Cost of Wetland Protection Using Cable Logging Systems

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ABSTRACT

Forest managers, loggers, land-use planners, and other decision makers need an understanding of estimating the cost of protecting wetlands using cable logging systems to harvest timber products. Results suggest that protection costs can range from $244.75 to $489.50 per acre depending on the degree of protection desired.

Keywords: Harvesting costs

INTRODUCTION

Wetlands and wet areas are among our most important natural areas. From a biological perspective, forested wetlands are the most productive wildlife habitat on the continent (Dept. of Fish and Wildlife Resources, 1990). In addition to providing habitat for a wide range of game and non-game wildlife species, these areas also rank as some of the most productive sites for the production of high-quality wood products. Protection of forested wetlands is a top priority with most state and federal conservation agencies. It needs to be a priority in the private sector as well. Protecting forested wetlands involves tradeoffs of wood utilizaton, protection costs, returns to the landowner, and logging costs.

Cable logging technology has been used in the Eastern United States to remove timber from environmentally sensitive steep-slope forest sites. The technology can be used to protect wetlands while removing wood products. Results of time- and motion studies have provided the production rate and cost estimates for cable logging systems over a range of operating conditions and sites. General costing packages have been developed and integrated with wood value and growth- and-yield projection systems for use in forest planning and decision making. Research also has shown that cable logging systems can minimize timber harvesting effects on forest sites (Patric and Gorman, 1978). Although much work has been completed and reported, decision makers, loggers, managers, and planners need to understand, and have methods for, estimating the cost of wetland protection when using cable logging systems. The challenge is greater for eastern cable logging operations where loggers are operating in a wide range of site and stand conditions in which operating conditions can change not only from site to site but within a given logging chance.

In this study, the costs of protecting a wetland area are estimated for harvesting a mixed hardwood stand using a Christy[1] cable yarder (Figure 1). The Christy is a small, low-priced cable yarder, and the results can be applied to other yarders of the same class in similar applications.
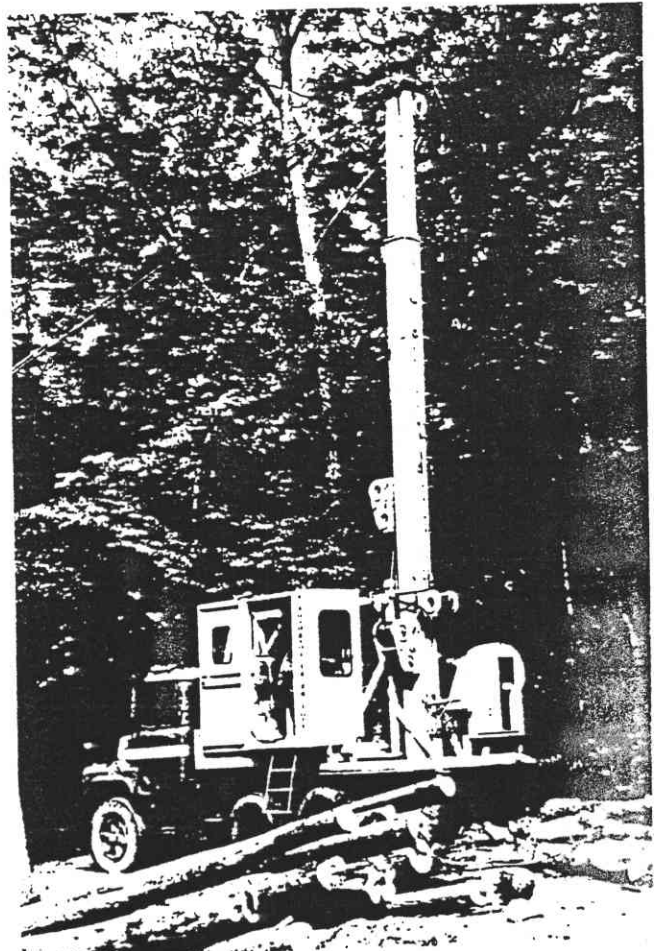

Figure 1.--Christy yarder.

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Stand Conditions

The initial stand is a 40-acre mixed hardwood stand that averages 195 trees per acre. The prinicpal species components are red maple, red oak, white ash, hickory, and white oak. The stand has a site index of 60, is 90 years old, with an average tree d.b.h. of 10.2 inches (trees 5-inches d.b.h. and above are included in the average). The stand at age 90 contains 4.5 Mbf/acre of sawlogs and an additional 27 cords/acre of fuelwood and pulpwood (3,317 ft³ total).

