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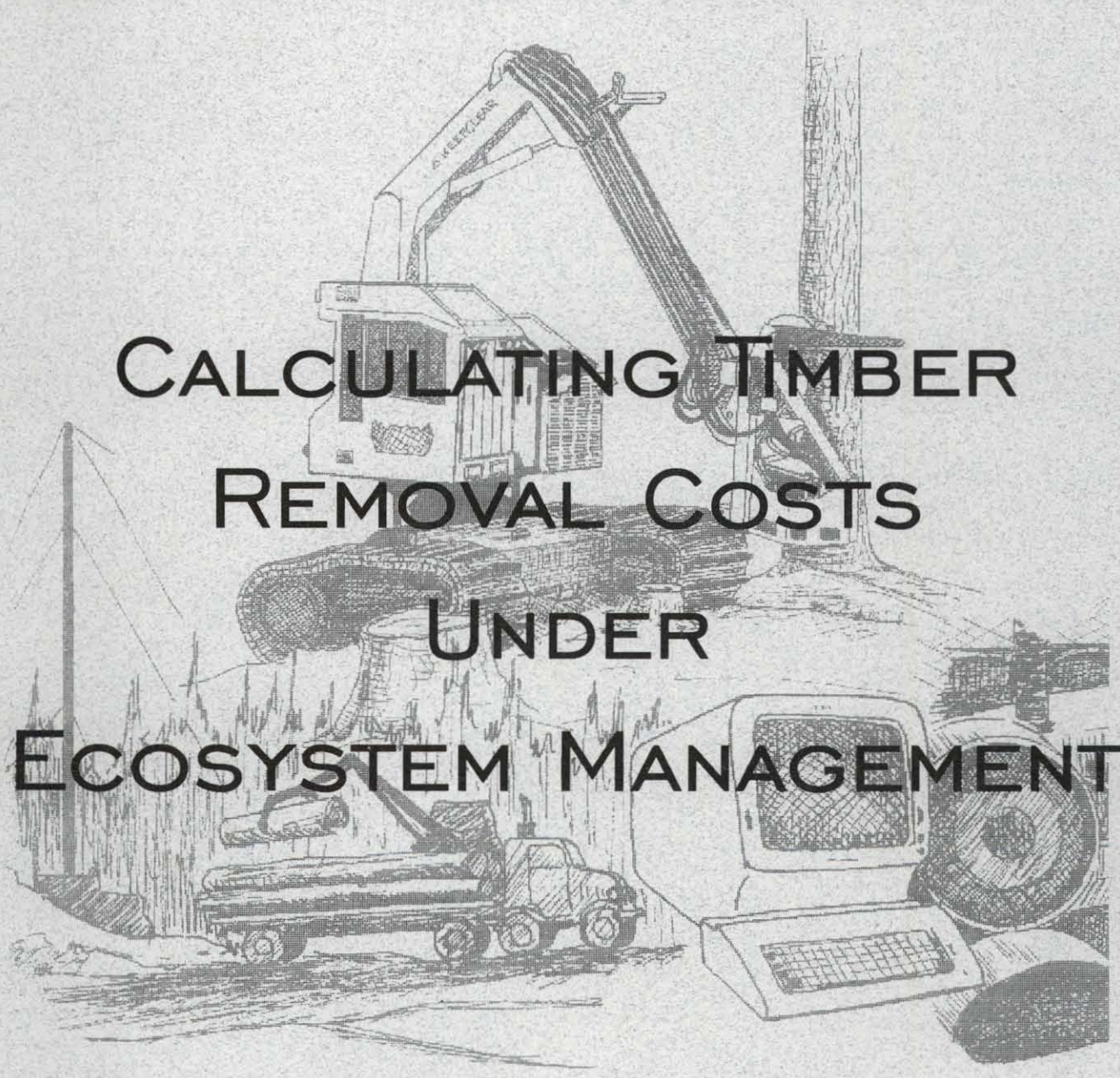

