LOGGING PLAN AND FINANCIAL FORECAST FOR THE GOODMAN WORKING CIRCLE

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1939

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logging

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This dissertation is submitted as partial fulfillment of the requirements for the degree of Master of Forestry in the University of Michigan.

January 28, 1939

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ACKNOWLEDGMENTS

Grateful acknowledgment and thanks to Professor D. M. Matthews of the School of Forestry and Conservation, University of Michigan, for his suggestions and help in preparing this dissertation.

Recognition is also due the United States Forest Service for providing the basic data made use of herein.

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Introduction

A suitable working plan for any given timber area requires more than the development of a plan for regulation of growing stock by proper cutting practices. The advantages of a well designed timber management plan may be nullified by uneconomical logging and milling practices. Planning must therefore be extended to include all phases of the operation which affect the net value of the finished product. It is evident at a glance that certain of the procedures in the production of timber goods have received more attention than others as to the use of the most economical operating methods. It is necessary therefore to determine which operations have been overlooked as to these points in the past, investigate the possibility of reducing their cost, and present appropriate financial calculations to indicate the desirability of adopting any suggested modifications.

In examining the Lakes States region as to the above considerations, it is apparent that along with the Northeast and Southeast regions, logging methods have been modernized but little during the last few decades. The loggers have been conservative along these lines, and more or

less justifiably so as, for a number of years, the improvements in logging machinery and methods were limited to the large sized timber prevalent in the West and were not adaptable to comparatively small sized timber in the East. However, within the last few years attention has been directed toward the problems confronting the eastern operators and as a result, certain machines and procedures have been devised which will sooner or later revolutionize eastern logging methods and reduce logging costs to an unprecedented low.

In devising a logging plan for the Goodman Working Circle, several recent developments have been included. The results are more than satisfactory from the financial standpoint as will be demonstrated in a later section.

General Logging Plan

As this paper is a direct continuation of the dissertation already submitted by this author ("Regulation of the Growing Stock and Calculation of the Cut on the Goodman Working Circle by Basal Area Control"), space is not devoted to subject matter which has been previously mentioned under separate cover.

The logging plan as herein developed pertains only to the 24,093 acres of uncut sawtimber which support an average stand of 8890 bd. ft. per acre. This area will

be cut over during the last ten years of the first cycle or from 1937-1946, an average cut of 4,575 bd. ft. per acre being removed. Although the same methods could be used to determine the logging practices and costs on the 17,515 acres which will be cut during the first ten years of each twenty year cycle, little additional value would be obtained from such a calculation, hence it is not included.

Since, in the type map presented in the Forest Service report covering this same working circle,[1.] the uncut sawtimber areas are not distinguishable from the selectively cut areas, it was necessary to select a more or less arbitrary location for the operations in uncut sawtimber which will be conducted during the last ten years of the cycle. This location was chosen so as to include an area on which average logging conditions obtain. Thus, although the location is more or less hypothetical, the methods used and results derived represent the average for all sawtimber stands and are applicable to other areas on the working circle.

In outlining the general logging plan to be followed on the Goodman area, certain operations are more or less standard. Included in this category are all felling and bucking procedures which, therefore, will be continued as in previous cutting on the working circle. It is in the

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1. U. S. Department of Agriculture, Timber Management and Financial Plans for the Goodman Working Circle, United States Forest Service, 1938. Bromley, W. S., Stott, C. B., and others, Appendix.

skidding operation that the first major change is to be effected. A great deal of leeway is allowed in the choice of a skidding device. It is necessary that the machinery and method selected be suitable to the size and volume of timber, the topography, and the necessary output, as well as several other less important factors. After considering conditions on the working circle, D4 tractors were chosen as the most practical skidding device. This is in contrast to the existing skidding method in which teams are used more extensively than in the modified plan.

Logs will be skidded to landings on roads, both of which will be spaced at the most economic interval as determined in later calculations. This spacing will vary with the volume to be cut on any given area but an average can be obtained which will allow correct calculations for the 24,093 acres. Each landing will serve areas on both sides of the road. Hot logging methods are to be used and loading will be accomplished by the use of horse operated A type jammers. In addition to furnishing the motive power for the jammers, the teams will be used for the necessary bunching operations at the landings and in some cases for skidding timber which is located especially close to the landing (within 300 feet). Teams will be used in the latter capacity only when loading and bunching operations are at a standstill due to tractor hangups or breakdowns.

Hauling will be done by trucks over unsurfaced woods roads and surfaced mainline and tap roads as contrasted to the existing operation which utilizes railroads for most hauling purposes. Again there is considerable latitude allowed in the choice of equipment. One and one-half ton truck and trailer outfits were selected as most nearly satisfying the conditions under which they are to be operated. Use will be made of all existing roads on the area and by so doing, tap road construction is eliminated and mainline road construction minimized.

This completes the general outline of the proposed logging plan for the Goodman Working Circle. No discussion of the milling operation is included since the methods will be identical with those already in use in the Goodman mill. It is now necessary to introduce sufficient financial calculations and schedules to indicate the advantage of the new logging methods.

