



# **2020 Foresters Forum**

## **February 6, 2020**

**Steve Hayes and Michael Niccolucci**  
**Bureau of Business and Economic Research**  
**University of Montana, Missoula**



# Who we are



## Research branch of the University of Montana's College of Business Administration

- **Regional economic analysis**
- **Survey research**
- **Industry analysis**
  - **Forest industry research**







# Industry Analysis

- **Rocky Mountains & Pacific Coast**
- **Describe industry structure, capacity, condition, and changes**
- **Track wood fiber from forest to marketplace**
- **Associate key economic indicators**







# Forest Industry Research

- **State-level industry studies**
- **Logging utilization studies**
- **Timber harvest reporting**
- **Quarterly Montana reporting**
- **Other projects**



# Why Estimate Logging Costs?



- To remain aware of impacts of changes and help maintain industry viability, managers and contractors must remain informed of operating costs
- Current harvesting capacity inadequate to meet future demand
- Industry expressed needs:
  - Provide resource for assessing equipment types and entry costs
  - Provide equipment cost and price per unit volume data for negotiation tool/baseline guide for bidding or appraisal for extended industry



FOREST INDUSTRY  
RESEARCH PROGRAM  
UNIVERSITY OF MONTANA







# Logging Cost Studies

- **Machine Costing**
- **Time and Motion Studies**
- **Expert Opinion**







# Hourly Machine Rates

- ▶ Machine rate
  - ▶ Originally proposed by Matthews (1942) *Cost Control in the Logging Industry*
  - ▶ Method of determining the average hourly cost of a single piece of equipment over its useful life, while operating in average conditions
- ▶ Fixed costs
  - ▶ "Ownership" costs
  - ▶ Incurred whether or not the machine works
- ▶ Variable costs
  - ▶ "Operating" costs
  - ▶ Only incurred when working



# Fixed Costs



- Depreciation
  - “Decline in value of a machine due to wear, obsolescence, and weathering.”
- Interest
  - “Rental amount charged by a lender for the use of money.”
- Insurance
  - Costs of liability and comprehensive insurance
- Taxes
  - Generally minimal for in-woods equipment





# Variable Costs



- Occur solely due to the operation of a machine
- Utilization =  $PMH/SMH$ 
  - PMH – productive machine hour: time when the machine is working productively
  - SMH – scheduled machine hour: time when the machine “should” be working
  - Utilization reported as % of SMH

Machine	Utilization
Feller-buncher	65%
Cable skidder	60%
Grapple skidder	65%
Forwarder	65%
Gate Delimber	90%
Chipper	75%

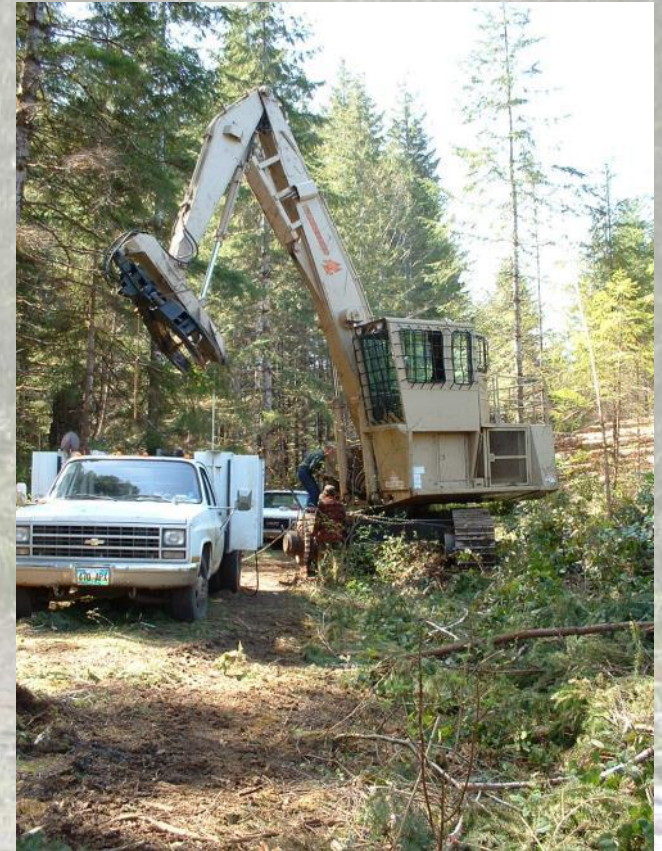




# Variable Costs



- Fuel
  - Primarily a function of HP
- Lube
  - Generally calculated as a % of fuel costs
- Repair and maintenance
  - Most unpredictable costs
  - Percentage of depreciation
- Labor
  - Wages are paid on SMH
  - Benefits – generally 50% of wage rate





**Table 2. Machine Rate Worksheet**

Machine description: \_\_\_\_\_

**1. Input Data**

Purchase price (P) \$ \_\_\_\_\_  
 Machine horsepower rating (hp) \_\_\_\_\_ hp  
 Machine life (n) \_\_\_\_\_ yrs  
 Salvage value, percent of purchase price (rv%) \_\_\_\_\_ %  
 Utilization rate (ut%) \_\_\_\_\_ %  
 Repair and maintenance, percent of depreciation (rm%) \_\_\_\_\_ %  
 Interest rate (in%) \_\_\_\_\_ %  
 Insurance and tax rate (it%) \_\_\_\_\_ %  
 Fuel consumption rate (fcr) \_\_\_\_\_ gal/hp-hr  
 Fuel cost (fcg) \$ \_\_\_\_\_ per gal  
 Lube and oil, percent of fuel cost (lo%) \_\_\_\_\_ %  
 Operator wage and benefit rate (WB) \$ \_\_\_\_\_ hr  
 Scheduled machine hours (SMH) \_\_\_\_\_ hrs/yr

