FINANCIAL ANALYSIS OF THINNING SMALL DIAMETER TREES ON THE COLVILLE NATIONAL FOREST

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ABSTRACT

An ongoing set of research studies on the Colville National Forest provides the background for this financial analysis of thinning small-diameter trees. This analysis was based on data from eight timber sales units that were thinned with a common silvicultural prescription. For purposes of this analysis, additional prescriptions were simulated. Four of the units were on steep ground and four were on gentle ground and a variety of harvesting systems were used to do cost studies on the different systems. Harvesting costs were simulated for two ground-based systems and one cable system. A regression equation was developed from the 120 simulated scenarios as a way to demonstrate the relative importance of tree size, harvest volume per acre, and harvesting system on the expected net return. All three of these variables were highly significant.

Keywords: thinning, financial analysis, small trees, Colville National Forest

INTRODUCTION

Stands comprised mostly of small trees and small trees in the understories of stands are often difficult to sell. It is therefore helpful for foresters managing such stands to have a good understanding of the attributes of timber sales that contribute positively or negatively to the value of trees that constitute a potential timber sale. The purpose of this paper was to identify and show the relative importance of several key attributes that affect profitability of sales of small trees on the Colville National Forest. Other papers in this proceedings provide an overview of research studies on the Colville National Forest and the types of stands and harvest activities involved.

The products that can be made from small trees are generally of similar quality to the products that can be made from larger trees (Willits et al. 1996), but the costs of harvesting and manufacturing products can make the value of small trees negative. The value of trees to a potential timber buyer can be estimated by calculating the net revenue or residual value of the trees to be cut. Net revenue or residual value is found by estimating the value of the products that can be made from the trees and subtracting the costs of harvesting and hauling the logs, and manufacturing the logs into products. This is what a potential buyer of a timber sale would consider to determine how much could be paid for the timber. The FEEMA (Financial Evaluation of Ecosystem Management Activities) software was used to calculate net revenue (Fight and Chmelik 1998). Although the eight timber sale units had a single, common prescription and various harvesting systems, for this analysis, additional prescriptions were simulated as well as harvesting costs for three harvesting systems. Regression analysis was used to confirm that the expected variables did account for a significant amount of variability in the results and to estimate the magnitude of their effect on net revenue. The regressions are not intended to be used as a predictive tool to estimate net revenue from thinning other stands.

HARVEST UNITS

Eight harvesting units in the Fritz Demonstration area were selected as the sites of research studies on harvesting small diameter trees. The four steep units were on slopes of over 35%, and the four flat units were on slopes of less than 15%. The steep units were thinned in summer 1998, and the flat units were thinned in summer 1999. More information on the harvest units can be found in Johnson (2002).

PRESCRIPTIONS

A single prescription was applied in all the harvest units. The prescription called for leaving 100 uniformly spaced trees with a preference for large trees. This resulted in some trees from all diameter classes being harvested because not all the large trees were located on the spacing pattern. Alternative prescriptions were simulated by selecting simulated cut trees by harvesting from below to residual numbers of trees per acre of 145, 100, 70, and 30. These prescriptions would leave all of the larger trees, but in a non-uniform spacing.

HARVESTING SYSTEMS

Various combinations of harvesting equipment were used on different harvest units in order to compare the productivities and cost of different systems. For purposes of this paper, two ground-based systems and one cable system that could be applied to the range of tree sizes and volumes per acre encountered in all scenarios were used. One ground-based system consisted of cut-to-length harvesting and forwarding. The other ground-based system consisted of mechanical felling and skidding of whole trees. The cable system consisted of manual felling, limbing, and bucking with cable yarding.

SIMULATED SCENARIOS

To increase the simulated data points for analysis, all five prescriptions and all three harvesting systems were applied to all eight of the harvest units. The eight harvest units were assigned an average slope of 15% when ground-based systems were simulated and an average slope of 45% when the cable system was simulated. This resulted in a total of 120 simulated scenarios.

Published in *Small Diameter Timber: Resource Management, Manufacturing, and Markets* proceedings from conference held February 25-27, 2002 in Spokane, Washington. Compiled and edited by D.M. Baumgartner, L.R. Johnson, and E.J. DePuit. Washington State University Cooperative Extension. (Bulletin Office, WSU, PO Box 645912, Pullman, WA 99164-5912. MISC0509. 268 pp.

Harvest Cost Simulation

Harvest cost simulations were done with the ST HARVEST harvesting cost simulator (Hartsough et al. 2001). The purpose of this analysis was to analyze the effects of tree and stand characteristics and decisions related to prescriptions rather than site characteristics. To avoid adding noise to the analysis, values for the unit shape, size, slope, and skidding or yarding distance were arbitrarily set in calculating the simulated values rather than using the actual values, which varied from unit to unit.

