-0.08578	53.88	49.99	192.25			
Rfrapr	0.36294	46.16	46.16	46.16			
LnDBH	6.55143	2.535	2.542	2.617			
	2009\$/Tn						
priceNW	28.21775				6.23	175.7966	1.0702
priceSW	27.70336				6.11	169.2675	1.0702
PriceCen	14.68233				6.59	96.75653	1.0702

Table B summarizes the data used in calculating the stumpage price for the Northwest, Southwest and Central zones. The Table is divided into an upper and lower part. The first column in the upper part shows the coefficient names that were used in developing the statistical model shown in the previous table. The second column shows the actual coefficients that were estimated in the model shown in Table A. The third column shows the value of the regression variable. For example the mean value of RKEEPER the inflation adjusted log price in the sales in the Northwest Zone was 279.72, the mean value of the second variable was 53.88 and so forth. The framing market price variable (RFRAPR) was the sample mean of all the transactions rather than those in a particular zone.

To show how the price for each zone is calculated, the Northwest zone is shown in detail in the bottom half of the table. The Northwest Zone price is first calculated in dollars per ton in constant 2009 dollars. It is $-19.7269 + 0.068659 \times 279.72 - 0.08578 \times 53.88 + .36294 \times 46.16 + 6.55143 \times 2.535 = 28.21775$. This is next converted to dollars per thousand board feet by using the zone average mbf/ton. ($28.21775 \times 6.23 = \$175.7966$). Finally, it is converted into the most recent purchasing power of money ($175.7966 \times 1.0702 = \188.14). The values in the Southwest and Central zones are calculated in a similar way but using the coefficient values for each particular zone and the zone mbf/ton conversions for that zone.

The graph below shows the inflation adjusted Lumber Price Index for the appraisal period. This graph shows the dynamic effect that the lumber prices have played during the appraisal period of the variables in the statistical model summarized in Table A. The graph clearly shows a wide range of lumber prices during the appraisal period. The statistical model indicates that the lumber market is a key factor influencing bid prices. The timing of a timber sale clearly influences its value. Lumber prices in early 2013 were more than double those at the bottom of the construction depression (2008). In calculating the final stumpage prices, adjustments have been made to reflect the average market conditions for the appraisal period. This will assure that a zone with a comparatively high percentage of its sales occurring in a high price period will not be over valued relative to other zones. Because BBER log prices are specific to timber species, zone differences in the distribution of timber species are captured through the BBER prices.

Figure A



Timber prices for Eastern Montana were estimated in a different way. The Montana DNRC sold only one green timber sale in the Eastern region during the 5-year appraisal period. In order to get a better idea of timber values in that zone, information was gathered for three USFS sales (Custer National Forest) and two sales administered by the Bureau of Indian Affairs. The USFS sales are measured in both board feet and cubic feet. The two BIA sales were measured in board feet. The Montana DNRC sales were measured in both tons and board feet. The sales were converted to a common unit of measures using conversion factors from previous appraisals. After adjusting them to a common purchasing power of money, an arithmetic mean was calculated and then converted to a 4th quarter dollars. The result is \$14.61 reported earlier in Table

Finally, a note on how this the appraisal equation could be used in shorter reappraisals. Instead of using the framing price index and delivered log prices for a five year period, the values for these variables for the past two years could be used in to come up with values in each zone. That would mean that every two years the data base would be updated and used in a reappraisal. How the rest of the other appraisal variables such as management costs would be changed would be a decision made by the Department of Revenue.

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