Financial Forecast

Logging Costs

In order to demonstrate clearly the technique employed, the following paragraphs will show the development of each logging cost item before it is placed in the general logging cost schedule. Several of the more or less standard costs are taken directly from the financial plan of the Forest Service report, for the most part from a table of costs per

M bd. ft. for various diameter classes.[2]

Felling and bucking costs can be determined by applying the volume of each diameter class to be removed to the cost per M bd. ft. for that diameter as taken from the Forest Service cost sheet. The derivation of these costs is not shown since the calculations are comparatively simple. The average felling and bucking cost by the above method is $2.55 per M bd. ft.

Skidding costs require more complex calculations in order to reduce them to the desired minimum. It is first necessary to obtain the average diameter of the trees to be skidded, this being 16.7 inches. By the use of this figure it is then possible to determine fixed and variable costs from a schedule prepared by the Caterpillar Tractor Company for D4 tractors (Table 1). The fixed cost per M bd. ft. so determined is 65¢ while the variable cost is 9¢ per M bd. ft. per 100 feet of skidding distance. The average skidding distance per M necessarily depends upon the spacing of the roads. This road spacing must be so designed as to bring to the lowest total the two costs varying directly with the spacing, namely the skidding cost per M bd. ft. and the road construction per M bd. ft. When these two costs are equated, a formula for the spacing of roads (and landings) may be developed. This formula

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2. U. S. Department of Agriculture, op cit, Appendix p. 90.

Table 1

Cost of Skidding Logs with

D4 Type Caterpillar Tractor*

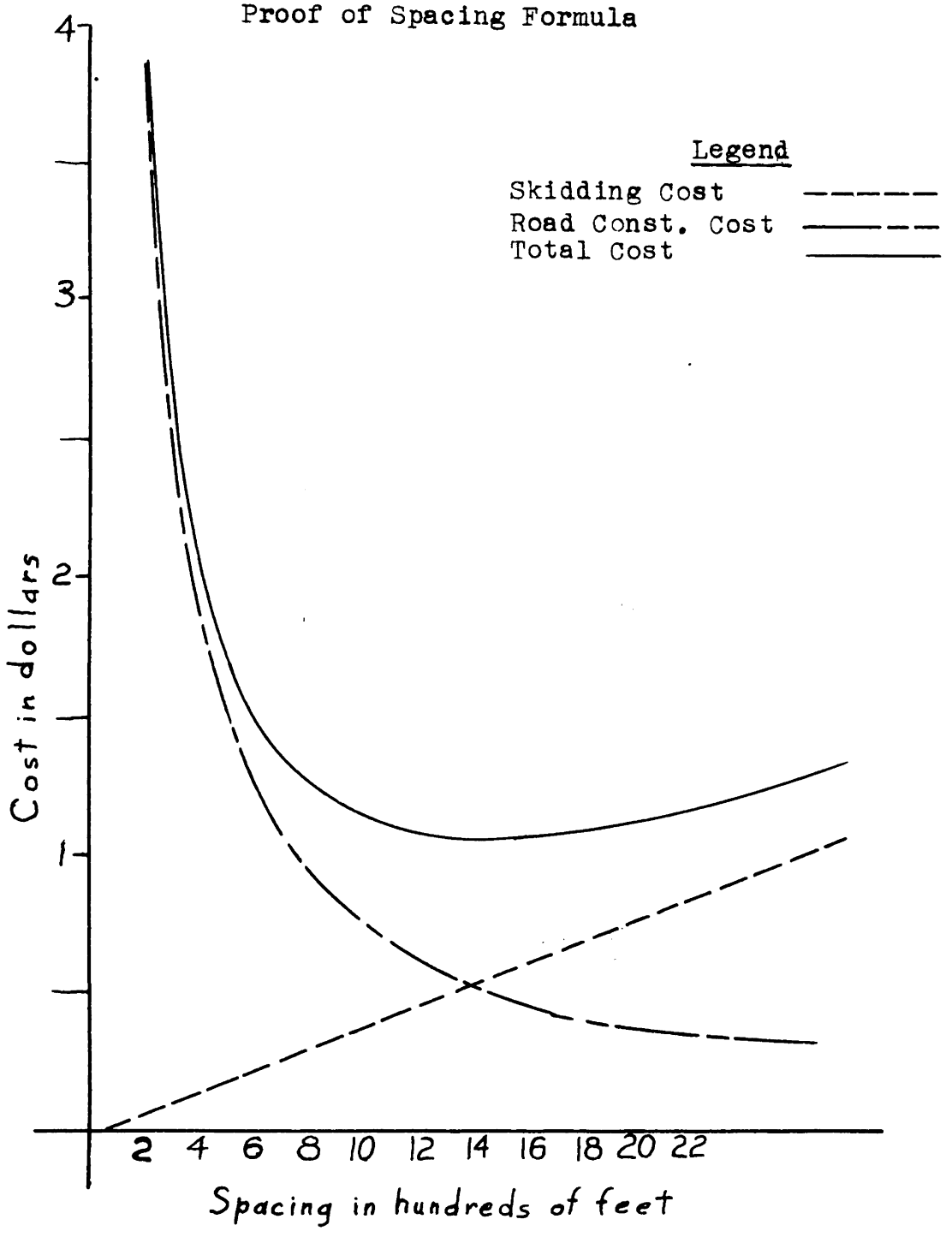
Av. DBH of Stand. Inches	Bd.Ft. Doyle Scrib. Rule	Hook & Unhook Time - Mins.	Delay Time - Mins.	Total Fixed Time per Turn Mins.	Cost at Above Charge Per Min.	Fixed Time Cost Per M	Hauling Cost Per MBM Per 100' of Hauling Distance
			(at $.0286 per min.)				
12	150	7	2	9	$.257	$1.71	$.210
16	325	6	2	8	.229	.70	.097
(16.7)	(348)	(5.8)	(2)	(7.8)	(.224)	(.65)	(.090)
20	470	5	2	7	.200	.43	.067
24	580	4	2	6	.172	.29	.054
28	640	3	2	5	.143	.22	.049
32	680	2	2	4	.114	.17	.046