**2. Calculations**

Salvage value (S) = (P\*rv%) \$ \_\_\_\_\_  
 Annual depreciation (AD) = ((P-S)/n) \$ \_\_\_\_\_  
 Average yearly investment (AYI) = (((P-S)\*(n+1))/(2\*n))+S) \$ \_\_\_\_\_  
 Productive machine hours (PMH) = (SMH\*ut%) \_\_\_\_\_ hrs/yr

**3. Ownership costs**

Interest cost (IN) = (in%\*AYI) \$ \_\_\_\_\_ yr  
 Insurance and tax cost (IT) = (it%\*AYI) \$ \_\_\_\_\_ yr  
 Yearly ownership cost (YF\$) = (AD+IN+IT) \$ \_\_\_\_\_ yr  
 Ownership cost per SMH (F\$SMH) = (YF\$/SMH) \$ \_\_\_\_\_ hr  
 Ownership cost per PMH (F\$PMH) = (YF\$/PMH) \$ \_\_\_\_\_ hr

**4. Operating costs**

Fuel cost (F) = (hp\*fcr\*fcg) \$ \_\_\_\_\_ hr  
 Lube cost (L) = (F\*lo%) \$ \_\_\_\_\_ hr  
 Repair and Maintenance cost (RM) = (AD\*rm%/PMH) \$ \_\_\_\_\_ hr  
 Operator labor and benefit cost (WB/ut%) \$ \_\_\_\_\_ hr  
 Operating cost per PMH (V\$PMH) = (F+L+RM+(WB/ut%)) \$ \_\_\_\_\_ hr  
 Operating cost per SMH (V\$SMH) = (V\$PMH\*ut%) \$ \_\_\_\_\_ hr

**5. Total Machine Costs**

Total cost per SMH (T\$SMH) = (F\$SMH+V\$SMH) \$ \_\_\_\_\_ hr  
 Total cost per PMH (T\$PMH) = (F\$PMH + V\$PMH) \$ \_\_\_\_\_ hr





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Clipboard Font Alignment Number Styles Cells Editing

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**General Machine Rate Calculation**

Valmet 445 w/bar saw

**A General Assumptions**

- 1 2000 Scheduled hours/yr *This is how many hours each year you would plan for work. Five, 8-hr days per week, 50 weeks per year is 2000 SMH.*
- 2 \$3.10 Fuel cost (\$/gal off-highway diesel) *Check current diesel price trends at <http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp>*
- 3 0.10 Interest rate (dec. %) *This would be either a loan rate or your personal time-value of money.*
- 4 0.6 Utilization (PMH/SMH) *This is the ratio of actual working hours to shift hours*

**B Fixed Equipment Costs**

- 5 \$467,000 Purchase Price (less tires on line 13 if you want detail)
- 6 0.15 Salvage value (dec. %) *A general rule-of-thumb is that logging machines are worth about 25% of new after 5 yrs*
- 7 3.5 Insurance rate (% of replacement cost) = **\$16,345.00** *lyr premium payment*
- 8 5 Life (yrs) *The ownership period or economic life of the asset*

**C Variable Equipment Costs (Productive Hour Basis)**

- 9 300 Horsepower
- 10 0.02633 Fuel consumption (g/hp-hr) = **7.9 gal/PMH**
- 11 40 Lube (% of fuel)
- 12 75 Repair and maintenance (% of dep) = **\$3,953.62 /month**
- 13 Tires 4000 PMH/set
- Miscellaneous Consumables*
- 14 \$0 ie, sawbar PMH/item bar
- 15 \$0 extra A PMH/item chain
- 16 extra B PMH/item

**D Labor Costs**

- 17 \$16.50 Base pay \$/hr
  - 18 50 Benefits/fringe (% of base)
- TOTAL = \$133.17 \$/SMH  
\$221.95 \$/PMH**

Capital cost = \$55.86 /SMH  
 Insurance = \$8.17 /SMH  
**OWNERSHIP COSTS = \$64.03 /SMH**

Fuel = \$24.49  
 Oil and Lube = \$9.79  
 Repair & Maint = \$39.70  
 Tires/tracks = \$0.00  
*Misc. Op Costs*  
 Item A =  
 Item B =  
 Item C =  
**OPERATING COSTS = \$73.98 /PMH**  
**LABOR = \$24.75 /SMH**



# Machine Rate Costing



Major Components included in costing:

- Operators Wages
- Fixed Costs
  - Purchase price
  - Interest
  - Taxes
  - Insurance
- Variable Costs
  - Fuel
  - Lube and oil
  - Repair and maintenance



# Machine Rate Costing



	<b>**1993 Total \$/Day</b>	<b>2013 Total \$/Day</b>	<b>Change in \$/Day</b>	<b>Change in %</b>
<b>Feller Buncher</b>	\$1,191	\$1,460	\$270	+23
<b>Skidder</b>	\$710	\$1,167	\$457	+64
<b>Track Skidder</b>	\$850	\$1,278	\$428	+50
<b>Slide-Boom Delimber</b>	\$1,110	\$1,533	\$423	+38
<b>Loader</b>	\$793	\$1,125	\$332	+42

\*\*Champion International cost data, adjusted for inflation

Dodson, Hayes, Meek, and Keyes. (2015). Montana Logging Machine Rates, *International Journal of Forest Engineering*





# Machine Rate Costing



## Contributing factors for increases:

- Purchase price of new equipment
  - Emission standards
  - New technology
  - Safety features
- Cost of Steel
  - 1993- \$175/ton (2013 dollars)
  - 2013- \$216/ ton 23% increase
- Fuel
  - 1993- \$1.33/gallon off road diesel (2013 dollars)
  - 2013- \$3.50/gallon off road diesel
- Repair and maintenance-parts and labor
- Labor/Insurance costs