The desired silvicultural treatment is to grow the stand to optimal rotation length of 110 years and then conduct a regeneration harvest of the stand. The rotation length is based on maximizing present net value. The stand at age 110 contains 8.7 Mbf/acre of sawlogs and an additional 28 cords of fuelwood and pulpwood (4,290 ft³ total). The distribution by species and 2-inch diameter classes for the 110-year-old stand is shown in Figure 2. The stump-to-mill logging costs were estimated with ECOST (LeDoux, 1985) and time study data for a Christy yarder (LeDoux, unpublished). ECOST is a microcomputer program that can be used to estimate the stump-to-mill cost of cable logging eastern hardwoods.
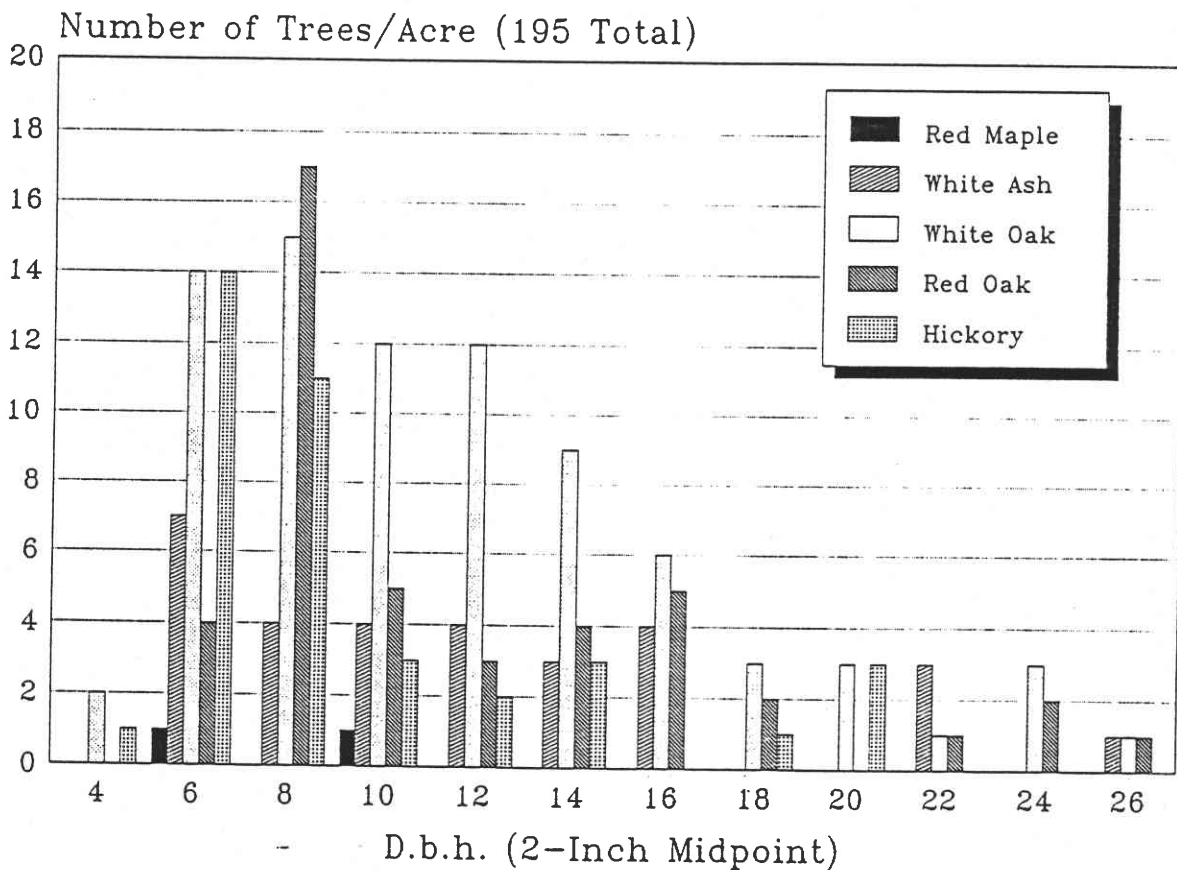

Figure 2.--Diameter distribution by species for the 110-year-old stand at final harvest.