Figures in parenthesis obtained by interpolation.

*Courtesy of Caterpillar Tractor Company.

Chart 1

Proof of Spacing Formula



is increasing more rapidly than the road construction cost is decreasing, thus the total cost is rising. Therefore, the lowest total cost will be at the point where the two cost curves cross, this being at 1390 feet. This spacing will not be strictly adhered to over the whole area but will vary in different areas with the volume to be removed per acre. Thus, as indicated by the formula, if the volume per acre on a certain area exceeds 8,890 bd. ft., a larger cut will be taken and the spacing of the roads will be decreased, as will the interval between landings. If, on the other hand, the volume per acre drops below 8,890 bd. ft., the cut will be reduced and the roads and landings will be spaced farther apart. The figure 1390 represents the average spacing for the entire 24,093 acres. Chart 2 illustrates the road plan as it would appear on the average acre.

Variable skidding costs can now be calculated as follows:

$$\text{Av. skidding cost} = .427\ CS = .427 \times 9¢ \times 13.9 = \underline{54¢}$$

$.54 plus the fixed skidding cost per M bd. ft. or $.65 equals the total skidding cost of $1.19.

Road construction costs per M bd. ft. can also be calculated by the use of the following relationship:

$$\text{Const. cost per M} = \frac{S \times r \times 4.356}{V \times S \times S}$$

or,

$$\text{cost per M} = \frac{13.9 \times 758¢ \times 4.356}{4.5 \times 13.9 \times 13.9}$$