United States  
Department of  
Agriculture

Forest Service

Forest  
Products  
Laboratory

General  
Technical  
Report  
FPL-GTR-171



# CHARGEOUT! Determining Machine and Capital Equipment Charge-Out Rates Using Discounted Cash-Flow Analysis

E.M. (Ted) Bilek



2007





# Daily Costs

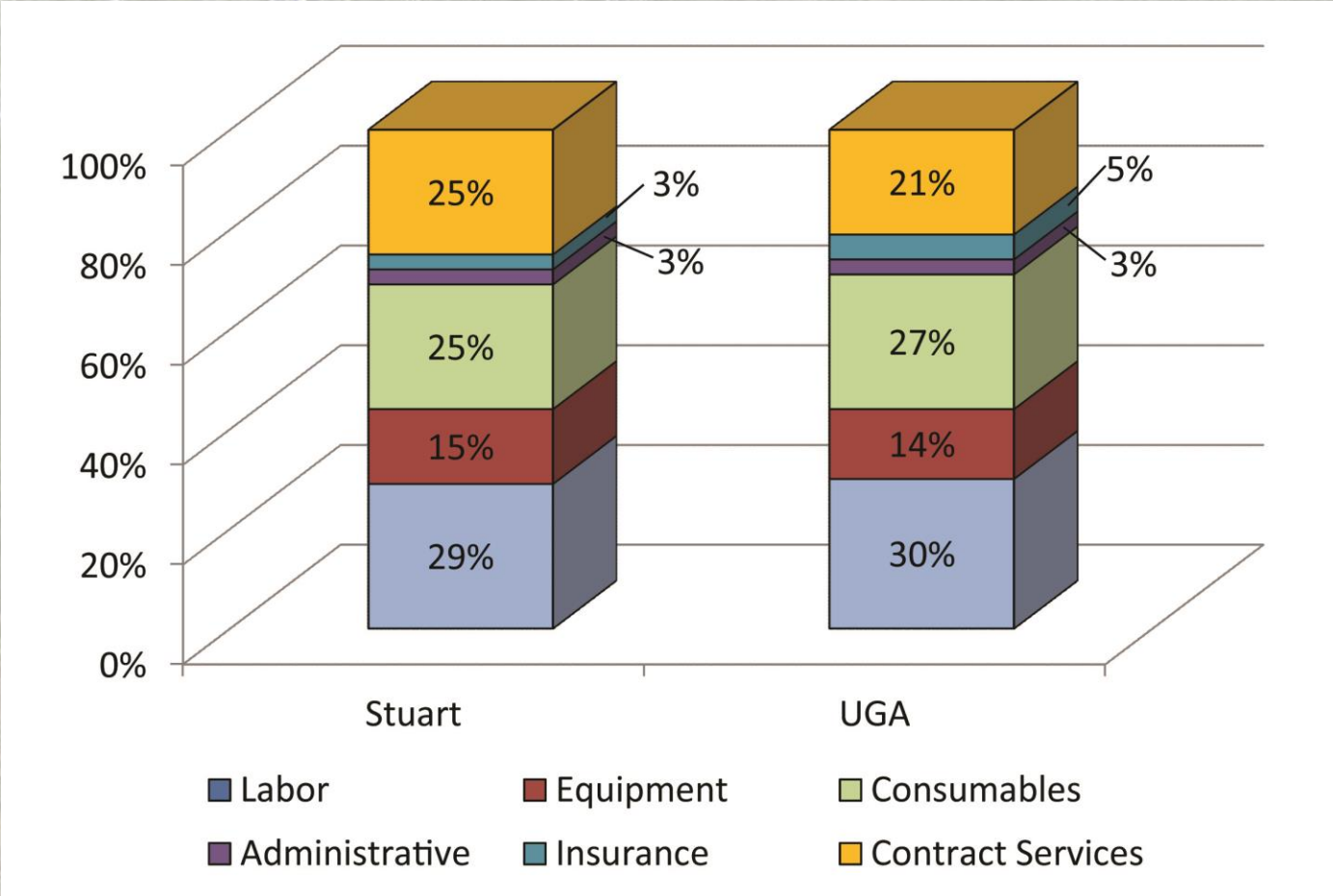


- Sum of machine rates
- Crew transportation and housing
- Rent (office, shop, etc.)
- Professional services (accountant, legal, etc.)
- Training and professional accreditation





# Cost Components



Stuart et al. (2008), Greene & Baker (2011)



# Estimating Production

- Basis of measure
  - Volume – MBF, tons
  - Area – acre, station
- Will depend on how the job is bid/paid for
- Timber sale: generally based on volume of saleable product produced
- Service contract: generally based on area treated





# Estimating Production - Volume



- Area/length – direct measure (GPS, hip chain, etc.)
- Volume
  - Volume per piece
  - Scale up to volume per turn
  - Scale or truck tickets

**BASIC AMERICAN FOODS**  
40 EAST 7TH NORTH  
REXBURG, ID 83440

MILL RESIDUE WEIGHT AND MOISTURE ANALYSIS

OSLER LOGGING WEEK ENDING 11/8/2008  
ATTN: JEREMY OSLER  
400 MOUNTAIN LION TRAIL  
BOZEMAN, MT 59718

DATE	SCALE TICKET	NET WEIGHT	PERCENT MOISTURE	H2O POUNDS	BDS POUNDS
11/4/2008	95105	47,460	22.0	10,441	37,019
11/4/2008	95106 ✓	31,000	18.0	5,580	25,420
11/5/2008	95127 ✓	43,440	17.0	7,385	36,055
11/5/2008	95132 ✓	33,480	15.0	5,022	28,458
11/8/2008	95136 ✓	36,260	17.0	6,164	30,096
11/5/2008	95140	32,740	17.0	5,566	27,174
11/5/2008	95147 ✓	63,580	19.0	12,080	51,500
11/5/2008	95149 ✓	45,680	20.0	9,136	36,544
11/5/2008	95144 ✓	38,240	15.0	5,736	32,504
11/6/2008	95164 ✓	48,740	25.0	12,185	36,555
11/6/2008	95166 ✓	48,880	30.0	14,664	34,216
11/6/2008	95169 ✓	56,820	25.0	14,205	42,615
11/6/2008	95173 ✓	50,660	28.0	14,185	36,475
11/6/2008	95183 ✓	48,700	21.0	10,227	38,473
11/6/2008	9525 ✓	53,460	24.0	12,830	40,630
11/6/2008	11555 ✓	50,800	30.0	15,240	35,560
11/6/2008	9959 ✓	50,440	22.0	11,097	39,343
11/6/2008	7956 ✓	46,660	19.0	8,865	37,795
11/7/2008	95198 ✓	42,780	24.0	10,267	32,513
11/7/2008	95210 ✓	47,960	23.0	11,031	36,929
11/7/2008	95214 ✓	52,740	19.0	10,021	42,719
11/7/2008	95218 ✓	51,600	20.0	10,320	41,280
11/7/2008	95219 ✓	49,040	19.0	9,318	39,722
11/7/2008	95224 ✓	44,560	23.0	10,249	34,311
11/7/2008	95229 ✓	53,660	22.0	11,805	41,855
		1,169,380		253,619	915,761