Calculating Timber Removal Costs Under Ecosystem Management

Harry W. Lee and Leonard R. Johnson

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IMPLEMENTING ECOSYSTEM MANAGEMENT ON NIPF LANDS IN THE PACIFIC NORTHWEST

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Introduction

Recently, we have seen a variety of terms used to describe a changing and evolving philosophy toward forest management. We have heard of concepts called new forestry, adaptive forestry, environmental forestry, and ecosystem management. Although there are differences in how forest management is viewed in each of these concepts, the impact on the cost of vegetative manipulation and timber removal will be similar. All of these forest management concepts put a greater emphasis on partial cutting, are likely to result in harvesting a larger portion of trees from the smaller diameter classes and, in some cases, stress a reduction in the road density used to access the site. These factors generally translate into higher timber removal costs.

Estimating the cost of timber harvesting can be difficult because of the large number of factors affecting harvesting costs. When silvicultural prescriptions and methods of timber removal change significantly from those normally encountered, cost estimation can be even more difficult. This publication can be used to develop cost estimates for timber harvesting under the stand conditions and silvicultural prescriptions likely to be found when applying principles of ecosystem management. The cost estimation process can also be used to determine the impact on logging costs of alternative silvicultural prescriptions. Costs are developed in dollars per unit of output, in this case a thousand board feet of timber (MBF) and are based on actual 1995 cost data for equipment and labor.

The cost analysis uses a basic cost calculation to determine the cost per MBF to fell, buck, skid, load and haul the timber. The basic costs are a function of the hourly cost of the equipment, the size of the removed trees, pieces moved or processed per productive cycle, and the average cycle time. Each cost component is modified by factors related to the density of the timber stand, the percent of trees removed, steepness of the site, and skidding and hauling distances. Costs of each of the revised components are then summed to provide an estimate of the total logging cost. Costs to prepare the site for logging, to move equipment to the site, to pile slash and close trails after operations, and an allowance for overhead and profit of the owner of the logging firm are added to these costs. The user is guided through this process through a series of tables compiled in Appendix A. Example calculations describe the process in detail.

A large array of equipment is available to perform the specific tasks of timber harvesting. The data shown here represent the most common types of equipment in this region and allows the user to select from among a limited choice of common equipment options.

As the size and cost of the equipment increases, such as that used in mechanized harvesting operations, the size of the harvest unit becomes more important. The cost to move the equipment to the logging site is a fixed cost and must be offset by a sufficient size area and sufficient volume for removal. Small units (20 acres and less) can generally not justify use of mechanized systems unless they are close to an area that is also utilizing the same mechanized system. Conventional systems using chainsaws to fell and buck are generally more mobile than the mechanized systems and can be moved to a site for less cost.

Base Assumptions for Average Costs

The initial cost calculation for each of the tasks of harvesting represents an estimate for an average stand and typical harvest prescription. Volumes are expressed in gross MBF, the common practice in the region since that is the basis for paying the logger. The mill, however, will pay for the wood (after making a deduction for defect) on the net board feet delivered. Harvesting timber with high defect will result in less revenue, but the same logging costs, as harvesting timber with low defect.

The average conditions assumed for the base costs shown here include the following:

Volume/Acre:	5000 - 8000 Gross BF/Acre
Removed Volume/Acre:	2400 - 3200 Gross BF/Acre
Percent Defect:	10%
Initial Density of Trees (Down to 4 Feet in Height):	350 Trees/Acre
Merchantable tree density:	200 Trees/Acre
Final Tree Density:	300 Trees/Acre
Percent Tree Removal:	25% of Merchantable
Percent Volume Removed:	40% of Merchantable
Range of Piece Diameter:	8 to 16 Inches
Average Piece Diameter:	10 Inches
Average Merchantable Tree Length:	65 Feet
Average Log Length:	28 Feet
Average Skid Distance:	500 Feet
Percent Slope for Skidding:	5% Favorable
Pieces/Skidding Cycle:	6

The average logging cost calculated in the base calculation reflects these conditions. Variance from these conditions can be accounted for through a set of cost modifiers provided in the accompanying tables. These modifiers adjust costs for differences in skid distance, slope, density of trees, percent of trees removed, percent defect of the trees, and piece size. The costs do not reflect additional time and cost that might be required to work safely around snags or other hazards or the additional cost required to achieve some specific aesthetic goal of the landowner.