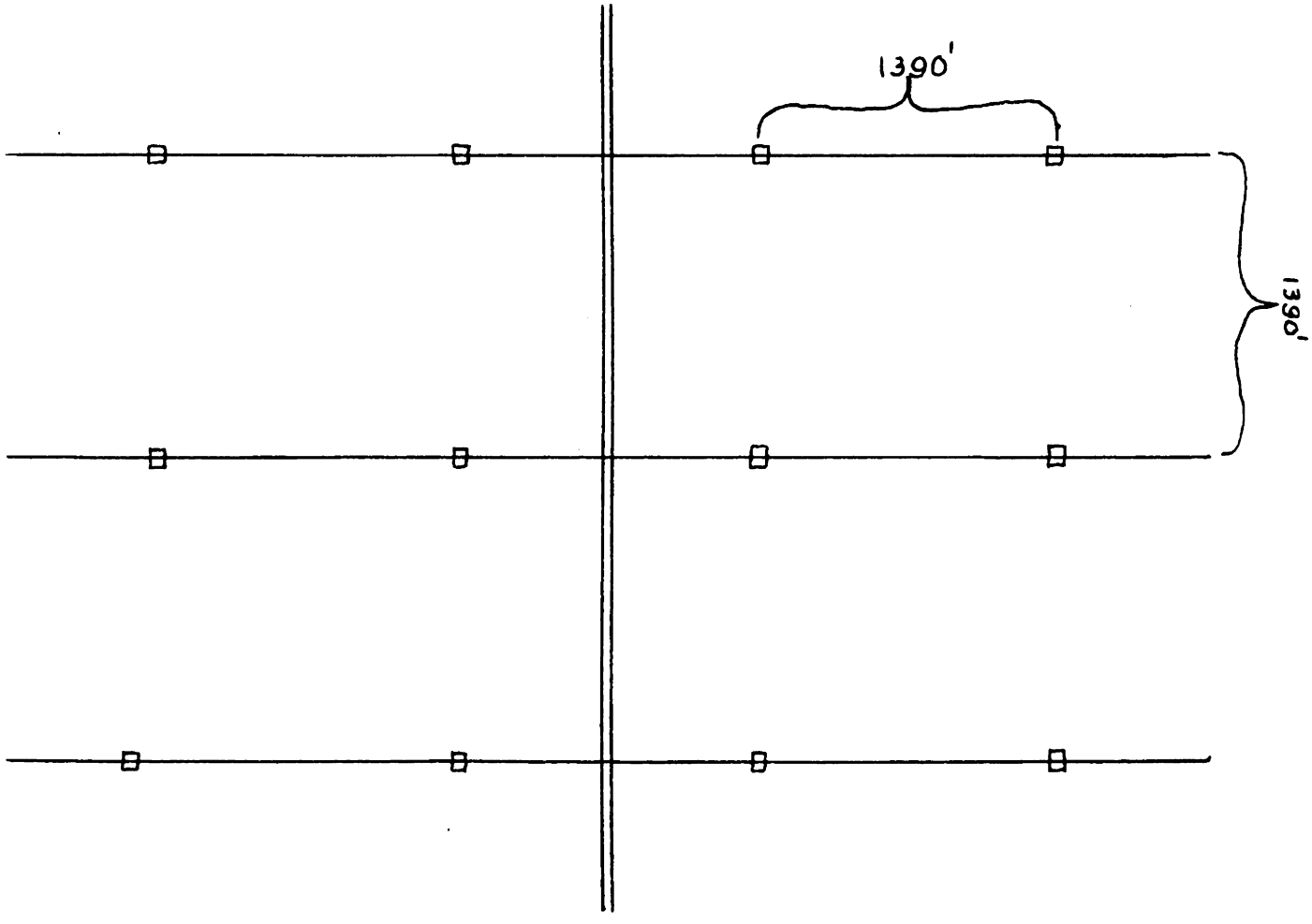
or, $\underline{53¢}$

Chart 2

Woods Road and Landing Spacing

for an

Average Acre



Legend

Mainline

Woods Road

Landing

Since this figure approximately equals the variable skidding cost, a check is provided on the formula which was originally set up to equate the variable cost per M bd. ft. against road construction cost ($.54 against $.53).

Loading and unloading costs were determined on a time basis of 30 minutes for loading and 15 minutes for unloading, the average load being 2 M bd. ft. The loading cost will be the sum of the total cost of the team and the fixed cost of the truck while the loading takes place. Therefore, the loading cost can be determined as:

Team -- 30 x 1.375 (total cost per minute) = $.41

Truck - 30 x .975 (fixed cost per minute) = .29

$.70

or, $.70 per load. This divided by the load or 2 M bd. ft. equals $.35 per M bd. ft. Unloading costs will equal approximately $.35/2 or $.17 per M bd. ft.

It is now necessary to calculate the average hauling cost per M bd. ft. Since three different types of roads are being utilized and each allows a different average speed, three schedules must be devised as shown in Tables 2, 3, and 4. The items listed in these schedules are necessarily conservative but approach as nearly as possible actual costs (data which was received too late to be incorporated in this paper shows that the figures herein used compare very closely with truck hauling costs collected in northern Michigan within the last two months).

Table 2

Truck Operating Costs on Woods Roads for 1½ Ton Truck and Trailer

(Based on operating year of 2,000 hours.)

Investment:

Truck complete with dual wheels	$ 650.00
Trailer complete with dual wheels	450.00
Gross investment	$1100.00
Less tires (charged off on mileage)	300.00
Net Investment	$ 800.00
Trade in value after 2 years	300.00
Amount to be depreciated	$ 500.00

Fixed Cost per hour:

Driver's wages	$ 0.40
Interest, license, taxes, and insurance	0.06
Depreciation-$500 written off in 4000 hours	0.125
Total	$ 0.585

Fixed Cost per minute - $\frac{\$0.585}{60} = \$0.00975$ or 0.975¢

Operating Cost per Mile on Dirt Woods Road:

	Per hour	Per mile
Gasoline @ 18¢ per gallon, 8 miles per gal.		2.3¢
Tires-(speed 6.7 miles per hour)	35¢	5.2
Oil		.2
Repairs, maintenance and greasing	30	4.5
Total direct operating cost per mile		12.2¢
Pro-rated fixed cost at one mile in 9 minutes - 9x0.975¢		8.8
Total fixed and operating cost (one way)		21.0¢
Total fixed and operating cost (round trip)		42.0¢

Cost per 100 feet of round trip distance $\frac{21.0¢}{26.4} = .83¢$

Table 3

Truck Operating Costs on Mainline Roads
for 1½ Ton Truck and Trailer

(Based on operating year of 2,000 hours)

Fixed Cost per Minute (as taken from Table 2) - 0.975¢

Operating Cost per Mile on Mainline Roads:

	Per hour	Per mile
Gasoline @ 18¢ per gallon, 8 miles per gal.		2.3¢
Tires - (speed 15 miles per hour)	35¢	2.3
Oil		.2
Repairs, maintenance, and greasing	30	2.0
Total direct operating cost per mile		6.8¢
Pro-rated fixed cost at one mile in 4 minutes - 4 x 0.975		3.9¢
Total fixed and operating costs (one way)		10.7¢
Total fixed and operating costs (round trip)		21.4¢

Table 4

Truck Operating Costs on Tap Road
for 1½ Ton Truck and Trailer

(Based on operating year of 2,000 hours)