BDS TONS 457.8805  
GREEN TONS 584.69

AVERAGE WEEKLY PERCENTAGE OF MOISTURE CONTENT 21.69%



# Logging Costs



1. Determine costs (\$/hour, \$/day)
2. Determine production rate (MBF/hour, ton/day, acre/day)
3. Calculate cost per unit output (\$/MBF, \$/acre, \$/ton)







# BBER Logging Cost Study

- **Expert Opinion**





## Introduction

The Bureau of Business and Economic Research at the University of Montana-Missoula is conducting an ongoing logging cost study to characterize Montana timber harvest costs.

## Objectives

This study characterizes Montana timber harvest costs by:

- Updating stump-to-loaded truck cost estimates for several timber harvest systems using expert opinion derived costs
- Quantifying costs for increases or decreases in fuel, labor, insurance, parts and other cost factors affecting harvest to a 2019 cost basis
- Quantifying the effects of tree size and skidding, yarding, distances with a constant harvest volume per acre

## Methods

2019 was the sixth time since 2009 the survey was mailed to over 400 independent logging contractors and timber harvesting companies in Montana and Idaho asking for cost estimates for several timber harvest systems. Contractors responding to the survey were offered continuing education credits through the Montana Logging Association and Idaho Associated Logging Contractors. Three scenarios; whole tree ground based (figure 1), whole tree cable/skyline based (figure 2), cut to length in woods processed (figure 3) were presented.

The Survey participants were presented with a silvicultural/harvest prescription and asked to prepare a cost estimate or bid for each scenario (Table 1)

Table 1. Variables used to determine costs included:

Average skidding distance	600 feet
Average yarding distance	800 feet
Average Forwarding distance	1000 feet
Average DBH removed	13 inches
Trees per acre removed	42 (partial cut)
Cubic foot volume of average tree	24
Volume removed per acre	1,000 ft <sup>3</sup> (30 green tons)
Overall harvest acres treated	40-80 acres

## Literature Cited:

Keegan, C.E., and J. Halbrook. Harvest Cost, Employment and Labor Income Estimates for Montana's Forest Products Industry. 2006. Missoula, MT. The University of Montana, Bureau of Business and Economic Research.  
 Keegan, C.E., M.J. Niccolucci, C.E. Fiedler, J.G. Jones and R.W. Regel. 2002. Harvest Costs Collection Approaches and Associated Equations For Restoration Treatments On National Forests. Forest Prod. J. 52(7/8); 96-99.

Figure 1. Ground Based System

	All costs in 2019 dollars							
	\$/Green Ton				\$/MBF			
	2009	2011	2013	2015	2017	2019	2017	2019
Feller-buncher	\$8.41	\$7.85	\$7.74	\$8.42	\$8.57	\$7.90	\$53.15	\$48.98
Skidding 600'	\$6.62	\$5.94	\$6.16	\$6.94	\$6.86	\$6.74	\$42.52	\$41.79
Skidding 1,200'	\$8.57	\$7.40	\$7.73	\$8.71	\$8.67	\$8.74	\$53.73	\$54.19
Skidding 1,800'	\$10.62	\$8.87	\$9.41	\$11.28	\$10.94	\$11.15	\$67.84	\$69.13
Processing	\$8.06	\$7.41	\$7.50	\$8.16	\$8.27	\$8.14	\$51.29	\$50.47
Loading	\$3.80	\$3.85	\$3.79	\$3.57	\$3.63	\$3.89	\$22.49	\$24.12
Administration	\$1.66	\$1.39	\$1.89	\$1.88	\$2.06	\$2.45	\$12.76	\$15.19
<b>Total</b>	\$28.56	\$26.44	\$27.08	\$28.98	\$29.39	\$29.12	\$182.21	\$180.54



Figure 2. Cable System

	All costs in 2019 dollars							
	\$/Green Ton				\$/MBF			
	2009	2011	2013	2015	2017	2019	2017	2019
Hand-Felling	\$5.77	\$5.40	\$4.97	\$4.80	\$5.32	\$5.59	\$32.99	\$34.66
Yarding 800'	\$25.79	\$24.96	\$22.28	\$23.42	\$23.33	\$21.79	\$144.64	\$135.10
Yarding 1,600'	\$30.65	\$30.76	\$24.56	\$27.08	\$28.12	\$26.43	\$174.35	\$163.87
Yarding 2,000'	\$35.28	\$33.49	\$26.02	\$30.04	\$30.46	\$29.17	\$188.84	\$180.85
Processing	\$8.15	\$7.56	\$7.39	\$8.32	\$8.51	\$9.00	\$52.77	\$55.80
Loading	\$3.79	\$3.73	\$3.66	\$3.85	\$3.95	\$5.27	\$24.48	\$32.67
Administration	\$2.11	\$1.84	\$1.81	\$1.78	\$1.81	\$2.85	\$11.21	\$17.67
<b>Total</b>	\$45.62	\$43.48	\$40.11	\$42.17	\$42.92	\$44.50	\$266.09	\$275.90