Overview of Equipment

The tables for felling and skidding include the most common equipment used in the region to harvest timber. This includes manual felling and bucking, two types of mechanized feller-bunchers, two types of mechanized delimber-processors (mechanized bucking), skidders and crawlers in two size classes, a cut-to-length forwarder, a small and medium-sized cable yarder for operations on steeper slopes, a conventional hydraulic loader and conventional log trucks. Costs are included for new and used equipment in the skidder and crawler classifications since many loggers utilize functional used equipment for skidding to reduce their investment in equipment.

Felling and skidding equipment is most often used in some common combinations. Manual felling and bucking is generally combined with a skidder or crawler on gentle terrain (slopes less than 35-40%). The crawler is often selected rather than the skidder where skidding distances are relatively short or where slopes are steeper (25% and higher). Many small-scale loggers, however, will utilize a small crawler as their single skidding vehicle because of its versatility and its ability to maneuver in the limited areas common when thinning stands. This capability allows the small crawler to work effectively in small woodlots.

Material will normally be skidded tree length to a landing and bucked to log lengths at that location. Consideration of the damage that might be caused to the residual stand by movement of tree length material may cause the landowner to require log-length logging. In this case, material is felled, limbed and bucked in the woods, and logs, rather than entire trees, are skidded to the landing. Log length skidding is more costly than with tree length logging because more pieces are handled in the skidding operation. Newer equipment such as the cut-to-length forwarder might be combined with a log length felling and bucking operation where skidding distances are long and the logs are prebunched to a skid trail for the forwarder. The forwarder is an expensive machine, however, and would probably have to work with several small operations to make this pay. Even this approach may not be feasible because of problems associated with working with several different landowners and the work involved in moving the forwarder.

When slopes exceed 35 to 40 percent, cable yarders will usually be used to move material to the landing. This operation is called yarding rather than skidding. Two size classes of cable yarders are shown in the equipment table. The small size is most appropriate for average tree diameters of 12 to 15 inches, but with proper technique can still be used to move larger logs. The medium-sized yarder would normally be used when a significant number of logs are larger than 15 inches in tree diameter.

Cable yarding operations are usually done with log length material to facilitate handling and decking at limited landings areas. In these cases, felled trees are limbed and bucked in the woods.

Mechanization of one step of a logging operation usually requires mechanization of all steps. A feller-buncher in the felling function would be linked to a skidder or crawler with a grapple. The grapple is needed on the skidding vehicle to effectively handle the bunches produced by the feller-buncher and to keep up with the production of the feller-buncher. Mechanization would also be needed in the processing step of the operation; usually, some type of mechanized limbing and bucking equipment would be operating at the landing.

Basic Cost Calculation

The accompanying tables in Appendix A are organized in the order they would be used to develop harvesting costs.

The basic cost calculation shown in Table 5 considers the hourly cost of the equipment, the hours required per productive cycle under the average conditions noted above, the pieces that can be processed per cycle and the average volume per piece. Hourly costs, average hours per cycle and pieces per cycle are obtained from Tables 2 and 3 for felling, bucking, and skidding equipment. Average piece size comes from the average conditions of the stand being harvested, and can be calculated as shown in Table 1 from the number of harvested trees per acre, the harvested volume per acre, the average tree length, and average log length. Many modern computer programs can provide estimates of the required information from common timber inventory (cruise) data.

Costs related to moving equipment, preparing the site, performing follow-up activities after logging and owner profit and overhead are added to these basic logging costs to develop a total cost estimate for logging.