Fixed Cost per Minute (as taken from Table 2) - 0.975

Operating Cost per Mile on Tap Road:

	Per hour	Per mile
Gasoline @ 18¢ per gallon, 8 miles per gal.		2.3¢
Tires - (speed 20 miles per hour)	35¢	1.8
Oil		.2
Repairs, maintenance, and greasing	30	1.5
Total direct operating cost per mile		5.8¢
Pro-rated fixed cost at one mile in 3 minutes-3 x 0.975		2.9
Total fixed and operating costs (one way)		8.7¢
Total fixed and operating costs (round trip)		17.4¢

When the cost per roundtrip mile has been obtained for each of the three classes of roads, the total cost of hauling can be derived by multiplying the cost per mile by the average haul (as taken from the map) and dividing by the average load. The results are as follows:

Hauling on woods road	$\frac{1.5 \times \$.42}{2}$	or	\$0.32
Hauling on mainline	$\frac{4 \times \$.214}{2}$	or	0.43
Hauling on tap road	$\frac{18 \times \$.174}{2}$	or	1.57
			\$2.32

Since the tap road has already been constructed, the only remaining road construction cost is that incurred in running in 13 miles of mainline. \$1500 a mile is the figure which has been used to cover the expense of constructing a gravelled mainline road. The cost per M bd. ft. will therefore be: $\frac{13 \times \$1500}{24,093 \times 4.5}$ or \$.18. In addition to the 18¢ construction cost, a charge of \$100 per year per mile of mainline has been allowed for maintenance. Since all of the mainline will not be built at once but gradually over the ten years, an average figure must be used, this being 18/2 or 9. The cost for maintenance is then :

$\frac{\$900}{2409 \times 4.5}$ or \$.08 per M bd. ft.

Landings must be constructed every 1390 feet along the roads and \$15 per landing was taken as a suitable allowance for such construction. The cost of landings therefore is:

$\frac{\$15 \times 4.356}{4.5 \times 191}$ or \$.08 per M bd. ft.

The remaining logging costs can, with slight modification, be transferred directly from the Forest Service cost

sheet to the schedules. These remaining costs are the camp construction cost of $.20 per M bd. ft. and the indirect costs that vary most with the total annual cut. The latter includes woods supervision, general woods expense, and forester's salary and expense which totals to $2.01. Since that figure is calculated for a 12,000 M annual cut and the management plan herein followed allows for only an 11,020 M annual cut, the cost item must be increased by $\frac{12,000,000}{11,020,000}$, thereby equaling $2.19.

This completes the logging cost items which when totalled as shown in Table 5, equal $9.76.

Milling Costs

Milling costs are easily determined since the milling procedure remains the same as that already employed by the Goodman Company. For direct and indirect milling costs that vary most with the size of tree cut, it is necessary to follow the same procedure as already indicated for deriving the felling and bucking costs, that is, apply the volume to be cut per acre in each diameter class to the cost per M bd. ft. (from the Forest Service cost sheet) for that class. The sum of these calculations will be the total cost per M bd. ft. under the proposed management plan. There are two milling costs which require this treatment. The first includes direct milling costs, namely sawing labor and boom and pond expense. These costs, when calculated as

Table 5

Logging Costs for Selective Plan

Item	Derivation		Cost per M
Felling & Bucking	Forest Service Cost Sheet		$2.55
Skidding			
Variable	.427 x 9 x 13.9 =	$0.54	
Fixed	Tractor Cost Sheet	.65	1.19
Loading	(30x1.375) plus (30 x .975)		.35
Unloading	$\frac{\$.35}{2}$		.17
Hauling on Woods Road	$\frac{1.5 \times \$.42}{2M}$		.32
Hauling on Mainline	$\frac{4 \times \$.214}{2M}$		.43
Hauling on Tap Road	$\frac{18 \times \$.174}{2M}$		1.57
Woods Road Const.	$\frac{13.9 \times 758 \times 4.356}{4.5 \times 191}$		.53
Mainline Const.	$\frac{13 \times \$1500}{24093 \times 4.5}$		.18
Mainline Maintenance	$\frac{\$900}{2409 \times 4.5}$		.08
Landings	$\frac{\$15 \times 4.356}{4.5 \times 191}$		.08
Camp Const.	Forest Service Cost Sheet		.20
Total Direct Logging Cost			$7.57
Logging Costs that Vary with the Vol. of Annual Cut	$\frac{\$2.01}{.92}$		2.19
			$9.76

Total Logging Cost ---- $9.76

explained above, amount to $2.66. The second cost classification includes all indirect milling costs which vary slightly with the size of tree cut, these being made up of repairs to mill, general repairs, sawing supplies, power expense, and oil and waste expense. When the calculations as described above are applied to these items, the total cost is $2.38 per M bd. ft.