Figure 3. Cut-to-length System

	All costs in 2019 dollars							
	\$/Green Ton				\$/MBF			
	2009	2011	2013	2015*	2017*	2019	2017	2019
Harvester	\$15.73	\$13.47	\$15.72	\$16.70	\$16.50	\$16.56	\$102.31	\$102.67
Forwarding 1,000'	\$10.96	\$9.26	\$10.31	\$11.52	\$13.17	\$13.01	\$81.65	\$80.66
Forwarding 2,000'	\$16.05	\$11.88	\$15.94	\$13.55	\$15.34	\$14.50	\$95.10	\$89.90
Forwarding 3,000'	\$19.73	\$15.85	\$18.69	\$17.30	\$19.27	\$17.00	\$119.45	\$105.40
Loading	\$4.13	\$3.83	\$4.29	\$4.22	\$4.21	\$4.61	\$26.09	\$28.58
Administration	\$1.77	\$1.45	\$2.09	\$1.82	\$1.92	\$2.68	\$11.92	\$16.62
<b>Total</b>	\$32.58	\$28.01	\$32.41	\$34.26	\$35.80	\$36.86	\$221.86	\$228.53



All costs in 2019 dollars

\* 2015 and 2017 CTL costs are calculated since no surveys were returned

## RESULTS

• 2019 reported stump to loaded truck costs ranged from \$29.12 per green ton for ground based systems employing whole tree skidding to \$36.86 for cut to length and \$44.50 for cable systems based on Table 1 harvest characteristics.

• Results indicate that smaller-diameter trees and longer skidding/yarding distances tend to increase costs and that cable systems are more expensive than ground-based systems.

• 2019 reported logging costs were typically higher than 2017 but lower than some previous survey years based costs, despite higher fuel and other operating costs.

• Lower harvesting costs are due primarily to attempts by loggers to continue operating in a competitive economic market. With improving delivered log prices some increases in logging cost are expected.

• Loggers felt "The 2009/2011 rates are not sustainable and contractors were bidding to maintain a viable core business & crew at minimal profit levels."

• Because of the survey's simplicity and repeatability, results can be compared with previous (Keegan et al. 1995, 2002) and future cost surveys to examine the impacts through time of changing fuel costs, harvest characteristics, or other items of interest.

## SURVEY RESPONSE COMMENTS

• "... our costs are way up; payroll and health insurance for our employees, fuel and repairs are taking all what we make; can't log for any less.

• Overall rates/costs are too low, especially with the cost of fuel and parts going up.

• Changes in fuel costs affect logging costs directly, 10% change in fuel = 2.5% change in logging costs.

• Sometimes there are a number of overlooked conditions that have more effect on expenses vs. production than the obvious ones of TPA/diameter/distance.

• Every job is so different that giving you our cost would be a wild guess.

• There are very few equipment operators left that can do the job right and that care about what they do. So with the cost of fuel, parts, labor, insurance and work comp you barely break even at the current logging prices. If you add in a new equipment payment you would go broke.

• Political policy and federal regulation has sent this industry into a deliberate yet totally unnecessary tailspin-shame-shame-shame!



# Survey Questions

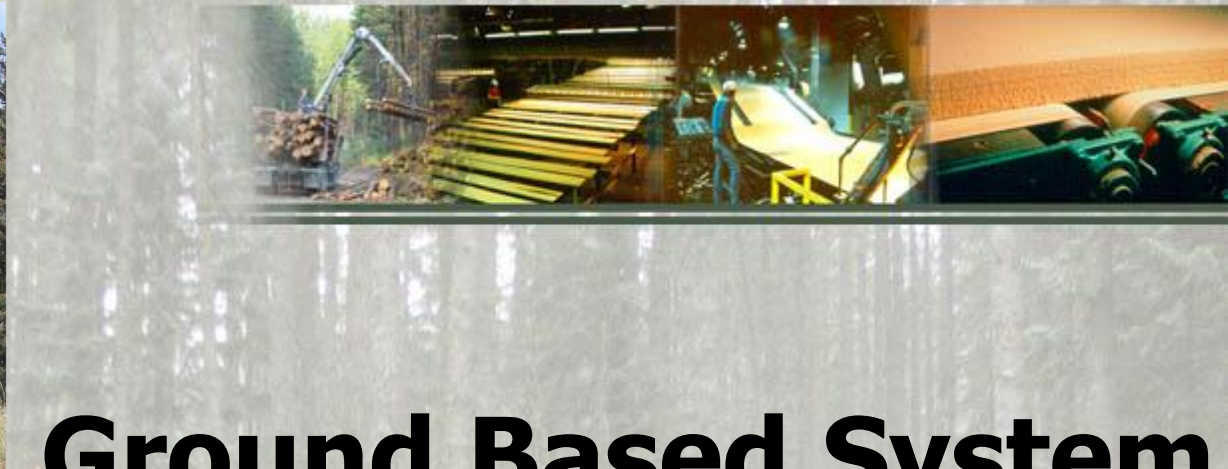


**Ground based whole-tree costs** (stump-to-loaded-truck) include a feller-buncher, grapple skidder or cat, delimeter, loader, and planning & administration. On an average sale unit, slope < 35%, no special provisions. Please provide cost for all skidding distances. How would a change in volume per acre change your stump-to-truck costs? Provide costs in \$/Green ton or \$/MBF whichever you are most familiar with.