Example Calculations

Calculation of basic harvesting costs and use of the information provided in the tables can best be illustrated through example calculations. Three are provided here.

Example 1: Conventional Logging

Suppose you are removing 50 of the 350 trees per acre on your 40 acre woodlot. The removed volume will average 2,400 board feet per acre. Trees have low defect, average 10 inches in diameter, and average 50 feet in merchantable height. The preferred log length is 33 feet. The average log length will be something less than the 33 foot log. Shorter logs are cut to make a specific log product, because of defect or form problems, or to utilize logs from the top of the tree. Ground slopes are fairly gentle and average 5% down to the landing. Your average skid distance is 600 feet. Because of the gentle slopes and low intensity of removal, you elect to use manual felling with a chainsaw and tree length skidding with a small, new wheeled skidder. Bucking will take place at the landing. You are located 50 miles from the mill.

Using the formulas of Table 1, you calculate your average piece size and the number of logs per tree as follows:

$$\text{Logs/Tree} = \frac{\text{Average Merchantable Tree Length}}{\text{Preferred Log Length}} = \frac{50}{33} = 1.52 \text{ Logs/Tree}$$

Rounded to 2 Logs/Tree

$$\text{MBF/Tree} = \frac{\text{Removed MBF/Acre}}{\text{Removed Trees/Acre}} = \frac{2{,}400}{50} = 48 \text{ BF/Tree} = .048 \text{ MBF/Tree}$$

$$\text{MBF/Log} = \frac{48 \text{ BF/Tree}}{2 \text{ Logs/Tree}} = 24 \text{ BF/Log} = .024 \text{ MBF/Log}$$

$$\text{Total Volume Harvested} = \left[\frac{2{,}400 \text{ BF}}{\text{Acre}} * 40 \text{ Acres}\right] / 1{,}000 = 96 \text{ MBF}$$

The next step determines hourly cost and production for felling, skidding and bucking. Using Tables 2 and 3, we find hourly costs, product and pieces per cycle for our selected equipment.

	Hourly Cost	Hours/Cycle	Pieces/Cycle
Felling	25.87	.05	1
Bucking	25.87	.04	2 *
Skidding	49.06	.20	5 **

* Number of logs per tree

** Interpretation between load size for 8" and 12" material

Note that the feller and bucker produce one tree per cycle. For the bucker, this represents a cycle size equal to the number of logs per tree. Felling, bucking and skidding costs can now be calculated using the formula from Table 5.

Base Felling Cost = $\frac{(25.87)}{(1)}\frac{(.05)}{(.048)}$ = $26.95/MBF

Base Bucking Cost = $\frac{(25.87)}{(2)}\frac{(.04)}{(.024)}$ = $21.56/MBF

Base Skidding Cost = $\frac{(49.06)}{(5)}\frac{(.20)}{(.048)}$ = $40.88/MBF

Felling costs are now modified by factors in Table 6. With an original density of 350 trees per acre and a 14% tree removal, the adjustment to felling costs, Tree Density for Felling (TDF), will be 1.095*. Final felling costs, therefore, will be:

$26.95 x 1.095 = $29.51/MBF

* Use adjustment factor for 25% removal and average 300 and 400 trees.

Skidding costs are modified by the factors in Table 7. With a removal level of 50 trees per acre, the tree density factor (TD) is 1.37 (factor for 50 trees per acre). At an average skid distance (SD) of 600 feet, the modifier for distance is 1.14 (half the difference between 500 feet and 700 feet). With a 5% favorable slope, the modifier for slope (S) is 1.0. The final skidding costs is:

$40.88(TD)(SD)(S) = $/MBF

$40.88(1.37)(1.14)(1.0) = $63.85/MBF

With the relatively small size of the recovered material, load size will average 3500 board feet per load with a cost of $12.74 per MBF (average of 8" and 12" material)*. Hauling costs are calculated on the basis of a 50 mile haul.