The remaining two milling cost classifications can be taken from the cost sheet and placed directly in the cost schedule with little modification. The first classification pertains to indirect milling costs that are fairly constant per M bd. ft. and includes sorting and piling lumber, yard repairs, shipping and planing, sales, and mill depreciation. The total of these items is $6.59, this figure remaining the same as for the Forest Service plan. The second milling cost classification is made up of indirect milling costs which vary most with the total annual cut. Included in this classification are insurance, manufacturing administration, and general office overhead, the total of these items being $4.24. Again, since the annual cut in the proposed management plan is less than in the Forest Service plan, these costs must be increased by $\frac{12,000,000}{11,020,000}$ or to $4.62. The total milling costs as shown in Table 6 amount to $16.25 per M bd. ft. mill scale.

Since the milling costs are given on a mill scale basis, an overrun factor must be calculated to transform them to

Table 6

Calculation of Realization Value
(Selective Cut Plan

			Log Scale Per MBM
Gross Value of Lumber	($185.59 / 4.513)		$41.10
Increased Value of Lumber	($4.50 x 1.145)		5.15
Total Value of Lumber			$46.25
Logging Costs		$ 9.76	
Milling Costs			
Direct, vary with size	$ 2.66		
Indirect, vary with size	2.38		
Indirect, constant	6.59		
Indirect, vary with annual cut	4.62		
Total, Mill Scale	$16.25		
Total, Log Scale (1.145 x $16.25)		18.60	
Allowance for Stumpage Depletion		6.50	
Total Cost of Production			34.86
Realization			$11.39

Net Realization per M bd. ft. $11.39

Net Realization per Acre $52.10

log scale which is used in the financial schedule. By interpolation in the Forest Service table an overrun percent figure of 14.5% was arrived at. The milling costs therefore become $16.25 x 1.145 or $18.60 per M bd. ft. log scale.

One other cost has been allowed for by the Goodman Company, this being a flat rate charge of $6.50 per M bd. ft. for depletion of stumpage. When this is added to the logging and milling cost, the total cost of production becomes $34.86, as shown in Table 6.

Lumber Value

The value of lumber per M bd. ft. is naturally a very difficult figure to determine. To avoid confusion and complicated calculations, the Forest Service figure representing the average value for the Goodman mill at the date of March 13, 1937 was appropriated for use in the schedule. The total gross value per acre for dry lumber (as used in the Forest Service plan) is $185.59 log scale,[3.] which, when divided by their cut of 4,513 bd. ft. gives a value of $41.10 per M bd. ft. To this must be added a figure representing the increased value of lumber due to higher overrun, better prices for veneer, etc. This figure is $4.50 per M bd. ft. mill scale which, when expressed on a log scale basis, becomes $4.50 x 1.145 or $5.15 per M bd. ft. log scale. The total value of lumber produced is therefore $41.10 plus $5.15

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3. U. S. Department of Agriculture, op cit, Appendix, p. 85.

or $46.25 per M bd. ft.

Calculation and Comparison of Net Realization and Income

When the total cost of production is subtracted from the total value, the result indicates the net realization value before taxes which, in this case, is $11.39 per M bd. ft., log scale. This figure is comparable to the net realization value before taxes obtained by the Forest Service under present logging methods and Forest Service management plan, their value being $8.09.[4.] This represents an increase in gross income (before taxes) of $3.30 or 40.8%.

For purposes of comparison, the preceding calculations have been applied to the same stand of 24,093 acres under a management plan which is devised for liquidation in ten years by clear cutting to a 12" limit (the most economical limit). The same logging methods are used as in the selective plan although the spacing is changed by the almost doubled cut per acre. Except for part of the logging costs, the cost items are taken directly from the Forest Service cost sheet.[5.] Calculations for the clear cut operation are shown in Tables 7 and 8. The net realization value before taxes for the clear cut operation is $10.03 as shown in Table 8. This figure is comparable to the value $7.22 obtained by the Forest Service for the logging methods now in use.

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4. U. S. Department of Agriculture, op cit, p. 56.

5. Ibid, p. 61.

Table 7

Logging Costs for Clear Cut Plan
(Cut-20,445,183 BM)

Spacing of Roads: $\sqrt{\frac{10.22\ r}{VC}} = \sqrt{\frac{10.22 \times 758}{8.5 \times 9.7}} = 9.7 =$ 970 Feet. Size of Average Tree -- 16". (Av. Load -- 1840 Bd. Ft.)

Item	Derivation		Cost per M
Felling & Bucking	Forest Service Cost Sheet		$2.83
Skidding			
Variable	.427 x 9.7 x 9.7	$.40	
Fixed	Tractor Cost Sheet	.70	1.10
Loading	$\frac{\$.70}{1840}$		.38
Unloading	$\frac{\$.35}{1840}$		.19
Hauling on Woods Road	$\frac{1.5 \times \$.42}{1.84}$		.34
Hauling on Mainline	$\frac{4 \times \$214}{1.84}$		.47
Hauling on Tap Road	$\frac{18 \times \$.174}{1.84}$		1.70
Woods Road Const.	$\frac{9.7 \times \$7.58 \times 4.356}{8.5 \times 93.9}$		.40
Mainline Const.	$\frac{13 \times \$1500}{24093 \times 8.5}$		.09
Mainline Maintenance	$\frac{\$900}{8.5 \times 2409}$		.04
Landings	$\frac{\$15 \times 4.356}{8.5 \times 93.9}$		.08
Camp Const.	Forest Service Cost Sheet		.10
Total Direct Logging Cost			$7.72
Logging Costs that Vary with the Volume of Annual Cut	Forest Service Cost Sheet		.79
			$8.51