Net Value Calculation

Net values were based on making random-length dimension lumber from trees that would make at least one 16-foot log with a small-end diameter of 5 inches and utilizing trees to a 5-inch top. Product prices were from the first quarter 1998, which were somewhat above the prices at the time of the conference. Manufacturing costs were derived from data used in Wagner et al. (1998). Nominal costs of $9 per acre were included for road maintenance and other work not directly involved in removing the logs.

RESULTS

Various factors affect net revenue through their influence on costs or revenues. Tree size determines log size and larger logs tend to have higher recovery in the volume of products and a higher average grade, both of which increase gross revenue. Small-log mills basically run logs end-to-end into the mill at a constant speed. Because larger logs have more volume, the production per day is higher and the cost of production per unit of lumber is lower for larger logs. Increasing tree size therefore tends to reduce costs. Tree size also determines the size and volume of pieces that are handled in logging. Larger pieces tend to be less costly to harvest on a unit volume basis. As reductions in cost and increases in gross revenue both have a direct positive effect on net revenue, it is to be expected that tree size is a key variable in explaining variation in net revenue.

The volume harvested per acre is another factor that affects logging costs. Low volumes per acre mean that trees are more widely spaced. Harvesting productivity is reduced because more time is spent traveling between trees. In addition, the fixed costs of moving equipment and getting ready to log a unit is spread over less volume. Both of these effects result in higher costs per unit volume of logs harvested when harvest volumes are low.

The third factor considered in this analysis is the logging system. In general, ground-based systems result in lower costs than cable systems.

Regression analysis was done on the net revenues from the 120 harvest simulations. The variable that was used to capture the effect of tree size was the proportion of cubic volume of harvest that was in trees less than 8 inches dbh. The variable that was used to capture the effect of harvest volume per acre was the inverse of cubic volume per acre. Dummy variables were used for logging system where the variable was 1 if it was a cable system and 0 otherwise. All variables were highly significant with P-values of less than 0.00001. Figure 1 shows that for the ground-based systems, positive net revenues occurred only at volumes greater than 6 ccf and when the proportion of volume in trees smaller than 8 inches dbh did not exceed 0.5. Net revenues for hand falling and bucking with cable yarding would be less by over $200, and none of the scenarios with cable yarding showed a positive net return. This cable system (with hand felling) is apparently not representative of the less traditional cable system used at the Fritz Demo sites that accomplished the harvest at a lower unit cost (Johnson 2002). That system utilized mechanized felling equipment that could both fell and bunch trees for subsequent cable yarding.

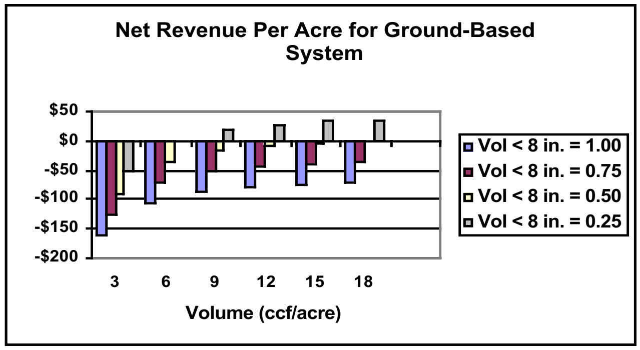

Figure 1.—This graph, based on the regression equation from the simulated harvest cost data, shows the effect on net revenue per acre of volume harvested per acre and proportion of the volume that is in trees less than 8 inches dbh.

CONCLUSIONS

Obtaining a positive net return from harvesting small trees has always been challenging. One objective of the CROP studies has been to show under what circumstances small trees can be harvested with a positive net return. This analysis with simulation of harvesting costs for systems that are generally applicable to the CROP conditions, but not necessarily optimal, reinforces the need for innovative approaches to keep harvesting costs low enough to achieve positive net returns.

LITERATURE CITED

Fight, R.D. and J.T. Chmelik. 1998. Analysts guide to FEEMA for financial analysis of ecosystem management activities. Gen. Tech. Rep. FPL-GTR-111. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 5 p.

Johnson, L.R. 2002. Adapting conventional harvesting equipment to small diameter stands: The Fritz Experiment. *In:* Small Diameter Timber—Resource Management, Manufacturing, and Markets. Proceedings of symposium February 25-27, 2002, Spokane, WA. D.M. Baumgartner et al. (eds.). Washington State University Cooperative Extension, Pullman. pp. 113-119.

Willits, S., R.J. Barbour, S. Tesch, D. Ryland, J. McNeel, R. Fight, S. Kumar, G. Myers, B. Olson, and A. Mason. 1996. The Colville study: wood utilization for ecosystem management-preliminary results of study of product potential from small-diameter stands. Res. Pap. FPL-RP-559. Madison, WI: USDA-Forest Service, Forest Products Laboratory. 11 p.

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