Calculating the hauling cost from the cost formula:

$$\text{Haul Cost} = \frac{\$550/\text{Day}}{[3\ \text{Loads/Day}]\ [3.5\ \text{MBF/Load}]^{**}}$$

Haul Cost = $52.38/MBF

* Calculated as the average cost for 8" and 12" material [(16.59 + 8.89)/2] - TABLE 8

** Calculated as the average of loads for 8" and 12" material [(3000 + 4000)/2] - TABLE 8

Total cost can now be determined by summing these component costs, as is outlined in Table 10.

Felling	$ 29.51/MBF
Bucking	$ 21.56/MBF
Skidding	$ 63.85/MBF
Loading	$ 12.74/MBF
Hauling	$ 52.38/MBF
Logging Cost	$180.04/MBF

The costs for moving in and out, site management before and after harvest, and operational overhead now need to be added to this total.

Cost for moving a conventional system the 50 miles from the mill is moving cost divided by sale volume:

$$\text{Move In/Out} = \frac{\$550}{96\ \text{MBF}} = \$5.73/\text{MBF}$$

Costs of site management and overhead are based on a percentage of the logging cost. Site management includes a cost allowance for slash disposal, seeding skid trails and landings, constructing water bars, etc. The allowance for overhead includes such things as profit for the owner of the logging equipment, costs of supervision and management, etc.:

Site Management = (.08)($180.04) = $14.40/MBF

Overhead = (.07)($180.04) = $12.60/MBF

So total costs to harvest this site are estimated at:

Logging Cost:	$180.04/MBF
Move In/Out:	$ 5.73/MBF
Site Management:	$ 14.40/MBF
Overhead:	$ 12.60/MBF
Total Cost Estimate	$212.77/MBF

Example 2: Mechanized Harvesting

Suppose you want to consider harvest of the stand described in Example 1 with a mechanized harvesting system. You would follow the same process as before, but this time we will select equipment from the mechanized options - a frame mounted feller-buncher, a CTR type mechanized processor and a new grapple skidder. Relevant data on hourly costs and production are as follows:

	Hourly Costs	Hour/Cycle	Pieces/Cycle
Felling:	75.94	.025	1
Bucking:	29.80	.012	2*
Skidding:	61.23	.140	5**

* Number of logs/tree.

** Interpretation between load size for 8" and 12" material.

Base costs will calculated as:

$$\text{Felling: } \frac{(75.94)(0.025)}{(1)(.048)} = \$39.55/\text{MBF}$$

$$\text{Bucking: } \frac{(29.80)(0.012)}{(2)(.024)} = \$7.45/\text{MBF}$$

$$\text{Skidding: } \frac{(61.23)(.14)}{(5)(.048)} = \$35.72/\text{MBF}$$

Modifiers to these costs are the same as they were in Example 1 so modified costs are as follows:

Felling: ($39.55)(TDF) = ($39.55)(1.095) = $43.31/MBF

Skidding: ($35.72)(TD)(SD)(S) =
($35.72)(1.37)(1.14)(1.0) = $55.79/MBF

Loading and hauling costs do not change from Example 1 so the resulting cost is:

Felling:	$ 43.31/MBF
Bucking:	$ 7.45/MBF
Skidding:	$ 55.79/MBF
Loading:	$ 12.74/MBF
Hauling:	$ 52.38/MBF
Logging Cost	$171.67/MBF

Total costs need to include moving costs, site management and overhead.

Cost to move the mechanized system is calculated from information in Table 10 as:

$$\text{Move In/Out} = \frac{\$1,040}{96\ \text{MBF}} = \$10.83/\text{MBF}$$

Site Management = (.08)($171.67) = $13.73/MBF

Overhead = (.07)($171.67) = $12.02/MBF

Total cost is now calculated as:

Logging Cost	$ 171.67/MBF
Move In/Out	$ 10.83/MBF
Site Management	$ 13.73/MBF
Overhead	$ 12.02/MBF
Total Cost	$ 208.25/MBF

The mechanical operation appears to cost slightly less than the conventional logging system. One should remember that production levels are higher with the mechanical system, therefore, greater difficulty may be experienced in keeping the machines busy.