MONTANA	Costs from 2015 survey		Your 2017 cost estimates							
	4 mbf/acre cut		4 mbf/acre cut		8 mbf/ac cut		10 mbf/ac cut		12 mbf/ac cut	
	\$/Green Ton	\$/MBF	\$/Green Ton	\$/MBF	\$/Green Ton	\$/MBF	\$/Green Ton	\$/MBF	\$/Green Ton	\$/MBF
Feller-buncher	\$7.85	\$48.67								
External Skidding										
600 feet	\$6.47	\$40.11								
or <b>1,200 feet</b>	\$8.12	\$50.34								
or <b>1,800 feet</b>	\$10.51	\$65.16								
Processing	\$7.61	\$47.18								
Loading	\$3.33	\$20.65								
Administration	\$1.75	\$10.85								
<b>Total</b>	<b>\$27.01</b>	<b>\$167.46</b>								







# Ground Based System

	\$/Green Ton						\$/MBF	
	2009	2011	2013	2015	2017	2019	2017	2019
<b>Feller-buncher</b>	\$8.41	\$7.85	\$7.74	\$8.42	\$8.57	\$7.90	\$53.15	\$48.98
<b>Skidding 600'</b>	\$6.62	\$5.94	\$6.16	\$6.94	\$6.86	\$6.74	\$42.52	\$41.79
<b>Skidding 1,200'</b>	\$8.57	\$7.40	\$7.73	\$8.71	\$8.67	\$8.74	\$53.73	\$54.19
<b>Skidding 1,800'</b>	\$10.62	\$8.87	\$9.41	\$11.28	\$10.94	\$11.15	\$67.84	\$69.13
<b>Processing</b>	\$8.06	\$7.41	\$7.50	\$8.16	\$8.27	\$8.14	\$51.29	\$50.47
<b>Loading</b>	\$3.80	\$3.85	\$3.79	\$3.57	\$3.63	\$3.89	\$22.49	\$24.12
<b>Administration</b>	\$1.66	\$1.39	\$1.89	\$1.88	\$2.06	\$2.45	\$12.76	\$15.19
<b>Total</b>	\$28.56	\$26.44	\$27.08	\$28.98	\$29.39	\$29.12	\$182.21	\$180.54



## GROUND BASED REGRESSION MODEL COMPARISON

### 2019 Ground Based Logging Cost Model (Predicting Survey Data)

Variable	Coefficient (\$ / Ton)		\$/Ton
Constant	29.015		\$ 29.02
Skid Dist (100 ft)	0.310	600.0	\$ 1.86
Vol / Acre (MBF)	-0.363	4.0	\$ (1.45)
State (MT=0, ID=1)	0.000	MT	\$ -
			\$ 29.42

### 2019 STUMP TO LOADED TRUCK PREDICTED COSTS (\$ PER TON)

#### Yarding Distance (100's ft)

Volume / Acre Harvested (MBF)	4	6	8	10	12	14	16	18	20
4	\$28.80	\$29.42	\$30.04	\$30.66	\$31.28	\$31.90	\$32.52	\$33.14	\$33.76
6	\$28.08	\$28.70	\$29.32	\$29.94	\$30.55	\$31.17	\$31.79	\$32.41	\$33.03
8	\$27.35	\$27.97	\$28.59	\$29.21	\$29.83	\$30.45	\$31.07	\$31.69	\$32.31
10	\$26.62	\$27.24	\$27.86	\$28.48	\$29.10	\$29.72	\$30.34	\$30.96	\$31.58
12	\$25.90	\$26.52	\$27.14	\$27.76	\$28.38	\$29.00	\$29.62	\$30.24	\$30.86
14	\$25.17	\$25.79	\$26.41	\$27.03	\$27.65	\$28.27	\$28.89	\$29.51	\$30.13
16	\$24.45	\$25.07	\$25.69	\$26.31	\$26.92	\$27.54	\$28.16	\$28.78	\$29.40
18	\$23.72	\$24.34	\$24.96	\$25.58	\$26.20	\$26.82	\$27.44	\$28.06	\$28.68
20	\$22.99	\$23.61	\$24.23	\$24.85	\$25.47	\$26.09	\$26.71	\$27.33	\$27.95

#### NOTES:

1. Yellow shaded cells define the range of the base data.
2. Use sale specific conversion factors to convert to \$ per CCF or \$ per MBF.

N = 14 surveys





# Cable System

	\$/Green Ton						\$/MBF	
	2009	2011	2013	2015	2017	2019	2017	2019
<b>Hand-Felling</b>	\$5.77	\$5.40	\$4.97	\$4.80	\$5.32	\$5.59	\$32.99	\$34.66
<b>Yarding 800'</b>	\$25.79	\$24.96	\$22.28	\$23.42	\$23.33	\$21.79	\$144.64	\$135.10
<b>Yarding 1,600'</b>	\$30.65	\$30.76	\$24.56	\$27.08	\$28.12	\$26.43	\$174.35	\$163.87
<b>Yarding 2,000'</b>	\$35.28	\$33.49	\$26.02	\$30.04	\$30.46	\$29.17	\$188.84	\$180.85
<b>Processing</b>	\$8.15	\$7.56	\$7.39	\$8.32	\$8.51	\$9.00	\$52.77	\$55.80
<b>Loading</b>	\$3.79	\$3.73	\$3.66	\$3.85	\$3.95	\$5.27	\$24.48	\$32.67
<b>Administration</b>	\$2.11	\$1.84	\$1.81	\$1.78	\$1.81	\$2.85	\$11.21	\$17.67
<b>Total</b>	\$45.62	\$43.48	\$40.11	\$42.17	\$42.92	\$44.50	\$266.09	\$275.90





# Cut-to-length System

	\$/Green Ton						\$/MBF	
	2009	2011	2013	2015*	2017*	2019	2017	2019
<b>Harvester</b>	\$15.73	\$13.47	\$15.72	\$16.70	\$16.50	\$16.56	\$102.31	\$102.67
<b>Forwarding 1,000'</b>	\$10.96	\$9.26	\$10.31	\$11.52	\$13.17	\$13.01	\$81.65	\$80.66
<b>Forwarding 2,000'</b>	\$16.05	\$11.88	\$15.94	\$13.55	\$15.34	\$14.50	\$95.10	\$89.90
<b>Forwarding 3,000'</b>	\$19.73	\$15.85	\$18.69	\$17.30	\$19.27	\$17.00	\$119.45	\$105.40
<b>Loading</b>	\$4.13	\$3.83	\$4.29	\$4.22	\$4.21	\$4.61	\$26.09	\$28.58
<b>Administration</b>	\$1.77	\$1.45	\$2.09	\$1.82	\$1.92	\$2.68	\$11.92	\$16.62
<b>Total</b>	\$32.58	\$28.01	\$32.41	\$34.26	\$35.80	\$36.86	\$221.86	\$228.53