Total Logging Cost --- $8.51

Table 8

Calculation of Realization Value
(Clear Cut Plan)

			Log Scale Per MBM
Gross Value of Lumber	($344.21 / 8.487)		$40.60
Increased Value of Lumber	(F. S. Cost Sheet)		2.64
Total Value of Lumber			$43.24
Logging Costs		$8.51	
Milling Costs	(Forest Service Cost Sheet)	18.20	
Allowance for Stumpage Depletion		6.50	
Total Cost of Production			33.21
Realization			$10.03
Net Realization per M bd. ft.		$10.03	
Net Realization per Acre		$85.40	

It is now possible to develop a financial schedule to determine the net income per M bd. ft. and per acre, after allowing for taxes. The schedule is more or less self-explanatory and follows that of the Forest Service[6.] in that each line of the new schedule corresponds to the line in the Forest Service schedule which is headed by the same capital letter.

Two schedules have been developed, one for the selective cut management plan previously presented (Table 9), and one for a clearcutting plan allowing liquidation in ten years (Table 10). The results obtained from these two schedules and from the two Forest Service schedules (which were developed for the logging methods now in use) are as follows:

Results of Schedule for Present Logging Methods

	Annual Cut	Net Income per M	Net Income per acre
Selective Cut	12,000,000	$3.93	$17.74
Clear Cut	20,445,183	$4.30	$36.49

Results of Schedule for Proposed Logging Methods

	Annual Cut	Net Income per M	Net Income per acre
Selective Cut	11,020,000	$7.09	$32.43
Clear Cut	20,445,183	$6.48	$54.90

6. U. S. Department of Agriculture, op cit, Appendix p. 103.

Table 9

Schedule for Determination of Net Income
(selective cut plan)

Item	Derivation	
A. Value removed per acre	$41.10 x 4.575	$188.20
B. Cost of production	$28.36 x 4.575	$129.75
C. Gross realization per acre	A - B	$ 58.45
D. Volume cut - mill scale	5240 (4575 x 1.145)	5240
E. Increased revenue per acre	$4.50 x D	$ 23.56
F. Total gross realization	C plus E	$ 82.01
G. Stumpage depletion charge	$6.50 x 4,575	$ 29.75
H. Net realization per acre (before any taxes)	F - G, also($11.39 X 4.5	$ 52.10
I. Total realization(before any taxes)	H x 2409 acres	$125,600
J. Less land & timber taxes	F. S. cost sheet	$ 15,000
K. Less Social security & excise tax	F. S. cost sheet 3% x $28.41 x 11020 M	$ 9,390
L. Total net taxable income	I - J and K	$101,210
M. Federal Normal Tax	13% x L	$ 13,160
N. Adjusted & undistributed net income	L - M	$ 88,050
O. Federal tax on capital tax	.01 x $1,200,000	$ 1,200
P. State Normal tax	6% of L	$ 6,070
Q. State surtax	1/6 of normal tax	$ 1,012
R. Total Federal & State taxes	Sum of M, O, P, Q,	$ 21,442
S. Total income after income and stock taxes	L - R	$ 79,768
T. Total net income after 2% state tax on dividends	S - 2%	$ 78,173
U. Total net income per M bd. ft. (log scale)	$78,173 / annual cut	$ 7.03
V. Total net income per acre	U x 4.575	$ 32.43

Table 10

Schedule for Determination of Net Income
(Clear cut plan)

Item	Derivation	
A. Value removed per acre	$40.60 x 8.487	$344.21
B. Cost of production	$26.71 x 8.487	$226.51
C. Gross realization per acre	A - B	$117.70
D. Volume cut - mill scale per acre	8487 x 1.201	10,189
E. Increased revenue per acre	$2.20 x D	$ 22.42
F. Total gross realization	C plus E	$140.12
G. Stumpage depletion charge	$6.50 x 8,487	$ 55.17
H. Net realization per acre (before any taxes)	F - G, also $10.03 x 8.487	$ 84.95
I. Total realization (before any taxes)	H x 2409 acres	$205,000
J. Less land & timber taxes	F. S. cost sheet	$ 15,000
K. Less social security & excise tax	3% x $28.41 x 20,445 M	$ 17,425
L. Total net taxable income	I - J and K	$172575
M. Federal normal tax	13% of L	$ 24,150
N. Adjusted & undistributed net income	L - M	$148,425
O. Federal tax on capital tax	.01 x $1,200,000	$ 1,200
P. State normal tax	6% of L	$ 10,360
Q. State surtax	1/6 of normal tax	$ 1,726
R. Total federal & state taxes	Sum of M,O,P,Q,	$ 37,438
S. Total income after income and stock taxes	L - R	$135,137
T. Total net income after 2% state tax on dividends	S - 2%	$132,434
U. Total net income per MBM (log scale)	T/20,445,183	$ 6.48
V. Total net income per acre	U x 8.487	$ 54.90

It is evident in examining these figures that the net income obtained by the use of the suggested logging plan is greater both per M bd. ft. and per acre than the net income under the present logging plan. This is true for both the selective and clear cut operations. In the former, the net income per M bd. ft. is increased 80.4% and the net income per acre increased 82.7%. In the clear cut operation, the use of the proposed logging methods would increase the net income per M bd. ft. 50.7% and the net income per acre 50.5%.