Example 3: Cable Yarding Operation

Consider another case where the trees are larger, but the area is located with slopes steep enough to require a cable yarding operation. You plan to remove 50 of the 200 merchantable trees per acre on the 40 acre site. This represents an estimated removed volume of 10,000 board feet per acre. Trees average 15 inches in diameter and 60 feet in merchantable height. The preferred log length is 33 feet with an average of 28 feet. Average yarding distance is 750 feet. We will use a medium skyline system. This site is located 25 miles from the mill.

First, calculate volume per piece and logs per tree:

$$\text{Logs/Tree} = \frac{60}{33} = 1.82\ \text{Logs/Tree}$$

Round to 2 Logs/Tree

$$\text{MBF/Tree} = \frac{10\ \text{MBF/Acre}}{50\ \text{Trees/Acre}} = .20\ \text{MBF/Tree}$$

$$\text{MBF/Log} = \frac{.20\ \text{MBF/Tree}}{2\ \text{Logs/Tree}} = .10\ \text{MBF/Log}$$

$$\text{MBF} = \left[\frac{10{,}000\ \text{BF}}{\text{acre}} * 40\ \text{acres}\right] / 1{,}000 = 400\ \text{MBF}$$

Since this is a cable yarding operation, we will buck in the woods. Base cost and production are as follows:

	Hourly Cost	Hour/Cycle	Pieces/Cycle
Fell/Buck	25.87	.12	1
Skidding	141.47	.23*	5

* Use production for 800 feet distance.

Base costs are calculated as:

$$\text{Felling: } \frac{(\$25.87)(.12)}{(1)(.20)} = \$15.52/\text{MBF}$$

$$\text{Skidding: } \frac{(\$141.47)(.23)}{(5)(.10)} = \$68.08/\text{MBF}$$

These costs are modified by the factors in Tables 6 and 7. The felling operation removes 25% (50 trees) of 200 trees per acre and has an adjustment factor of 1, so the felling cost will stay at its calculated base costs.

Skidding (yarding) costs are adjusted only for removed tree density. A removal density of 50 trees per acre translates to an adjustment factor of 1.37, yielding an adjusted skidding cost of:

($68.08/MBF)(1.37) = $93.27/MBF

Trees in this size class will result in load sizes of 5000 board feet (Table 8), with a cost of $5.69/MBF for loading and a loading time of .36 hours.

Hauling costs for a 25 mile haul can then be calculated as:

$$\text{Haul Cost} = \frac{\$550/\text{Day}}{[\ 5\ \text{Loads/Day}]\ [\ 5\ \text{MBF/Load}]}$$

Haul Cost = $22.00/MBF

Total logging costs are then:

Felling/Bucking	$ 15.52/MBF
Skidding (Yarding)	$ 93.27/MBF
Loading	$ 5.69/MBF
Hauling	$ 22.00/MBF
Logging Cost	$136.48/MBF

Costs to move equipment, for site management and for overhead are calculated as:

$$\text{Move In/Out} = \frac{\$455}{400\ \text{MBF}} = \$1.14/\text{MBF}^*$$

* Costs for 20 and 30 mile move divided by 2.

Site Management = (.08)($136.48) = $10.92/MBF

Overhead = (.07)($136.48) = $ 9.55/MBF

Total costs can now be calculated as:

Logging Cost	$136.48/MBF
Move In/Out	$ 1.14/MBF
Site Management	$ 10.92/MBF
Overhead	$ 9.55/MBF
Total Cost	$158.09/MBF