# SURVEY COMMENTS



- Changes in fuel costs affect logging costs directly, 10% change in fuel = 2.5% change in logging costs.
- Reduced harvesting & the economic situation have resulted in bid rates well below prior year averages. In my opinion these rates are not sustainable and contractors are bidding to maintain a viable core business & crew at minimal profit levels.
- Two years ago we were running five mechanized sides but because of market conditions and the economy we have cut our work force to 3 mechanized sides.
- Our costs are way up; these prices are too low, Payroll and health insurance for our employees and fuel costs are taking all what we make. Cost of new equipment, fuel and repairs is a killer; can't log for any less.
- The problem with logging is the cost of equipment and parts have doubled in the last 4-5 years and the pay to the logger has stayed at a low level. At the same time the work force is shrinking, hard to find someone that is willing to do a good job and care.
- Sometimes there are a number of overlooked conditions that have more effect on expenses vs. production than the obvious ones of TPA/diameter/distance.
- If some change does not happen soon we will be out of business, lack of profitable jobs, due to market conditions and greedy mills. In this area we don't see them hurting. It is all put onto the logger to make up for shortfalls.





# **Estimated Log Hauling Costs for Idaho and Montana 2010, 2012, 2014, 2016 & 2018**

- The goal of this project is to develop better estimates of log hauling costs and to get a better understanding of key variables and factors impacting log hauling costs.**





# Excel Haul Appraisal Workbook



Haul Appraisal Worksheet:

Calculated Fields

User input fields

### Road Classification

C = "goat roads"  
 BC = avg. woods  
 B = fast grav/woods  
 AB = pavement  
 A = fed/state hwy

Appraisal formula	Est. RT	Destinations or/ one way mileage / round trip hours								
		<u>Mill 1</u>		<u>Mill 2</u>		<u>Mill 3</u>		<u>Mill 4</u>		
		# miles	RT hrs.	# miles	RT hrs.	# miles	RT hrs.	# miles	RT hrs.	
Class	\$/ton	mph								
C	\$ 0.27	6	0	0.00	0	0.00	0	0.00	0	0.00
BC	\$ 0.19	13	10	1.54	10	1.54	0	0.00	0	0.00
B	\$ 0.15	22	0	0.00	0	0.00	0	0.00	0	0.00
AB	\$ 0.20	30	0	0.00	0	0.00	0	0.00	0	0.00
A	\$ 0.16	55	150	5.45	240	8.73	30	1.09	50	1.82
Other	\$ -	0	0	0.00	0	0.00	0	0.00	0	0.00
		Load hrs		0.75		1		0.75		0.75
base rate	\$ -	Unload hrs		0.75		1		0.75		0.75
		Haul miles & hrs / RT =	160	8.49	250	12.27	30	2.59	50	3.32
		Avg. tons/load =		28		28		28		28
		Appraisal formula \$/ton & \$/hr =	\$25.90	\$85.39	\$40.30	\$92.00	\$4.80	\$51.87	\$ 8.00	\$67.51
		Proposed \$/ton & \$/hr =	\$24.54	\$80.90	\$37.44	\$85.47	\$7.85	\$84.84	\$10.32	\$87.08
		Fuel Surcharge:								
		Base Rate:	\$24.54	\$80.90	\$37.44	\$85.47	\$7.85	\$84.84	\$10.32	\$87.08



# Log Hauling Costs



- Following an engineering/cost analysis and discussion with individuals in the trucking and logging industry, researchers developed questionnaires to be administered to truckers and to entities contracting with truckers hauling logs.
- Operators responded to estimated costs developed for hauls of various lengths on paved and gravel roads. If the respondents' costs differed from BBER costs they were asked to supply their own cost estimates of operations.







# Haul Cost

A single cost per mile, for a range of haul distances, is not sufficient to estimate haul costs; in estimating costs it is necessary to account for loading and unloading (and other delays).

- Cost per day of operating a logging truck ranged from \$970 to \$1,050 given a 70 mile one way haul, \$3 diesel .
- At \$4 diesel the range increases to \$1,038 to \$1,124.
- About a 7% increase.







# Conventional Truck: cost/delivered ton

One-way Haul Miles	30	50	70	110	160	250
Diesel Cost						
\$1.80/gal	\$6.74	\$8.88	\$11.29	\$14.62	\$19.80	\$29.94
Decrease	-6%	-8%	-9%	-10%	-11%	-11%
\$3.00/ gal	\$7.20	\$9.65	\$12.36	\$16.31	\$22.25	\$33.76
\$4.00/gal	\$7.58	\$10.28	\$13.25	\$17.71	\$24.30	\$36.95
Increase	5%	7%	7%	9%	9%	14%







# Conventional Truck: cost/mile/ton

One-way Haul Miles	30	50	70	110	160	250
Diesel Cost						
\$1.80/gal	\$0.22	\$0.18	\$0.16	\$0.13	\$0.12	\$0.12
Decrease	-8%	-10%	-11%	-13%	-14%	-14%
\$3.00/gal	\$0.24	\$0.19	\$0.18	\$0.15	\$0.14	\$0.14
\$4.00/gal	\$0.25	\$0.21	\$0.19	\$0.16	\$0.15	\$0.15
Increase	4%	10%	6%	7%	7%	7%





# Why does it Matter?



Random lengths composite index construction lumber price:		\$436/mbf lumber tally	
Modern high-tech mill overrun/lumber recovery is 2 x mbf log scale:		\$872/mbf lumber tally	
Costs:	Manufacturing cost, including Profit and Risk:	\$300/mbf	
	Log hauling cost:	\$100/mbf	
	Logging cost: Ground based:	\$175/mbf	
		Skyline/cable:	\$256/mbf
	Other management costs:	\$100/mbf	
Stumpage:	What's \$\$\$ left for the owner of the trees?		
	With ground based logging	\$197/mbf	
	With skyline/cable logging	\$116/mbf	





