CABLE HARVESTING OPERATIONS FOR SMALL DIAMETER TIMBER

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ABSTRACT

Cable harvesting technology is often underutilized because of a lack of understanding about cable systems along with the knowledge about the key components for developing and maintaining a successful program with this technology. Research results from Pacific Northwest coastal and interior forests have identified important factors for success with cable yarding systems operating in thinning, fuels reduction, small diameter timber, and low value stand conditions. These include the harvesting productivity benefit of prebunching operations, the economic advantages of small skyline yarders, the importance of skyline corridor layout, felling to lead, the appropriate use of skyline carriages to minimize residual stand damage, the economic benefit of including higher value timber to offset losses with low value wood removal in fuel reduction operations, and the opportunity to prescribe a range of stand prescriptions (thinning intensities) in higher value young-stand thinning because of the relatively low skyline harvesting cost differences between prescriptions. Important aspects of a successful management program involving small diameter tree utilization with cable harvesting technology includes (1) an integrated silviculture and harvesting feasibility planing approach, (2) the appropriate cable logging equipment and methods of operation, and (3) the knowledge and skills for successful implementation and monitoring to meet forest resource management objectives.

Keywords: forest health, logging, skyline yarding, fuels reduction, thinning, small timber, cable harvesting

INTRODUCTION

Cable logging methods were typically thought of as West Coast operations for yarding large logs on steep terrain. Today, however, there are a wide range of cable systems that are appropriate for harvesting small diameter timber. These systems are often underutilized, especially in regions where traditional logging methods have not included cable operations. In fact, some steep terrain may be identified as "inoperable" because conventional ground-based harvesting systems would be infeasible, yet cable operations could be feasible in these conditions. The underutilization of cable harvesting technology may be attributed to a general lack of understanding of current cable yarding equipment, planning and field layout requirements, methods of operation and monitoring. In addition, knowledge about the key components for developing and maintaining a successful timber harvesting program with cable operations is needed.

THINNING

A standing skyline system is the most appropriate method for small diameter harvesting operations in thinning and/or fuel reduction applications. These systems use slackpulling skyline carriages that allow for lateral yarding between skyline corridors that are spaced approximately 150 feet apart. The use of intermediate supports increases the cable system capabilities for yarding timber on broken topography, and can extend the spacing between transportation roads. In addition, the intermediate support jack helps reduce the lateral excursion of the skyline thus reducing residual stand damage along the skyline corridor.

Skyline yarders for small diameter timber applications are available with a wide range of capabilities:

- Uphill or downhill yarding
- 1000 to 2000 feet yarding distance
- 2,000 to 5,000 pound skyline load capacity
- $80,000 to $450,000 purchase price
- Yarding crew size from 2 to 6 people.

Common manufactures of small to midsize yarders include Koller, Christy, Madill/Thunderbird, and Diamond. Hochrein and Kellogg (1988) found that yarding in a commercial thinning operation with a midsize yarder (Madill 071) increased costs 11–12%, depending on thinning intensities, over those with a small yarder (Koller K300).

When harvesting small diameter timber, prebunching logs to the skyline corridor with a low-cost method, followed by skyline yarding to the landing, can increase yarding productivity and lower the harvesting cost (Kellogg and Hochrein 1988). Prebunching methods that have been studied include a small sled-mounted mini-yarder, a small skyline yarder, and a single-grip harvester.

The logging plan and field layout requirements are more involved with skyline thinning operations then ground-based operations or clearcut harvesting methods. Skyline thinning involves on-the-ground layout including skyline corridor flagging, intermediate support and tailtree layout, and guyline anchor planning. These activities are typically completed at an operational planning level by the landowner that includes close coordination and implementation of the logging plan on-the-ground with the logging contractor.

In a commercial thinning study, the U.S. Forest Service skyline planning and layout time and cost ranged from 3.75 hrs/acre to 7.25 hrs/acre; and $63/acre to $124/acre, depending on the complexity of the harvest units. The logging contractor time and cost for field layout ranged from 1.0 hrs/acre to 3.0 hrs/acre: and $34/acre to $94/acre (Kellogg et al. 1998).

Skyline harvesting costs are influenced by the thinning prescription and stand density removals. Logging productivity studies (Kellogg et. al. 1999) have shown that yard-

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ing cost increase from approximately 5–22% from heavy thinning (high volume and trees per acre removal) over light thinning (low volume and trees per acre removal). The light thinning intensity operations are still economical however because of the predominant removal of small diameter sawlogs.

Residual stand damage can be a major concern with skyline thinning operations however there are a wide range of practices that can be implemented to maintain relatively low levels of stand damage (e.g., 1–5%). These logging practices generally fall into the following areas of attention:

- Skyline corridor layout
- Felling to lead
- Slackpulling carriage control
- Crew experience and techniques

More detailed study results and recommendations can be found in Han and Kellogg (2000).

FUELS REDUCTION

Using cable harvesting operations in fuels reduction applications involves the same information/principles presented above for skyline thinning operations. Prebunching techniques however may be even more beneficial when harvesting/utilizing small diameter standing dead, down and small live trees. Harvesting productivity studies have shown the benefit of using a single-grip harvester for prebunching small pieces followed by skyline yarding to roadside (Brown and Kellogg 1996).

Fuels reduction harvesting studies in the Blue Mountains of eastern Oregon have shown the economic impact that the proportion of higher value sawlogs and lower value pulplogs has on forest health stand management applications. Furthermore, wood utilization specifications, markets, and relative prices from year to year greatly influence the profit or loss obtained from harvesting operations—especially when more expensive cable operations are required.

In the Deerhorn study (Brown and Kellogg 1996), a harvester-skyline operation resulted in a net revenue of $611 per acre. A key factor for the positive net revenue was the 30% sawlog and 60% pulplog mix. The sawlog utilization accounted for almost 60% of the net revenue, whereas the pulplogs (alone) were logged at loss based on their harvesting delivery log price at the time of the study.

In the Limber Jim study (Drew et al. 2001), a harvester-fowarder operation resulted in a positive net revenue of $1,112 per acre, while a harvester-skyline operation resulted in a negative net revenue of $479 per acre. Differences from the Deerhorn study included a much higher proportion of pulplogs (88–94%), and a more expensive skyline operation.

SUMMARY

To successfully develop and implement a small diameter tree utilization management program involving cable operations requires attention to several key aspects.

1. Integrate silviculture and harvesting feasibility planning. This includes a range of economic, environmental, and social sustainability factors. Specific harvesting considerations for cable operations involve the following:
   - Determine the need for cable harvesting (a comparison of the conventional versus new harvesting system. *Why change the system to something new?*
   - Determine the extent of the need. *How much work is there? Can you offer and sustain a program for the new system?*
   - Make a commitment to the program. *Will managers stick to the program?*
   - Provide support and administration for success.
2. Utilize appropriate cable logging equipment and methods of operation for the terrain and stand conditions including considerations for the following:
   - Yarding distance and direction
   - Shape of the terrain and tree rigging needs
   - Road and landing conditions
   - Yarder and skyline carriage compatibility
3. Obtain the necessary knowledge and skills for planning, field layout, implementation, and monitoring including the following:
   - Skyline corridor layout
   - Skyline deflection and payload analysis
   - Intermediate support and tailtree layout
   - Timber felling practices
   - Stand damage assessment

Principles of environmentally sensitive harvesting and appropriate technology can be utilized to capture small tree economic value with profit, improve stand productivity and lower the risk of catastrophic losses from insects and fire. Cable harvesting operations are a useful tool for the forest managers mix of mechanical harvesting alternatives.

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