Appendix A - Tables

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TABLE 1. CALCULATION OF LOGS PER TREE AND VOLUME PER PIECE

$$\text{Logs/Tree} = \frac{\text{Average Merchantable Tree Length}}{\text{Preferred Log Length}}$$

$$\text{MBF/Tree} = \frac{\text{Removed MBF/Acre}}{\text{Removed Trees/Acre}}$$

$$\text{MBF/Log} = \frac{\text{(MBF/Tree)}}{\text{(Logs/Tree)}}$$

$$\text{Logs/MBF} = \frac{1}{\text{(MBF/Log)}}$$

Example: Preferred Length = 33 ft
Tree Length = 63 ft

$$\text{Logs/Tree} = \frac{63}{33} = 1.91$$

Round to 2 Logs/Tree

TABLE 2. FELLING AND BUCKING - EQUIPMENT COST AND BASE PRODUCTION

One tree per cycle for tree length; average number of logs/tree each cycle for log length

			Hourly Costs				Hours/Cycle	
		Purchase Price	Fixed	Variable	Labor	Total	Tree Defect	
							Low	High
FELLING - ONE TREE/CYCLE								
Manual	Tree Length	$1,500	2.87	3.00	20.00	25.87	.05	.06
	Log Length	$1,500	2.87	3.00	20.00	25.87	.12	.13
Small, Boom - Mounted Feller Buncher 128 hp	Tree Length	$230,000	37.05	25.85	20.00	82.90	.021	.025
Small, Frame - Mounted Feller Buncher 130 hp	Tree Length	$200,000	32.21	23.73	20.00	75.94	.025	.029
BUCKING - ONE TREE/CYCLE								
Manual		$1,500	2.87	3.00	20.00	25.87	.04	.05
Processor Head & Cat 227 Carrier 150 hp		$300,000	26.28	27.02	20.00	73.30	.015	.02
Loader-Fed Stationary System (CTR or Danzoo Type)		$25,000	* 7.00 + 6.20	* 7.00 + 5.60	* + 4.00	29.80	.012	.018

* Base cost of the delimber plus 20% of the hourly cost of the loader

Table 3. Skidding Equipment Cost and Base Production

Production based on average skid distance of 500 ft., 5% favorable slope, an average load of 400 BF (4,000 LB), 80% efficiency for skidders and 65% for forwarder and processor.			Hourly Costs				Hours/Cycle		
		Purchase Price	**Fixed**	**Variable**	**Labor**	**Total**			
Small Skidder 110 HP	Winch - New	96,000	15.46	13.60	20.00	49.06	0.20		
	Winch - Used	38,400	6.18	13.67	20.00	39.85	0.20		
Medium Skidder 160 HP	Winch - New	125,000	20.13	17.60	20.00	57.73	0.28		
	Winch - Used	50,000	8.05	18.42	20.00	46.47	0.28		
	Grapple - New	140,000	22.55	18.68	20.00	61.23	0.14		
	Grapple - Used	56,000	9.02	19.91	20.00	48.93	0.14		
Medium High Track Crawler 105 HP	Grapple - New	185,500	29.87	20.48	20.00	70.35	0.25		
	Grapple - Used	74,200	11.96	22.43	20.00	54.39	0.25		
Small Crawler 80 HP	Winch - Used	39,200	6.32	12.76	20.00	39.08	0.37		
Cut to length processor and forwarder 7 tons	Processor	510,000	82.10	55.68	25.00	162.78	10 Ton/Hr		
	Forwarder	300,000	44.32	37.23	25.00	106.55			
Small standing skyline - 23' tower 80-100 HP	3 pieces per cycle	70,000	16.91	12.09	40.00	69.00	**500'** 0.13	**800'** 0.19	**1200'** 0.24
Medium live skyline - 55' tower 150 HP	5 pieces per cycle	200,000	48.32	33.15	60.00	141.47	0.18	0.23	0.25

Table 4. Skidding Pieces Per Turn for Ground Skidding

(Assumes the skidder averages this number of pieces per cycle for the average stand described earlier. Adjustments to cycle size for the effect of stand density are made later.)