# Logging Cost Study

**“Harvest Cost Collection Approaches and Associated Equations for Restoration Treatments on National Forests” Keegan, et al, Forest Products Journal, July/ August 2002.**







# Logging Cost Study

- **Cost Estimation Approaches**  
(Horngren et. al, 2000)
  - **Industrial Engineering Method (Time and Motion)**
  - **Conference Method (Expert Opinion)**
  - **Account Analysis Method**
  - **Quantitative Analysis Method**







# **BBER Logging Cost Approach**

- **Expert Opinion combined with Quantitative Analysis**
  - **Steve covered the cost collection process used to collect the expert opinions**
  - **I will cover the Quantitative Analysis used and recent results for Logging and Hauling Costs**







# **BBER Logging Cost Approach**

- **Methods – Statistical Analysis of Expert Opinion Responses**
  - **Regression analysis used to develop logging and haul cost models based on costs collected from experts**
  - **Repeated measure design**
    - **Each respondent considered an observation and each scenario served as the repeated measure**
  - **Very simple models. Tradeoff between survey complexity and development of a parsimonious model (model that accomplishes a desired level of prediction with as few predictor variables as possible)**







# BBER Logging Cost Analysis

***"all models are wrong, but some are useful" George E. P. Box***

***The model will never represent the exact real behavior ... but even if a model cannot describe exactly the reality it could be very helpful if it is close enough.***







# BBER Ground Based Logging Cost Results

2019 STUMP TO LOADED TRUCK PREDICTED COSTS (\$ PER TON)				2019 STUMP TO LOADED TRUCK AVERAGE COSTS (\$ PER TON)				DIFFERENCE BETWEEN SURVEY AVERAGE vs PREDICTED AVERAGE			
Yarding Dist. (100's ft)				Yarding Dist. (100's ft)				Yarding Dist. (100's ft)			
Vol / Acre Harvested (MBF)	6	12	18	Vol / Acre Harvested (MBF)	6	12	18	Vol / Acre Harvested (MBF)	6	12	18
4	\$29.42	\$31.28	\$33.14	4	\$29.68	\$31.12	\$33.55	4	\$0.26	-\$0.16	\$0.41
8	\$27.97	\$29.83	\$31.69	8	\$28.18	\$28.83	\$31.73	8	\$0.21	-\$1.00	\$0.04
10	\$27.24	\$29.10	\$30.96	10	\$27.50	\$29.20	\$30.88	10	\$0.26	\$0.10	-\$0.08
12	\$26.52	\$28.38	\$30.24	12	\$25.88	\$26.92	\$29.40	12	-\$0.64	-\$1.46	-\$0.84
16	\$25.07	\$26.92	\$28.78	16	\$25.39	\$27.20	\$29.27	16	\$0.32	\$0.28	\$0.49





# BBER Cable Logging Cost Results

2019 STUMP TO LOADED TRUCK PREDICTED COSTS (\$ PER TON)				2019 STUMP TO LOADED TRUCK AVERAGE COSTS (\$ PER TON)				DIFFERENCE BETWEEN SURVEY AVERAGE vs PREDICTED AVERAGE			
Yarding Dist. (100's ft)				Yarding Dist. (100's ft)				Yarding Dist. (100's ft)			
Vol / Acre Harvested (MBF)	8	16	20	Vol / Acre Harvested (MBF)	8	16	20	Vol / Acre Harvested (MBF)	8	16	20
4	\$45.00	\$51.07	\$54.11	4	\$44.82	\$50.59	\$54.25	4	-\$0.18	-\$0.48	\$0.14
8	\$43.03	\$49.11	\$52.14	8	\$42.00	\$48.00	NR	8	-\$1.03	-\$1.11	#VALUE!
10	\$42.05	\$48.12	\$51.16	10	\$43.18	\$48.62	\$51.85	10	\$1.14	\$0.50	\$0.69
16	\$39.09	\$45.17	\$48.21	16	\$38.51	\$44.40	\$46.81	16	-\$0.58	-\$0.77	-\$1.40
22	\$36.14	\$42.22	\$45.26	22	\$35.77	\$43.31	\$45.69	22	-\$0.37	\$1.09	\$0.43



## **BBER Haul Cost Results**

### **Loads per day based one way haul**

	<b>Miles</b>	<b>Loads / day</b>	
	30	4	
	50	3	
	70	2.5	
	110	2	
	160	1.5	
	250	1	





# 2018 BBER Haul Cost Results

## 2018 PREDICTED HAUL COSTS (\$ PER TON)

Total One Way Haul	10	30	50	70	90	110	130	150
	\$7.09	\$9.61	\$12.13	\$14.65	\$17.17	\$19.69	\$22.21	\$24.73



# Sale Feasibility Analysis (Gates 1-3)

## Use of Costs in Sale Development



	<b><u>\$ / MBF</u></b>
<b>REVENUES</b>	
Delivered Log Price	\$ 419.30
<b>COSTS</b>	
Private	
Stump-to-Loaded Truck Costs	\$ 250.60
Haul Costs	\$ 47.48
Forest Service Costs	
Road Maintenance Costs	\$ 10.10
Environmental Protection Costs	\$ 25.18
Temporary Development Costs	\$ -
Specified Road Costs	\$ 39.88
Non-sawtimber Adjustment	\$ -
Total Private and Forest Service Costs	\$ 373.24
<b>ESTIMATED STUMPAGE VALUE (REVENUE - COSTS)</b>	<b>\$ 46.06</b>
Minimum Rate or Required Reforestation	\$ 24.26
<b>BREAKEVEN POINT</b>	<b>\$ 397.50</b>



# Questions?



Contact Us!

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