The Christy yarder was selected because its capacity matches final harvest conditions and valuable time study data were available (Sherar and LeDoux, 1989; LeDoux, unpublished[2]). The growth and yield projections, volume estimates, and optimal rotation were estimated with MANAGE

(LeDoux, 1986). MANAGE, a computer program written in FORTRAN V, integrates harvesting technology, silvicultural treatments, market price, and economic concerns over the life of a stand. The simulation is a combination of discrete and stochastic subroutines. Individual subroutines model harvesting activities, silvicultural treatments, growth projections, market prices, and discounted present net-worth (PNW) economic analysis. The model can be used to develop optimal management guidelines for eastern hardwoods. The delivered prices for sawlogs and pulpwood were obtained from Forest Products Price Bulletins and Coastal Lumber Company, Hopwood, PA (Ohio Agric. Stat. Serv., 1989; Pa. State Univ., 1989; Tenn. Div. For., 1989) and are shown in Table 1.

Table 1.--Delivered prices for sawlogs and fuelwood/pulpwood by species.

Species	Large[1] Sawlogs	Medium[2] Sawlogs	Small[3] Sawlogs	Fuelwood/[4] Pulpwood
	------------------$/Mbf (Doyle Rule)---------------			$/Cord
Red maple	210	160	80	30
White ash	500	300	100	30
White oak	500	300	100	30
Red oak	600	350	100	30
Hickory	210	160	100	30

[1]Minimum small-end diameter ≥ 13 inches, length ≥ 10 feet.

[2]Minimum small-end diameter ≥ 11 inches, length ≥ 8 feet.

[3]Minimum small-end diameter ≥ 10 inches, length ≥ 8 feet.

[4]89 ft³/cord, minimum small-end diameter ≥ 4.0 inches that will not make large, medium, or small sawlogs.

The 40-acre stand is located on both sides of a wet area that includes 10 acres adjacent to a live stream as shown in Figure 3. The objective was to remove timber from both sides of the stream to a landing on the truck road while simultaneously protecting the stream and adjacent wetlands.
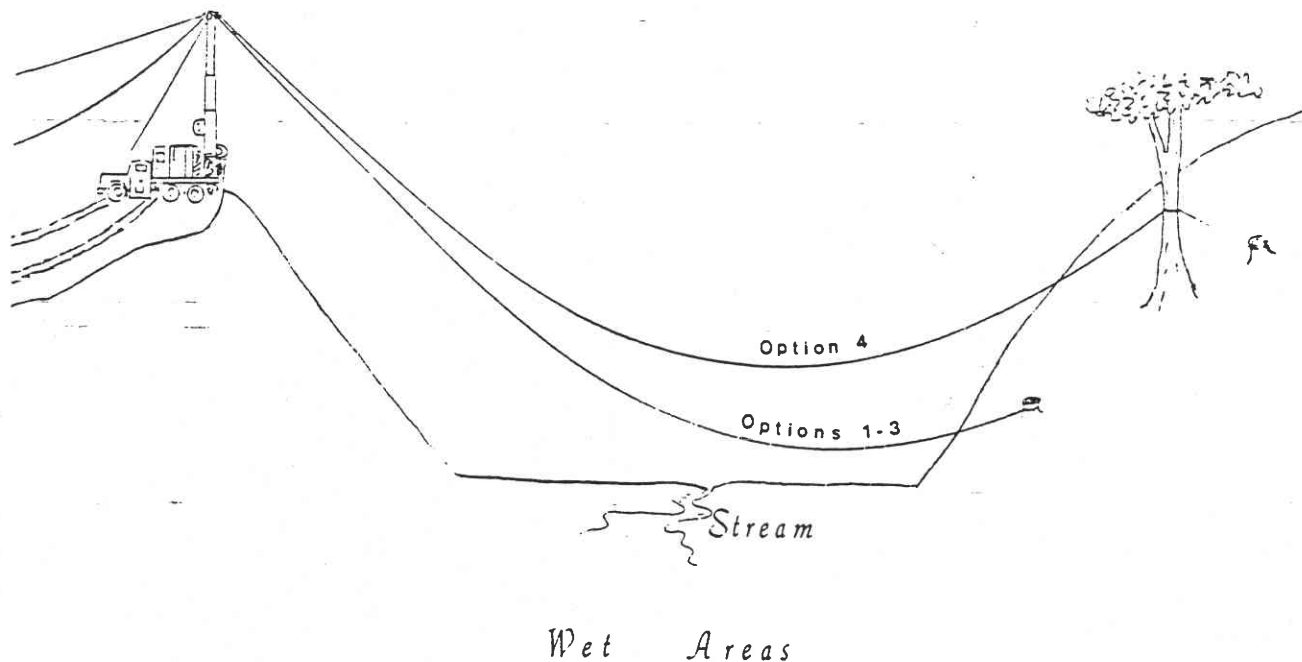
Figure 3.—Harvesting options offering different levels of stream protection.