	Pieces/Cycle		
Average Tree Size	**8"**	**12"**	**16"**
Log Length	8	4	3
Tree Length	7	3	2

Table 5. Base Cost of Felling, Skidding, Bucking

$$\frac{\$}{\text{MBF}} = \frac{(\$/\text{Hour})(\text{Hours/Cycle})}{(\text{Pieces/Cycle})(\text{MBF/Piece})}$$

Base Felling Cost	$_____/MBF
Base Bucking Cost	$_____/MBF
Base Skidding Cost	$_____/MBF

Table 6. Felling Cost Modifiers - TDF (Tree Density for Felling)

Original Density (Trees/Acre)	**Average Tree Spacing**	**% Removed**		
		25%	**40%**	**100%**
200	15 ft.	1.00	.90	.90
300	12 ft.	1.08	.93	.90
400	10 ft.	1.11	1.02	.90
500	9.3 ft.	1.14	1.12	.90

TABLE 7. SKIDDING COST MODIFIERS

Modifier for Removed Tree Density (TD)	Removed Trees Per Acre	Cost Modifier
(Ground Skidding and Cable Yarding)	500	0.80
	400	0.80
	300	0.90
	200	1.00
	100	1.13
	50	1.37

Modifier for Skid Distance (SD)	Average Skid Distance (Feet)	Cost Modifier
(Ground Skidding Only)	100	0.44
	300	0.72
	500	1.00
	700	1.28
	900	1.56

Modifier for Slope (SL)	Slope	Favorable	0%	Adverse
(Ground Skidding Only)	Cost Modifier	1.0	1.1	1.2

Table 8. Loading Costs

Includes 11 minutes per load for positioning and wrapping load after completion and a cold decking operation that assumes 75% efficiency of labor.

Loading Cost	**Hourly Costs**						
	Fixed	**Variable**	**Labor**	**Total**			
	$31.00	$28.00	$20.00	$79.00			
Average Piece Size (Pieces/Load)	Average Load Size		$/Hr	Hr/Load	$/Load	$/Piece	$/MBF
	BF	Tons					
8" (100)	3000	26	79	0.63	49.77	0.05	16.59
12" (60)	4000	26	79	0.45	35.55	0.60	8.89
16" (25)	5000	26	79	0.36	28.44	1.12	5.69

Table 9. Hauling Cost

Daily Cost of Truck and Driver: **$550/Day**

Number of Loads/Day:

One Way Distance	Under 30 Miles	30 - 40 Miles	40 - 50 Miles	50 - 60 Miles	Above 60 Miles
Number of Loads/Day	5	4	3	3	2

Average Load Size: **See Table 8**

Haul Cost: $\frac{\$550/\text{Day}}{[\text{Number of Loads/Day}][\text{Average MBF/Load}]}$

Base Loading Cost	$ _____/MBF
Base Hauling Cost	$ _____/MBF

TABLE 10. MOVING, PREPARATION, OVERHEAD

Cost to Move In/Move Out

	Miles			
	20	**30**	**40**	**50**
Mechanized System	650	780	910	1040
Conventional System	260	390	420	550
Cable System	390	520	650	780

Move In/Move Out = $\frac{(\$\ \_\_\_\_\_)}{\text{(Volume Removed)}}$

Site Management = 8% of Logging Cost

Overhead/Profit = 7% of Logging Cost

TABLE 11. TOTAL LOGGING COSTS

	Base Cost	*	**Modifier(s)**	=	**Final Cost**
Felling	$_____/MBF	*	(TDF) (Table ___)	=	$_____/MBF
Bucking	$_____/MBF			=	$_____/MBF
Skidding	$_____/MBF	*	(TD(SD)(SL)Table ___)	=	$_____/MBF
Loading	$_____/MBF			=	$_____/MBF
Hauling	$_____/MBF			=	$_____/MBF
Logging Cost				=	$_____/MBF
Move In/Out				=	$_____/MBF
Site Management			$_____/MBF * .08	=	$_____/MBF
Overhead/Profit			$_____/MBF * .07	=	$_____/MBF
Total Cost				=	$_____/MBF

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