The relationship between the clear cut and selective plans is also changed by employing the proposed logging plan. Under the present logging methods the clear cut plan exceeds the selective cut plan in net income per M bd. ft. by 9.4% while under the proposed plan the income from a selective cut exceeds that of a clear cut by 8.6%. In both logging plans the net income per acre from clearcutting exceeds the net income per acre from a selective cut. However, under the present logging methods the net income from clearcutting is greater by 105.7% while the use of the proposed logging method reduces the clear cut advantage per acre to 69.3%. To properly compare a selective cut plan with a clear cut plan the time element must be included and appropriate calculations made to allow for compound interest charges. However, since the acreage included in the previous calculations is to be cut during only the last half

of each cycle, it does not allow a continuous selective cut but only an intermittent one. This gives an unfair advantage to the clearcutting plan and therefore, a comparison on the basis of time would be valueless. However, trial calculations with a sample area allowing a continuous selective cut indicate that the selective cutting plan would be approximately equal in value to the clearcutting plan under the revised logging plan, while under present logging methods the selective cutting plan falls considerable short of the clearcutting plan when confronted with compound interest calculations.

Returning to the net income calculations, it is apparent that the use of proper planning and methods in the logging operation will increase greatly the net income per M bd. ft. and per acre and will, in addition, give a selective cut plan a better showing when compared to a clearcutting plan.

Summary and Conclusion

A complete working plan includes not only a well designed management plan but also plans for all phases of production. In order to determine the proper procedures and methods to be incorporated in the production plan, appropriate financial calculations must be developed to indicate the results of any suggested modifications of operations.

Certain production operations have received more attention than others as to economical methods and devices for production. In the Lake States, improvements in logging methods have been particularly limited during the last few decades. Therefore, in developing a production plan for the Goodman area, logging practices must be investigated to determine the possibility of the use of recently developed machines and methods.

The proposed logging plan for the Goodman will apply to the 24,093 acres of uncut sawtimber and in general will differ from the plan now in use in only two operations, skidding and hauling. Skidding is to be done by D4 tractors as opposed to considerable team skidding now used, while hauling is to be done by one and one-half ton truck and trailer outfits instead of by railroads which are used in the present operation. As to other logging procedures, felling and bucking will be continued as at present while loading will be done by A-type horse-powered jammers located at landings spaced at intervals equal to the road spacing. Horses will also be used for bunching at the landings and occasionally for a small amount of skidding.

In justifying the above plan, complete production costs must be ascertained in order to allow comparison with the plan now in operation. Minimization of logging costs under

the new plan depends for the most part upon reduction of the skidding and road construction costs to the lowest possible total. These two costs vary with the woods road spacing and it is therefore necessary to obtain the spacing figure which will give the most economical results. This can be done by the use of a break-even formula which equates the two costs (skidding and road construction) against each other and gives the most economical road spacing (as can be proved by a cost chart). After determining the road spacing it is comparatively easy to calculate the skidding and road construction costs.

Hauling costs vary with speed and must be determined separately for each of the three classes of roads (woods, mainline, and tap). Hauling distances are determined from the type map of the area, a hypothetical location having been selected which will represent average conditions on the working circle.

Other logging costs as well as milling costs can be taken from the Forest Service cost sheet (for the present operation) and, with slight modification, be placed directly in the schedule.

A conservative figure for the value of lumber may be obtained by adapting the value developed by the Forest Ser- to the management and logging plan to be used. To this value must be added the additional revenue derived from increased overrun, better prices for veneer, etc. When the

total production costs are subtracted from the total value, the result indicates the net realization value before taxes. A schedule must then be developed to allow for deduction of the various taxes. The final figure, after taxes are deducted, represents the net income. Like calculations were also carried out for a clear cut operation which would allow liquidation in ten years.

The results from the selective and clearcut plans under the proposed logging plan can be compared with the results for comparable plans under present logging methods. This comparison indicates that by using the suggested logging plan, the net income under either the clear cut or selective plan is much greater than the net income obtained under the present logging methods. In addition, the proposed logging methods allow the selective cut plan a better standing, in relation to the clear cut plan, than exists under the logging procedure now employed on the Goodman Working Circle.

BIBLIOGRAPHY

Matthews, D. M., Management of American Forests, McGraw-Hill Book Company, Inc., New York, 1935.

U. S. Department of Agriculture, Timber Management and Financial Plans for the Goodman Working Circle, United States Forest Service, 1938.

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