Stream/Wetland Protection Options

The area would be harvested under an even-aged management plan, harvesting all merchantable timber at the optimal rotation age of 110. The protection options evaluated include: (1) no protection, clearcut the stand and take all the timber; (2) leaving the wet area as a buffer zone on both sides of the stream and not removing any wood from this zone; (3) leaving a buffer zone on both sides of the stream, but selecting some timber from within the buffer zones (approximately 50% of the volume) and allowing logs to drag across the stream and wet areas; and (4) option 3, and requiring full suspension of the logs across the stream and wet areas. A wetland is defined as an area that is periodically wet and flooded, but which dries up during periods of low rainfall, thus allowing trees and other vegetation to grow on the dry soil.

Option 1 affords the least protection to the wet-area and stream but results in the most net revenue to the land owner (Table 2) and the highest utilization of wood in the stand (Table 3). Leaving a portion of the stand as a buffer zone, option 2, removes 42,900 ft³ less wood and results in $19,580 less revenue than option 1. Option 3 removes more wood from the stand and returns $9,790 more to the land owner than option 2. Al-

though option 4 removes the same amount of wood as option 3, the logging cost increase of about 11% reduces the net revenue by $7,977. The increase in estimated logging cost is due to additional bucking of logs to meet full-suspension payloads, smaller payloads, and the additional rigging required to attain full suspension. It is beyond the scope of this paper to detail the bucking, payload, and additional rigging costs incurred. The intent is to illustrate a method that can be used to estimate wetland protection costs and provide representative protection costs for the options specified.

If the value lost to the landowner is interpreted as the cost of wetland protection, then the treatments evaluated result in protection costs that range from $489.50/acre for option 2 to $244.75/acre for option 3 (Table 3). The additional protection of fully suspending the logs over the stream and wet areas, option 4, results in a protection cost of $444.18, which is only $45.33/acre or about 9% less than option 2. However, option 4 takes 21,450 ft³ more wood than option 2. The tradeoffs of wood removal, return to the landowner, protection costs, and logging costs must be evaluated carefully for each specific set of conditions.

Table 2.--Effect of protection option on logging costs.

Item	Protection option			
	1	2	3	4
	Dollars			
Fell, Buck, Limb	6,530	4,903	5,720	6,892
Yarding	27,221	20,415	23,820	25,773
Loading	6,996	5,248	6,122	7,183
Delay	6,864	5,147	6,005	7,065
Move In and Out	6,863	5,142	5,998	7,729
Haul	28,406	21,305	24,855	25,855

Table 3.--Costs and revenues by protection treatment for harvest of a 40 acre stand at optimal rotation age of 110.

Protection Option	Volume removed (ft^3)	Cost Logging	Revenue Gross	Net	Percent change (Net revenue) From Option 1
1	171,600	$82,880	$161,200	$78,320	0.0
2	128,700	62,160	120,900	58,740	-25.0
3	150,150	72,520	141,050	68,530	-12.5
4	150,150	80,497	141,050	60,553	-22.7

Although MANAGE evaluated only one mixed hardwood stand, cable logging technology, and four protection treatment options, the results show that protection costs can be substantial depending on the level of protection desired. Protection costs also will change with other protection objec-tives, product values, yarding systems, market lo-cations, crew efficiencies, and many other factors. However, protection scenarios could be easily evaluated by projecting existing stands to optimal rotation age, estimating logging costs and rev-enues for final or intermediate harvests, and then

focusing on the tradeoffs of protection costs, returns to the landowner, and the logging costs necessary to achieve the desired objective. The results can be used to assist decision makers, loggers, managers, and planners in understanding the costs involved in protecting wet areas for several treatment options. The tradeoffs to wood utilization, costs, and returns to the landowner depend on the objectives chosen.

The final decision and end results are up to the decision maker.

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[1]The use of trade, firm, or corporation names in this paper is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

[2]LeDoux, C.B. Production rates and costs of group selection harvests with a Christy cable yarder. Unpublished report on file at the Northeastern Forest Experiment Station, 180 Canfield St., P.O. Box 4360, Morgantown, WV 26505.

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